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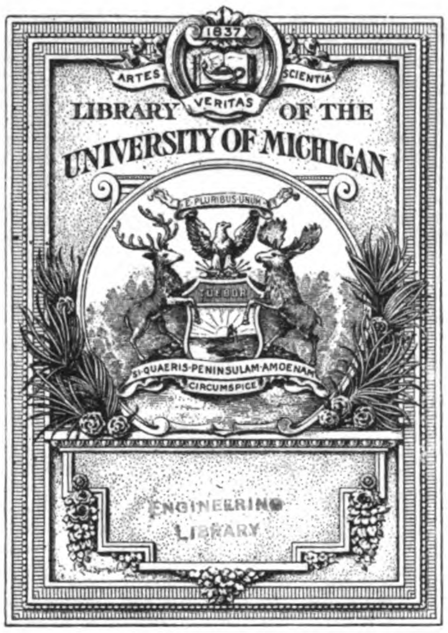

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PREFACE.

THIS book is a compilation of articles which have appeared in recent volumes of THE ENGINEERING RECORD, edited with a view of eliminating whatever was of timely or local interest, and arranged by divisions for convenience of use.

The science of paving and the need of proper maintenance of pavements is yet comparatively little understood in this country, and the same is true in even greater degree with regard to roads. The editor of the journal named was led to give the matter special attention by seeing what was done in Europe, during his visits there, and finally began an investigation of work on streets and roads in England, France and other countries, the result of which was the gathering of a large and very valuable mass of information in regard to the subject. Of this everything likely to be of practical use in America was printed in THE ENGINEERING RECORD, and is given here in more convenient shape. With it appears a large quantity of matter from American sources, including the prize essays on Road Construction and Maintenance submitted in the competition instituted by the journal named in December, 1889.

It will be seen that the great bulk of the book is made up of records of experience and statements of cost in different places. The comments are based on this experience.

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ELEVATED SIDEWALKS FOR NEW YORK.

LAST Sunday's issue of the New York *World* contains on its first page a cheerful picture, entitled "Looking Forward," which purports to be "a prophetic photograph of one of New York's busiest streets as it ought to appear before many years," and shows Broadway at Park Place, both streets being provided with elevated sidewalks on which crowds of happy pedestrians are serenely promenading, while below, as now, "the chariots rage in the streets and jostle one another in the broad ways," but with this difference, that there are no luckless wayfarers for them to molest or make afraid.

The beauty of this scene is enhanced by contrast with the visions of accident and sudden death which fill nearly a page of the inside of the paper and which are well calculated to convey the impression that the life of the average New York pedestrian is somewhat more dangerous than that of a railroad brakeman. Unfortunately these pictures do not exaggerate the conditions too often prevailing in the streets of the metropolis, for which no remedy but the elevated sidewalk seems to be practicable, and from many interviews published in the *World* the idea of such a remedy seems, as a rule, to be favorably received by all classes.

The people of New York are to be congratulated that such an important improvement has received the support of one of their leading dailies, and it is interesting now that the idea has been brought so prominently forward to trace its first beginnings, which, as might be expected, are to be found in the technical press.

Not to go back to the short lived Lowe Bridge over Broadway and Fulton Street, which seems to have been born out of due time, and to have produced little impression even as a precedent, the first published suggestion of street bridges in New York, apart from those connected with the elevated roads, seems to be found in the description of the new ferry house at Barclay Street, published in THE ENGINEERING AND BUILDING RECORD of November 24, 1888. The designers of this building, Messrs. Cooper & Namur, made provision for the future use of double deck ferry-boats and a foot bridge across West Street, so that passengers could pass from the upper deck of the ferry-boat to the east side of that crowded thoroughfare. This, however, only looked to a street crossing, but the complete idea of an elevated sidewalk was brought out in an editorial in this journal in November 23, 1889, where, in commenting on the offer of the Pennsylvania Railroad Company to build a bridge across West Street from its Cortlandt Street ferry house, it was suggested that it "should be supplemented by an elevated sidewalk continued up the streets towards Broadway to the elevated depots."

These West Street foot bridges were further and favorably commented on in this journal on February 1, 1890, and soon after the idea of the elevated sidewalk up Cortlandt Street was taken up by the *Scientific American*, which published some views of the proposed structure, as noted by us on February 15, 1890. Meanwhile the same idea had occurred to a German engineer or architect, H. Rosenbusch, whose pamphlet on the "Future Street of Great Cities" we had occasion to comment upon on the 17th of May last.

Now that the matter has been taken up by the daily press there is reason to hope that before long a popular feeling may be developed in favor of this important movement that will bear fruit in such legislation or other action as may be necessary to put the matter in practical shape.

Fortunately, unlike a subway system or underground road, the elevated sidewalk can be tried on a small scale to begin with, and gradually extended as it may find favor, first, say, from one or more of the North River ferries to Broadway, and then for certain down town streets through other streets, until those three big D's of pedestrianism in lower New York—dirt, delay and danger, shall have forever departed.

THE NEW JERSEY WATER SUPPLY.

THE annual report of the New Jersey State Geologist, C. C. Vermeule, C. E., has an interesting section in regard to the water supply. By this it appears that Jersey City, Newark, Camden, East Orange, Atlantic City, New Brunswick, Perth Amboy, Elizabeth, Burlington, Bordentown, and Mount Holly, ten cities having a population of 465,823, or more than one-third of all in the State, are dissatisfied with their water supply. Of these, cities with an aggregate population of 383,801 have their supply contaminated by other towns, while the supply of towns with a population of 61,694 was naturally poor. The contamination is in the Passaic River on the east and the Delaware on the west. The first-named river, supplying Newark, Jersey City and Bayonne, is contaminated by the sewage of Paterson and Passaic, while the latter, supplying Bordentown, Burlington and Camden, takes the sewage of Trenton. The report says: "It would seem that the Delaware below Trenton, and the Passaic below Paterson, are the natural sewers of their respective districts, and must be abandoned to that use."

Ten towns and villages, with an aggregate population of 30,000, are now constructing or projecting their first water-works. The largest of these is Plainfield, with 8,913 inhabitants, which has for some time been the largest town east of the Mississippi River without a public supply. At least six of the ten new works will get water from wells. Of the 56 water-works in the State which supply towns 43 have streams for their sources and 13 draw from wells. Eight of the latter are large open wells and five driven tube wells.

Classified as to ownership, 38 of the towns are supplied by private corporations and 18 own their systems. Of the latter, 13 were built by the towns, and five by private capital, being afterward bought by the towns. Among the cities not owning their water-works are Paterson, with a population of 63,273; Hoboken, population 37,721, and Elizabeth, population 32,119. Newark, Camden, Trenton, New Brunswick and Burlington bought their works from the companies.

Newark, it should be noted, is already providing for a new supply.

Mr. Vermeule says:

> It would appear to be the time for a more active and direct control of these matters to be assumed by the State. The initiative was taken by the act of 1683, authorizing a commission of State water supply, but this

commission was not continued. The control of the construction of dams, the prevention of unnecessary pollution of streams and guarding of cities against the adoption or use of contaminated sources of supply, would be the proper work of such a commission.

A SAFEGUARD FOR WORKERS IN COMPRESSED AIR.

IT has been found by sad experience that work in compressed air, such as has to be done sometimes in sinking foundations, or in driving subaqueous tunnels, often results in serious injury to health, and sometimes even causes death. The danger does not appear to lie so much in the application of the pressure as in its too rapid removal, especially after being exposed to it for too long a time, and it has been observed that if a workman who has collapsed on coming out of the air-lock, is promptly put back in the chamber, and the pressure then reduced very gradually, he will suffer little, if any, ill effect from what might otherwise prove a serious matter.

Noticing this circumstance, and finding frequent occasion to employ such treatment for the men engaged under his charge on the Hudson River Tunnel, the Resident Engineer in charge of the work, E. W. Moir, determined to make a special arrangement for such cases, as the gradual reduction of the pressure in the air locks often consumed so much time as to interfere with the progress of the work. He has, therefore, designed a separate pressure chamber, in which any man who shows symptoms of suffering from too rapid release of pressure on coming out of the air-lock, can be at once placed, and the pressure relieved as slowly as need be, while, at the same time, opportunity is given for the entrance of a physician, and no interference with the working air-locks is necessary.

The apparatus consists of a cylinder of $\frac{3}{8}$-inch boiler plate some 6 feet in diameter and 16 feet long, lying on its side. The air-tight door opens inward at one end, and in the middle is a partition, with a similar door. Light is given by some bull's eyes in the sides, and the structure is designed and braced for a pressure of 40 pounds per square inch.

The patient is carried in on a stretcher and placed in the inner chamber, the middle door is then closed and the air pressure turned on, which is afterward allowed to slowly escape. Should it be necessary for a physician to enter, the outer chamber will answer as an air-lock for that purpose; or, in case of emergency, it can accommodate another patient on a stretcher.

The chamber is being built by the Cockburn Barrow Company, of Jersey City, and it seems reasonable to expect that it will materially increase the safety and comfort of work in the tunnel.

THE NORFOLK DRY DOCK EXAMINED.

A REPORT that the floor of the new Government Dry Dock, at Norfolk, Va., sank when the cruiser Baltimore was put in it, led the Secretary of the Navy to appoint a special board to examine it, and the report of this board, just submitted, says that "the dock is in good condition, and no remedy is necessary." The receiving ship Franklin, with 4,074 tons displacement, was put in the dock as a test, but the depression noted, of $\frac{1}{8}$ to $\frac{5}{8}$ of on inch, was nearly recovered when the vessel was removed, and is said, by the report, to be no more than is usual from the compression of the timbers. There was no cracking of the cement floor. The board consisted of Captain O. F. Stanton, Constructors W. L. Mintonye and R. W. Steele, and Civil Engineers Thomas C. McCollom and George Mackay.

INLAND NAVIGATION CONGRESS.

THE fourth Inland Navigation Congress will open at Manchester, England, July 28.

The objects of the Congress are: To promote the improvement of inland navigation, and of estuaries; to direct attention to the economical value of navigable waterways; to examine, generally, technical questions relating to the construction and working of canals; to receive the report of the International Statistical Commission, appointed at the last Congress, and to take further steps towards the collection of statistics bearing on inland navigation.

The Congress will include one section devoted to engineering and another given to trading and economy. Invitations to appoint delegates have been sent to the Government of the United States, and to European Governments.

All communications relating to the Congress should be addressed to the Secretary, at Lombard Chambers, 46 Brown Street, Manchester, England.

THE NEW YORK WATER SUPPLY.

THERE is the usual complaint of increasing scarcity of water in New York City, and Public Works Commissioner Gilroy has issued a notice to the people urging economy in its use. He says that already water is being lowered in the reservoirs at the rate of an inch a day, and that this threatens in a little time to seriously increase the deficiency of supply in some localities. At a meeting of the Construction Committee of the Croton Aqueduct Commission, Wednesday, Chief Engineer Fteley said that if work was vigorously prosecuted the Aqueduct could be ready to deliver water by July 15, and action was taken that it is believed will secure that result.

MR. MULLETT'S CLAIM DISALLOWED.

THE Federal Court of Claims has finally dismissed, under the statute of limitations, the claim made by Alfred B. Mullett for compensation as architect of the building now occupied by the State, War and Navy Departments. A press report says that under ordinary circumstances the statute would have begun to run in 1875, when Mr. Mullett retired from service as architect of the Treasury Department, but that it was claimed, that, according to the custom of architects, the amount could not be computed until the work was finshed, and this was not until 1888. The Court, however, decided that the statute must be applied in the usual way, and referred to the Cologne Cathedral and the Washington Monument to illustrate the impracticability of making any different rule. The claim was for about $150,000.

ANNUAL CONVENTION OF THE AMERICAN SOCIETY OF CIVIL ENGINEERS.

THE annual convention of the American Society of Civil Engineers will be held at Cresson, Pa., opening at 10 o'clock, Thursday morning, June 26. There will be one business session, and other sessions for professional discussion. The annual address will be delivered by President Shinn. Members of the Society are specially invited to send to the Secretary papers that they will present to the convention that they may be given places on the programme.

The hotel at Cresson will entertain persons attending the convention for $3 per day. Arrangements have been made with the Trunk Line Association, the Southern Passenger Association and the Central Traffic Association (except in Michigan) for round trip tickets for one and one-third fare, and it is hoped that a similar rate will be given by the New England Passenger Committee and the Western States Passenger Association.

The families of members are invited. A special train will leave New York on the Pennsylvania Railroad at 10 o'clock Wednesday morning, June 25, arriving at Cresson in the afternoon. This train will be run as a second section of the Chicago limited. The cost of accommodations on this train will be about the same as on ordinary Pullman cars. Other special accommodations will be arranged for if it appears that any are needed. Further information may be had by addressing the Secretary, John Bogart, 127 East Twenty-third Street, New York City.

NOTES.

THE Suez Canal traffic for the last quarter of 1889, as reported by S. G. Broodlunt, American Consular Agent, included 776 vessels of 1,447,815 total tons burden. Eleven vessels of 24,392 total tons were American.

THE Baltimore *Sun* publishes a report to the effect that an association of French capitalists have got control of the stock of the Maryland and Delaware Ship Canal Company, and will immediately construct the work. The route selected is up the Sassafras River from Chesapeake Bay, and across the peninsula to Blackbird Creek and the Delaware River. It is said that there are but 7½ miles of solid cut on the line, and that the whole distance to be covered, including the dredging of marshes, is but 14½ miles.

NEW ORLEANS is to have public baths, with accommodations for men and for women and children in separate buildings arranged on either side of the Sanitary Association's flushing pump, which raises water from the river for flushing gutters.

A NEWSPAPER correspondent reports that not less than $1,000,000 has been spent in rebuilding Johnstown, Pa., which was swept away a year ago, and that real estate sells higher than before the flood.

THE arrival of 5,000 tons of steel rails from Pittsburg, Pa., at Piedras Negras, Mexico, is reported by Consul Fechet of that place. These are the first American rails sent to Mexico, and it is said that they can now be furnished cheaper than European rails.

THE first fellowship in architecture of Columbia College has been awarded to Arthur A. Stoughton, of New York City. It amounts to $1,300, and the money is to be spent in travel and study abroad. R. M. Hunt, C. F. McKim, T. Hastings and A. Rotch were the Awarding Committee.

OBITUARY.

FRANCIS C. LOWTHORP, M. Am. Soc. C. E., died at Trenton, N. J., June 1, at the age of 81 years. He invented a railroad turntable and designed many railroad bridges, among which was the pivot drawbridge over Newark Bay, built by the Central Railroad of New Jersey.

WILLIAM L. CRITTENDEN, C. E., in charge of the Third Division of the Government Survey in the upper Green River Country, Wyoming, was killed by Indians, June 1, with E. W. Timburlake, George Woods, and Henry Overmeyer, chainmen. Jesse Lee, Assistant Engineer, was badly wounded and left for dead, but survived. A party of Indians visited the camp, drank all their own whiskey and then demanded more from the engineers, and finally made a sudden attack upon the five whites, and killed four of them on the spot. Mr. Crittenden was about 45 years of age.

PERSONAL.

SAMUEL N. DAUGHERTY has been re-elected City Engineer of Xenia, O.

ARTHUR G. ERDMANN, architect, recently of Cincinnati, has opened an office in the Newsalt Block, corner of Fourth and Jefferson Streets, Dayton, O.

BRIGHAM & SPOFFORD, architects of the Massachusetts State House extension, have moved from Milk Street to 22 Beacon Street, Boston, Mass.

E. S. DAVIS, C. E., for the last eight years in the United States Surveyor-General's office at Denver, Col., has resigned, and accepted a position with the sewerage department of Boston, Mass.

J. C. RAWN, has been appointed manager of the Roanoke Gas and Water Company, of Roanoke, Va. He will continue to discharge the duties of Engineer-in-Charge of the Clench Valley Extension of the N. & W. R. R., which he has held for the past three years, with headquarters at Roanoke.

COMING MEETINGS.

THE ninth annual meeting of the New England Water-Works Association will be held at Portland, Me., June 11, 12 and 13.

THE annual convention of the American Society of Civil Engineers will open at Cresson, Pa., at 10 o'clock Thursday morning, June 26.

OUR ARCHITECTURAL ILLUSTRATIONS.

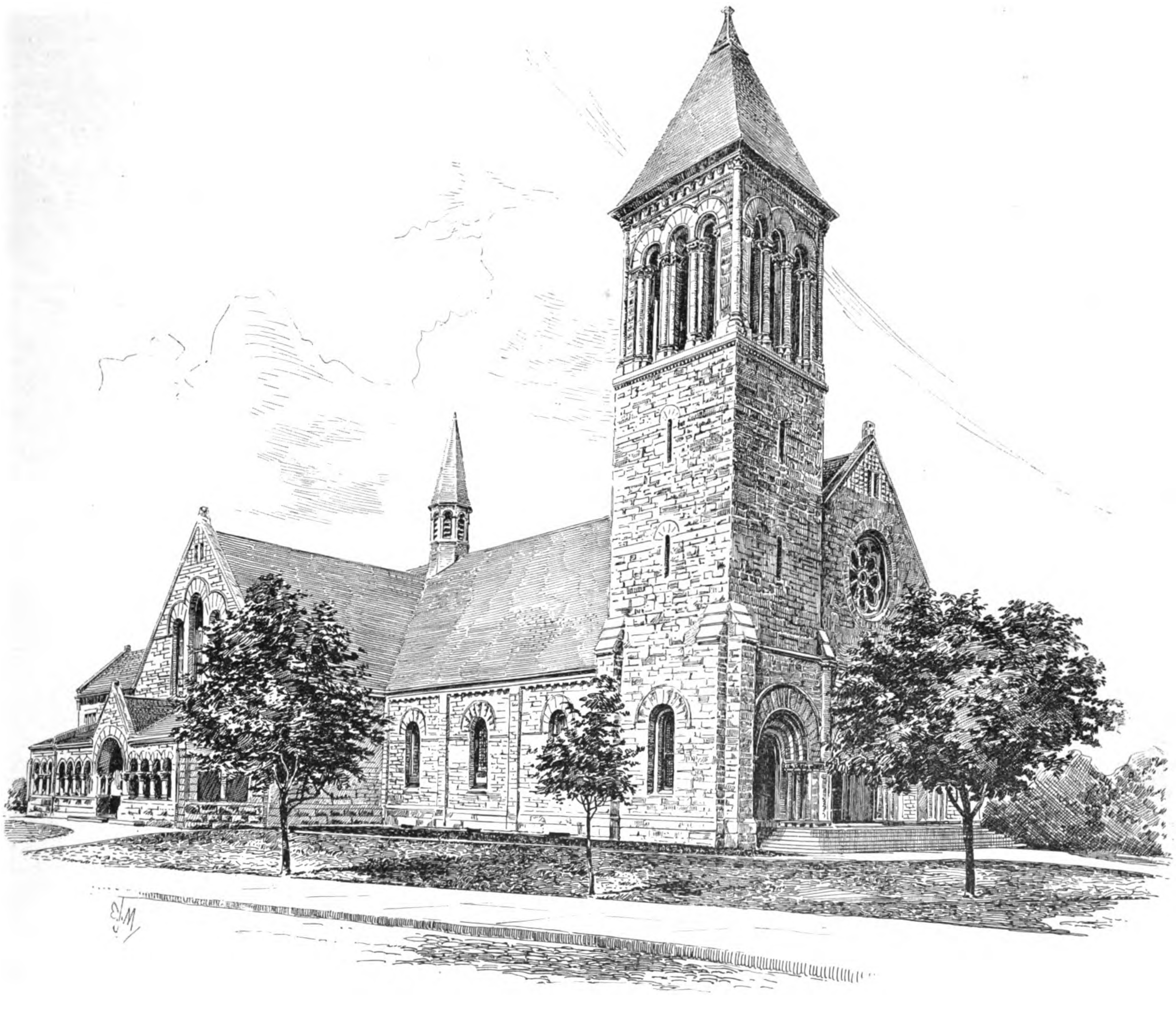
CHURCH AT PITTSBURG, PA.

LONGFELLOW, ALDEN & HARLOW, ARCHITECTS, BOSTON, MASS.

RAILROAD STATION AT WELLESLEY HILLS, MASS.

H. H. RICHARDSON, ARCHITECT, MASS.

This station on the Boston and Albany Railroad is built of pink Milford granite, with Kibbe sandstone trimmings, and has a slate roof. The interior is sheathed with hard wood, and all doors, seats and finish are of hard wood.



THE ENGINEERING AND BUILDING RECORD ILLUSTRATED SERIES.

CHURCH AT PITTSBURG, PA.

LONGFELLOW, ALDEN & HARLOW, ARCHITECTS, BOSTON, MASS.

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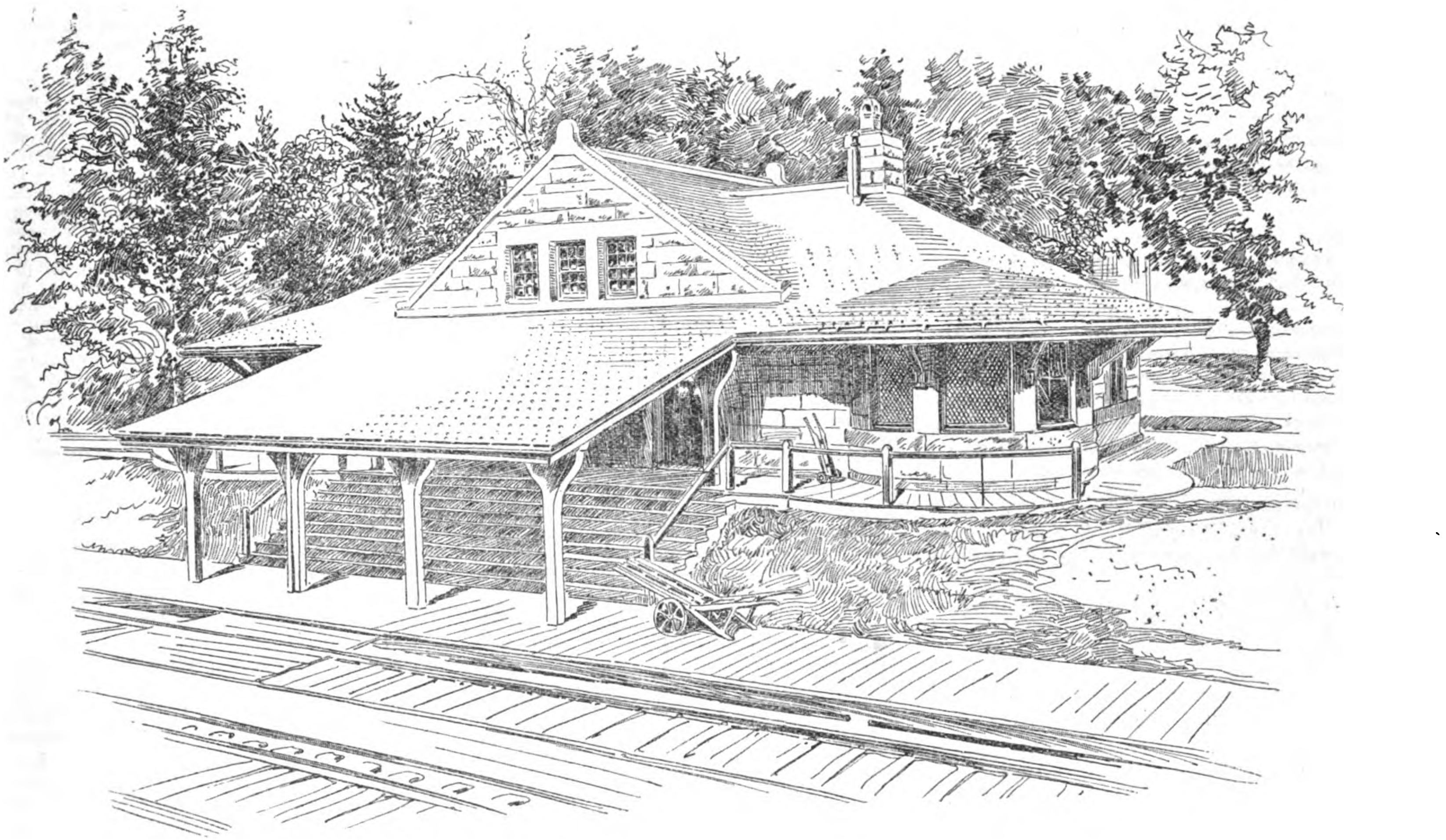
ENGINEERING SOCIETIES.

THE ENGINEERS' CLUB OF ST. LOUIS held a meeting May 21, with Professor Nipher in the chair, W. H. Bryan, secretary, and 19 members and 3 visitors present.

The paper of the evening, by George A. Brown, entitled "The Function of the Government in a Plan for General Irrigation," was read by Professor Johnson. It discussed at some length the necessity of providing some more complete and systematic method of dealing with the problem of the artificial distribution of water for irrigation, this problem being one of great importance, especially in the Western States and Territories. The Government is now asked to determine the amount of water available for the purpose and to provide laws regarding its distribution and apportionment. The author thought that the Government should give a title to certain water privileges, the same as it gives to land. The author was connected for a short time last season with the irrigation survey work done by the Government in Western Nevada, under the direction of Maj. J. W. Powell.

In the discussion, Professor Nipher said that experiments extending over a long period of years had demonstrated that the apparent increase in rain-fall in forests was due to the fact that the rain caught in the gauges was not affected by wind currents. Improved forms of rain gauges had shown that there was no actual difference between the amount of rain falling in forests and in open places.



RAILROAD STATION AT WELLESLEY HILLS, MASS.—H. H. RICHARDSON, ARCHITECT, BOSTON, MASS.

Mr. Robert Moore stated that such investigations as he had been able to make had satisfied him that the popular opinion that forests increased the amount of rain-fall was a fallacy, and he was glad to see the matter set at rest authoritatively. Messrs. Johnson, Blaisdell and Curtis also took part in the discussion.

THE AMERICAN SOCIETY OF CIVIL ENGINEERS held a regular meeting June 4, with President W. P. Shinn in the chair.

The death at Trenton, N. J., of Francis C. Lowthorp, a pioneer iron bridge builder, was announced, and followed by some biographical remarks.

Some informal notes of a visit to the line of the Panama Canal, from the journal of a Civil Engineer, by J. Foster Crowell were read, and the progress of arrangements for the Cresson convention was announced. Visits are proposed to the Jeanette Glass Works, to Johnstown, and to Altoona and other points of local interest, and the indications promise a full attendance.

Adjournment was followed by the usual collation.

The following candidates were declared elected :

As Members.—Rawlinson Tennant Bayliss, Resident Director and Manager Montana Company (Ltd) of London, operating the Drum Lummon (Gold) Mine at Marysville, Montana, in charge of the Company's business including construction of mills and machinery for the mining and reduction of 90,000 tons of ore per annum. Marysville, Mont.; Harry Winter Edwards, engaged on construction of new flour dock and warehouses with title of Division Engineer, West Superior, Wis ; John Edwin Greiner, Assistant Engineer, office of Engineer of Bridges B. & O. R. R., Baltimore, Md.; Carl Robert Grimm, engaged with New Jersey Steel and Iron Company; John Baillie Henderson, Government Hydraulic Engineer in charge of Water Supply Department, Brisbane, Queensland, Australia; Karl Emil Hilgard, Principal Assistant Engineer in charge Design and Superintendence of Construction Fourth Street Extension Chesapeake and Ohio Railroad, Cincinnati, O.; Gilbert Hodges, engaged in general engineering, Boston, Mass.: Charles Comstock Hopkins, Engineer of Sewers for Gloversville, N. Y.; Rice Creek Reservoir and Extension; Gloversville Water-Works, and Addison, N. Y., Water-Works; Andrew Langstaff Johnston, Chief Engineer Southside Land and Improvement Company of Virginia; and Richmond and Southside Electric Railway and Consolidated lines; Engineer Manchester Sewerage Company, Richmond, Va.; Claude William Kinder, Engineer-in-Chief to China Railway Company, Tientsin, North China; William McKelvy Marple, Assistant Engineer on construction of dams and reservoirs for same company, Scranton, Pa.; Charles Eyra Marvin, Time Roadmaster Main Stem Central Railroad of Georgia in charge Road Department, Bridges, Buildings and Water Supply, Macon, Ga.; Mitsugu Sengoku, now Engineer to the State Railway, Tokio, Japan; Reuben Shirreffs, Second Assistant Engineer East Jersey Water Company, Paterson, N. J.; Charles Wallace Walton, Superintendent and Engineer in charge construction and operation mills and log tramways for Anchor Manufacturing Company, Detroit, Mich.; Ethelbert George Woodford, State Mining Engineer, Department of Mines, to the Transvaal Republic, Pretoria, Transvaal.

As Juniors.—Wainwright Parish, Resident Engineer in charge construction Keeseville, Ausable Chasm and Champlain Railroad, and Assistant Engineer D. & H. C. Co., Albany, N. Y.; George Ernest Roehm, Bridge Inspector of Michigan Central Railroad, Detroit, Mich.; William Lee Sisson, Assistant Engineer to Engineer Maintenance of Way B. & O. R. R., Baltimore, Md.; Charles Horton Smith, Assistant Engineer New York, Ontario and Western Railway, Middletown, N. Y.

THE ENGINEERS' CLUB OF KANSAS CITY held a meeting May 12 with F. E. Sickels in the chair, K. Allen, Secretary, and 11 members present.

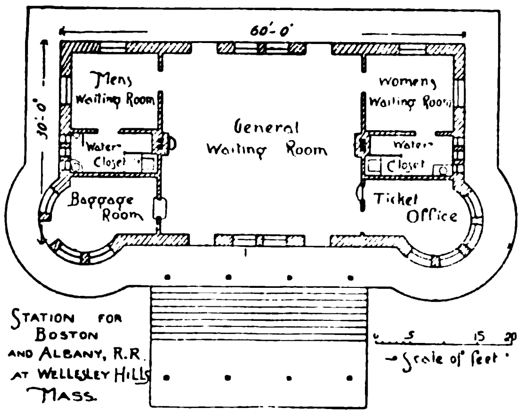
A. J. Mason read, for the Committee on Affiliation of Engineering Societies, abstracts from a communication from Prof. J. B. Johnson, of St. Louis, proposing a federation of the leading engineering societies. Mr. Mason also presented a brief verbal report for the Committee on Affiliation adverse to a connection of the local societies with the American Society. The report was accepted and the committee requested to continue.

Mr. Allen thought the field of work of the local societies was quite distinct from that of the American Society, and that joint publications would be unnecessarily expensive and cumbersome for many members.

Messrs. Filley and Stone were opposed to the proposed "Federation" having a local habitation, while Messrs. Sickles and Mason held the opposite view, and thought that by selecting the city of Washington especial advantages would be attained without incurring hostility.

A. Clifford Thomson was declared elected a member.

The secretary read for the author, Robert M. Sheridan, a paper on "The Evolution of the Elevator."



Beginning with the year 1855 the paper traced the growth of the elevator engine from the oscillating cylinder reversing engines (which marked the first step in the development of this branch of engineering) to the perfected steam worm-geared passenger elevator engine in use at the present time. A summary of the various steps embracing the charges in engines of this class was presented. The vertical cylinder hydraulic machine was described and compared with the perfected horizontal cylinder elevator and its improvements. The workings and advantages of the lever operating device in its connection with the auxiliary valve with the independent automatic stop valve were explained. A description of the principle of the centrifugal governnor attached to the car as a safety device was given, accompanied by a general statement concerning the present requisities for elevator service, covering the point of absolute regulation at the highest speeds by the use of the improvements mentioned. The travel of the tower elevator in the Chicago Auditorium building, passing through a distance of 220 feet at a speed of about seven miles per hour, or 600 feet per minute, was cited as a case in point covering the various demands upon elevator service at the present time. The future of the work, judging by the past, includes the elevator's evolution along the lines now set, keeping pace with the demand for buildings that tower nearer the sky year by year.

The Western Society of Engineers held a meeting at Chicago, May 7, with President L. E. Cooley in the chair, John W. Weston Secretary, and about 75 members and visitors present. Dwight H. Perkins, George F. Wightman, Edward W. Dewey, John M. Ewen, Ralph M. Shankland, Walker Miller, Frank G. Ewald and Charles Hansel were elected members.

A communication from the American Society of Civil Engineers in regard to relations between the associations, which had been delayed, was received, and Messrs. Williams, Herr, Chanute, Nagle and Morison were appointed a committee to respond in regard to the matter, but it was understood that they would not commit the society.

"The Railway Problem of Chicago," the subject assigned for discussion at the meeting, was brought up, and majority and minority reports from the committee appointed to consider the matter were read. Ossian Guthrie presented a paper bearing on the subject under discussion, which was largely a history of the growth of Chicago.

C. J. Rooney presented some figures in regard to viaduct and bridge work done in the city, and A. F. Robinson read a paper on 4-track viaducts, giving estimates of cost for steel with brick piers, and for structures wholly of brick. There was discussion of the subject by Messrs. Morgan, Morison, Wallace, Nourse, Northway, President Cooley, Fish, Herr and MacDonald.

The Engineers' Club of Philadelphia, held a meeting May 17, with President H. W. Spangler in the chair, Howard Murphy, Secretary, and 35 members and two visitors present.

Prof. J. W. Redway read a paper on the "Physical Geography of the Mississippi River."

The Secretary presented, for George W. Creighton, a paper on "Rail Joints."

A TOWER PROJECTED IN CHICAGO.

A tower of iron and steel, 1,500 feet high, has been designed by Charles Kinkle and G. R. Pohl, architects, of Washington, D. C., to be erected in connection with the World's Fair at Chicago, and the *Tribune* of that city reports that a number of capitalists in New York, Washington and Chicago are behind the enterprise and will erect the structure without asking aid of the Fair managers or anybody else. The only name given is that of M. B. Bailey, a contractor and builder, who is one of the incorporators. The tower, according to the report, is to be erected within a mile of the commercial center of the city, regardless of the location of the Fair, be permanent, and cost over $2,000,000. The base will be 480 feet in diameter, with a "skeleton of steel-framed lattice work on 16 hyperbolic curved legs"; and there are plans for a hall with a capacity to seat 30,000 people and a hotel with 4,000 rooms in the structure, space for the public library, rooms for the Grand Army, public institutions, etc. There are to be eight elevators for the first 100 feet, four to 200 feet, four to 400 feet, and two to the top. The floors will be 33 feet apart.

The Suez Canal traffic for the last quarter of 1889, as reported by S. G. Broadbent, American Consular Agent, included 776 vessels of 1,447,815 total tons burden. Eleven vessels of 24,392 total tons were American. The profits of the Canal for 1889 are reported to have been 37,212,925 francs. The average time of passing through the canal has been diminished four hours.

DESIRABLE EFFICIENCY OF HYDRANTS IN CONNECTION WITH WATER-WORKS.*

The suppression of fire is the most important factor we have to contend with. Convince the citizens of any city or town that they have a good fire protection, and the water-works become popular. The mains should be of a sufficient dimension to supply with ease the hydrants placed thereon, and they should never be less than 6-inch inlets. Many cities and towns make a great mistake in trying to reduce the cost of the works by using small mains and small hydrants. I can recall to mind instances where 10, 15, and even 20 hydrants are placed on a 6-inch main with no reinforcement, and the citizens expect that all of them could be used if wanted. It is a well known fact that four good fire streams is all that can be expected from that class of mains. I am reminded of an instance, related by a friend, where two competing fire companies were trying to put out a fire in a house, and each one was using two hydrants situated on a 6-inch main, with no effect on the fire, and as neither would give up to the other, the house was burned. If both companies had shut one hydrant each they would have been effective, and the house would have been saved. Another mistake that is made is locating hydrants too far apart, where you have mains of sufficient magnitude to supply. Hydrants are cheaper than hose, and will last longer with less care; besides you get better results with short lines of hose. The friction in the hose overcomes the pressure, and the effectiveness is lost to a large extent. The relative cost with the life of the hydrant in comparison with the life of the hose, is largely in favor of the closeness of hydrants. But they say the hydrants cost money; admit it does, what is the cost in comparison to its worth when you want it, and the location of one hydrant might save a hundred-thousand-dollar conflagration, or even more. Ask your chiefs of the fire department if they think you have too many hydrants where the pipes are of the capacity equal to the demand, and they will tell you no! But where they are not, the Fire Department is often censured for that which they are not to blame for, and in most of the cases the cause is traced to small mains and hydrants. The hydrant is looked upon by some as a useless thing because it is not used, or, in other words, because we do not have fires. We have on our works hundreds of hydrants that have never been opened for fire purposes in the past ten years, and yet I would not know where to discard one; in fact we do not wish to use them only when we have a fire, and then they are wanted more than their value. We never want a fire; it is like the insurance on our houses; we pay, but do not want them to burn. I remember a few years ago some of our citizens said we did not use them, and therefore ought not to pay for them. About that time we had a large lumber yard on fire, and it was a very dry time, and the wind was blowing in a direction which carried the sparks over the business part of the city. At one time we had the roofs of 60 buildings on fire. The hydrants were brought into service, playing 52 fire streams in that location, and in connection with the sill-cocks, which nearly every house has for garden hose, a conflagration was prevented which was liable to have cost a million of dollars. These same people said after that there were no useless hydrants in the city. All hydrants should be easy of access, and to have them so I believe the post hydrant is the most effective. I also believe the independent gate on each outlet for the hose is of more value than the extra cost of the same, and the day is not far distant when they will be more universally used. To illustrate: Take a fire just started, with two or four streams playing, and one line of hose bursts, you have to shut off the other streams to replace the hose. During the delay the fire may get such headway as to cause great damage, but in the use of the independent gate the other streams play right along. The first minute on a fire is worth hours at some other stage of the conflagration. Firemen have chucks which are screwed on to the hydrant or hose, but they are unwieldy in comparison with the gate. I know from experience that where you have a heavy pressure you can regulate it with the gate very easily. Superintendents of works should always look well, in making extensions of mains, to the efficiency of the hydrant. Another important factor is fast coming into use—the automatic sprinkers, used only in case of fire. They do their work before the hydrant is called for, and in case they fail by some unforeseen circumstance, they should be governed by gates so that when their efficiency is gone they can be easily shut off in the street. We have in our city miles of automatic sprinkler pipe, and fires occur daily that are never reported. Hydrants never should be used only for fire purposes, in cases of necessity. Some cities allow them to be used for sprinkling carts or watering down the streets, and other purposes, by inexperienced men. Then the firemen find them out of order, and the Superintendent has to stand the blame, as no one knows who did it. They should be inspected as often as twice a year and properly oiled, but never inspected in extremely cold weather, as by the introduction of water they are liable to stick with frost. Of course, there are certain kinds of flush hydrants that have to be looked after in extreme cold weather more frequently. With an experience of ten years with from 400 to 800 hydrants, we have never had but little trouble with frost. Ours are post hydrants with rubber disks, and shut against the pressure, and I have never had to remove one as yet. After having built your works it is well to know what you can do if called upon in extreme cases. I had faith to believe we could play 70 fire streams at once and maintain 80 pounds pressure while playing, and I so stated at the last convention at Louisville. On September 19, 1889, our Chief Engineer, Mr. John Brierly, was invited to play 70 one-inch fire streams through 50 feet of hose at once. This was successfully accomplished, holding a maximum pressure of 80 pounds during the time the test was made. The test was made on the 20 and 24-inch force main, 3½ miles long, leading from the pumps through the center of the city to the storage reservoir on the heights, at an elevation of 301 feet above tide-water, the engines with a capacity of 12,000,000 gallons all being running; 4,040 feet of this main was used, and the streams were taken from nine 6-wayed and eight 2-wayed hydrants. Four Edson recording gauges were placed on the line located so as to give the best results of the loss of pressure, and one before each pump. The cards show with what nicety and precision they exemplify and verify the pressure. By the use of these gauges we were enabled to verify facts which we should have been unable to do without them. The pressure at the No. 1 engine, which was the nearest to the draught of water, was reduced 24 pounds; at the No. 2, 10 pounds, and at the No. 3, 10 pounds. We were delivering during the trial 15,500 gallons per minute. The capacity of the pumps was 12,000,000 gallons per day, and the draught on the reservoir was 10,000,000 gallons per day, including the supply of the city at the same time, making a consumption of 22,000,000 gallons per day. I am satisfied that by distributing the hydrants over a larger territory we would be able to play 100 fire streams and maintain the same pressure. I contend that originators of water-works should always bear in mind that the efficiency of the hydrants is of the most importance, and should always be looked after with the greatest care. Superintendents having charge of works in making extensions should always try to connect all dead ends, so as to reinforce the supply to the hydrants, and make them more efficient as their works increase in magnitude.

Chief Scannell, of the San Francisco Fire Department, with the aid of his most powerful engine, recently gave the Grand Jury and the Mayor and Supervisors of that city an ocular demonstration of the crying need for proper protection against fire of additional fire hydrants. Of course these gentlemen knew perfectly well that in many parts of the city the distance between the hydrants was from 1,500 to 2,000 feet, but it is probable that they never before realized so thoroughly how great was the loss in power of a stream caused by the friction in the long line of hose thus made necessary. It is safe to say that they were somewhat surprised when, after seeing water thrown 206 feet through 100 feet of hose, the pressure at the nozzle standing at 90 pounds; 900 feet more of hose were coupled on and the enfeebled stream fell to the ground just 54 feet from the nozzle, where the pressure mark was but six pounds.

ANNUAL REPORTS.

The water-works report of Toledo, O., for 1889, H. C. Cotter Superintendent, shows that there were 39,016 feet of 4 to 12 inch mains laid during the year, making 367,791 feet in all; 29 hydrants set, making 464 in all; 448 services were added, making 3,384 in all, and 43 meters added, making 377 in use. There were 1,906,484,100 gallons of water pumped an average height of 167 feet, at a cost of $11,474, including $4,000 for fuel; in this case "fuel gas." The total amount charged to current expense account was $28,915, but $7,000 of this was for repairs to pumps, which the report says should be distributed over other years. There was $42,138 charged to construction account.

The report is accompanied by a letter to the water-works trustees, signed by George W. Davis, trustee from 1883 to 1889, and J. D. Cook, Chief Engineer and Superintendent of the works from 1873 to 1879. This communication refers to the history of the works and to a detailed recommendation for purifying the water by settling reservoirs in the report for 1885. The letter also urges that the increasing difference between high and low water in the Maumee River is making new pumping machinery necessary, and gives some figures showing the relative financial aspect of the proposed improvements. It is said that, as nearly as can be ascertained, the cost of water-works in all cities in the United States and Canada having 70,000 or more population averages $27.50 per capita, and the net earnings $1.42 per capita, while in Toledo, with the cost of the improvements added, the works would represent but $14.58 per capita of population, and the net earnings for 1889 were but $0.46.

How much importance is attached by the Germans to good connection by means of waterways, and easy navigation thereon, is evident, says the London *Builder*, if one bears in mind that, besides the long list of smaller works which outsiders scarcely hear of, a Danube-Oder Canal is being planned; that the Rhine is not only to be connected with the river Maas and the Dortmund-Ems Canal, but also with the Elbe, which latter is to have a new connection with the Trave; and that complicated schemes are being prepared in reference to the deepening of the Rhine and Elbe, so as to make them navigable for ships of greater tonnage.

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*From a paper read by Edwin Darling, Superintendent of the Pawtucket, R. I., Water-Works, at the Chicago meeting of the American Water-Works Association.

NEW OFFICES OF ADLER & SULLIVAN, ARCHITECTS, CHICAGO.

In connection with the articles on "The Organization of An Architect's Office," published in The Engineering and Building Record recently, the accompanying illustrations of the new offices of Messrs. Adler & Sullivan, of Chicago, will prove interesting.

The offices are in the tower of the Auditorium Building, of which these gentlemen were the architects, occupying the sixteenth and seventeenth stories, 206 feet above the sidewalk level. The plans show very clearly the general arrangement adopted and require no explanation.

PROPOSED WATER-WORKS AND SEWERAGE SYSTEM FOR BARRIE.

The town of Barrie, Ont., situated at the head of Kempenfeldt Bay, an arm of Lake Simcoe, has begun to feel the need of a water supply and a sewerage system and Willis Chipman, civil and sanitary engineer, of Toronto, Ont., has been requested to recommend plans for the same.

In determining the amount of water required he assumes that 250,000 gallons a day will be sufficient for the present domestic uses of the estimated population of 6,000 people, and doubles it to provide for future increase. For fire purposes he estimates that 700 gallons a minute should be allowed so as to supply at least three fire streams 1⅛ inches in diameter and 100 feet high, or at the rate of 1,008,000 gallons per day, making a total of 1,040 gallons a minute, or 1,500,000 gallons a day.

As to source of supply, after comparing the water from the bay and from various springs and creeks, he recommends the use of artesian, or more properly, driven wells, located near the bay about 50 feet apart and 4 inches in diameter, a pit to be excavated about each well to the level of the water in the bay. Water is found about 100 feet below this level and rises about 20 feet above it. The wells are to be connected by a suction main to the pumping station. Some 20 of such wells have been sunk in the town for various purposes with very satisfactory results, yielding through a 2 or 3-inch tube a flow of 20 to 30 gallons per minute of good water at a height of about 15 feet above the bay.

For pumping machinery a duplicate set of compound duplex engines is recommended with a capacity to easily deliver 1,040 gallons per minute against a head of 150 feet for domestic service, or 150 pounds for fire service. A stand-pipe on high ground, 25 feet in diameter and 50 feet high, is also advised.

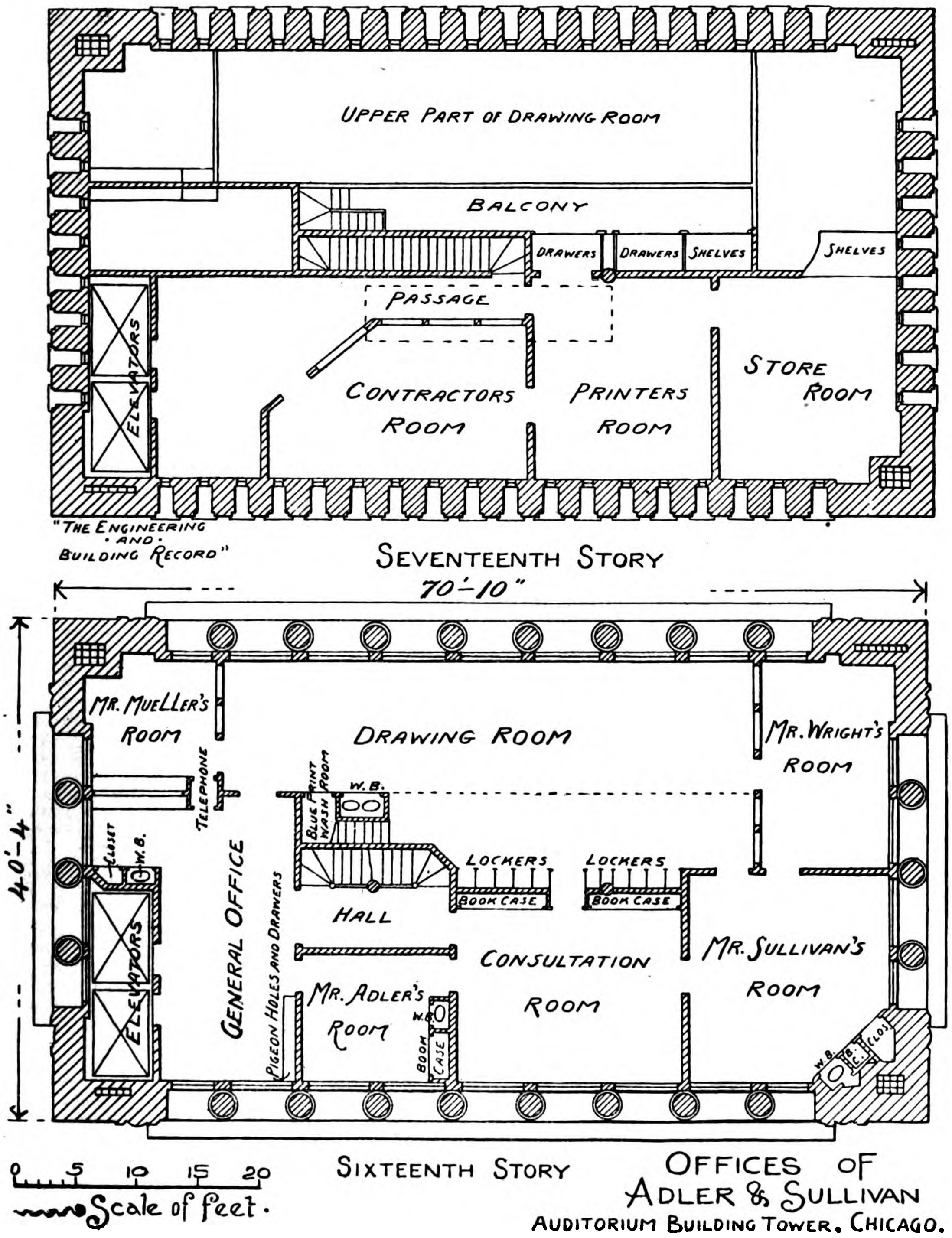
The estimated expense is as follows: Pump house, site, chimney and coal shed, $5,000; Pumping machinery, boilers, etc., $8,000; 27,000 feet of 10 to 4-inch distribution mains with 50 hydrants and necessary valves, $30,000; stand-pipe, $7,000; engineering and other expenses, $3,000; eight wells with connecting pipes, valves, valve chambers, etc., $4,000; total, $57,000. The annual running expenses for the first few years are estimated at $3,000, and the receipts are expected to equal that amount at the end of four years.

Mr. Chipman concludes his report by a strong argument in favor of municipal rather than private ownership and control of the water supply, and gives a tabular synopsis of statistics of water-works in Ontario bearing on the question.

For the sewerage the adoption of the modified separate system is recommended, the smallest size of sewer to be 8 inches; automatic flush tanks to be constructed at the heads of all sewers; sub-soil and cellar water to be removed by agricultural drain tiles laid alongside of and in the same trenches with the sewers; roof water to be admitted to the sewers only when necessary and when connections are properly trapped and storm water to be excluded.

For the larger part of the town a single cast-iron outlet extending some 300 feet into the bay is expected to suffice. For the rest of the town several separate outlets may be required.

The use of salt glazed pipes is advised, with manholes at all junctions and street intersections and changes of line and grade. The soil is sandy, and it is expected that the sewers can be laid at an average depth of 8 feet and at an average cost of $1.50 per lineal foot. No estimates of total length or cost are given.



OFFICES OF ADLER & SULLIVAN
AUDITORIUM BUILDING TOWER, CHICAGO.

THE DAVENPORT, IOWA, WATER-WORKS.

According to particulars bearing on the Davenport, Iowa, Water-Works, given by James P. Donahue, Secretary of the Davenport Water Company, the water-works system of that town represents an investment of nearly $1,000,000.

The Davenport Water Company is a private corporation, which was organized through the efforts of the late ex-Mayor Michael Donahue and his brother, the late Col. Peter Donahue, of San Francisco. The work comprises two pumping stations and a reservoir, and about 34 miles of water mains, from 4 to 16 inches in diameter. There are 308 public and 9 private fire hydrants, and about 1,800 water consumers.

The pumping capacity of Station No. 1 is 11,000,000 gallons in 24 hours. This station comprises the original works, and is situated on the Mississippi River. The pump-house is a large two-story building, 68 by 93 feet, including the boiler room. There are two sets of pumping engines in this station. Pumping Engine No. 1 is a condensing set of duplex engines of 5,000,000 gallons capacity per 24 hours, built by the Clapp & Jones Manufacturing Company. Pumping Engine No. 2, which has been more recently completed, is a high-duty Worthington compound condensing duplex engine of the latest design, and capable of delivering 6,000,000 gallons of water in 24 hours against a head of 345 feet. There has also been placed in this station within the last year a new triple set of steel boilers. At this station the smoke stack is 133 feet high, and one of the largest in the West. There is also one of the largest steam gongs ever built.

The pumping capacity of Station No. 2 is 5,000,000 gallons in 24 hours. The bluff or high service is supplied by reservoir water delivered by the pumps at this station, which are located at the reservoir. These engines are vertical—of the duplex compound condensing type. In 30 seconds the pumps of Station No. 2, which are continually running for the high service, can be changed so as to pump into the gravity service, and pump down hill in case the reservoir pressure is not sufficient for fire purposes. Then, too, there is another resource in case of fire, and that is Pumping Station No. 1, which can be set in motion and give all the additional pressure necessary. This means that the piping system is so designed that the pumps at Station No. 1 and Station No. 2 can pump at the same time, at their respective ends of the distribution mains, thereby insuring increased pressure—an almost unlimited supply of water and pressure in time of fire.

The reservoir has a capacity of 5,000 000 gallons. It was built in 1883, at a cost of about $100,000. It has an elevation of 115 feet. The purity of the water is assured, not only from the fact that no town of any size is drained within 40 miles, but also from the manner in which the water is taken from the river. The company tunneled under the bed of the river until the channel was reached, where the water runs over solid rock for several miles, with a current never less than six miles an hour. The water is delivered through this long tunnel into a large well 15 feet in diameter and 30 feet deep, and the water is, to a certain extent, filtered in this well before it supplies Pumping Station No. 1.

The water-works are managed by the following officers: Nicholas Kuhnen, President; James P. Donahue, Vice-President and Secretary; Thomas N. Hooper, Chief Engineer and Inspector. These officers, with Col. James M. Donahue, of San Francisco; Hon. J. H. Murphy and F. H. Griggs, of Davenport, constitute the Board of Directors.

SELBY AVENUE BRIDGE FLOOR.

The recent extension of a street cable railroad in St. Paul, Minn., made it necessary to build an iron highway and street car bridge on Selby Avenue, over the tracks of the Chicago, Milwaukee and St. Paul Railroad. This bridge consists of three thorough truss spans level and plate girder approach viaducts, on 6 per cent. grade. The total length of the structure is about 720 feet, with a width between railways of 41 feet 9 inches.

Figure 1 is a half cross section through a plate girder span, the part above V V being essentially the same as a cross section through a truss span. The bridge is symmetrical about the center line C C. The outer part, A B, of the roadway has a plank floor, on which a wooden block pavement, like that on the adjacent street, is laid. The remainder of the roadway has a buckle plate floor, B B B, with concrete ballast, on which similar paving blocks are set. I I are the track rails, and H H are the cable conduit rails. Access to the cable is had at every second panel through manholes, D D, located at each cable-bearing pulley. P is a sheet-iron trough shielding the cable.

Figure 2 is a plan of some of the center part of the roadway, with the concrete and paving blocks removed.

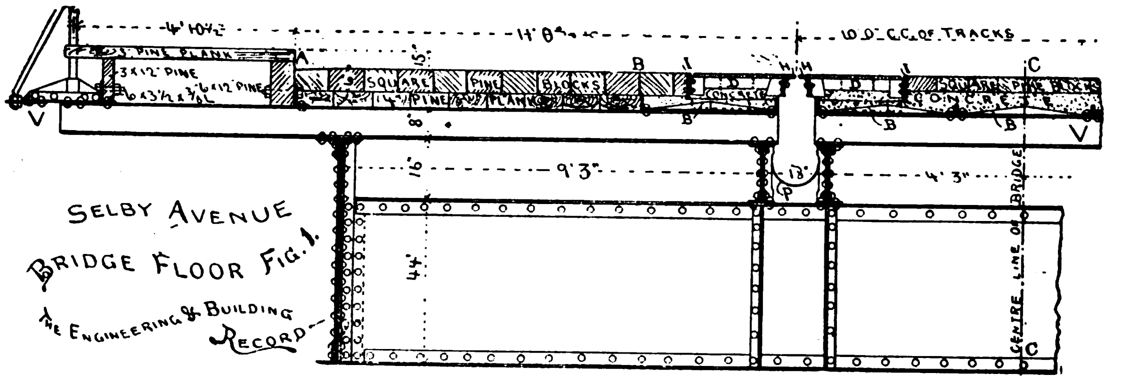
Figure 3 is a section and elevation at Z Z, Fig. 2; Fig. 4 is a section at Y Y; Fig. 5 is a section at X X; Fig. 6 is a plan of buckle-plates at the abutment masonry; Fig. 8 is a section at W W; Fig. 7 is a longitudinal section parallel to W W, through the outer part of the roadway, and Fig. 9 is a plan of the manhole frame and cast-iron cover (D, Fig. 1), with sections at U U and V V.

The buckle plates B B, etc., are riveted on their transverse edges to the floor joist C C, etc., and their longitudinal edges are riveted to the T bar splices D D, etc. The track rails I I and the conduit rails H H are supported by the cross-web plates F F, etc., to which they are connected by angle clips G G, etc. The edges of these plates are planed at A A for accurate bearing with the bottoms of the rails.

The double joist C' C' are for an expansion joint, and the opening between them is covered by an iron plate with beveled edges that extends across the full width of the roadway. The longitudinal angles M M, etc., and the rails, with the transverse vertical plates E E, etc., and part of the plates F F, etc., form side barriers to keep the concrete in place before it sets.

The iron work of this bridge will cost about $70,000, and is being built by the Edgemoor Bridge Co., of Wilmington, Del., in accordance with the plans and specifications of L. W. Rundlett, City Engineer of St. Paul, who furnished the data from which the above illustrations have been prepared.

In a paper on "Asphalt in Building Construction," recently read before the Architectural Students' League of Brooklyn, T. H. Boorman stated that Theophilus P. Chandler, Jr., architect, of Philadelphia, is using rock asphalt on every floor of a large apartment house; the carpets will lay on the asphalt, being fastened down to narrow strips of wood set against the partitions when the asphalt is laid.



Selby Avenue Bridge Floor Fig. 1.

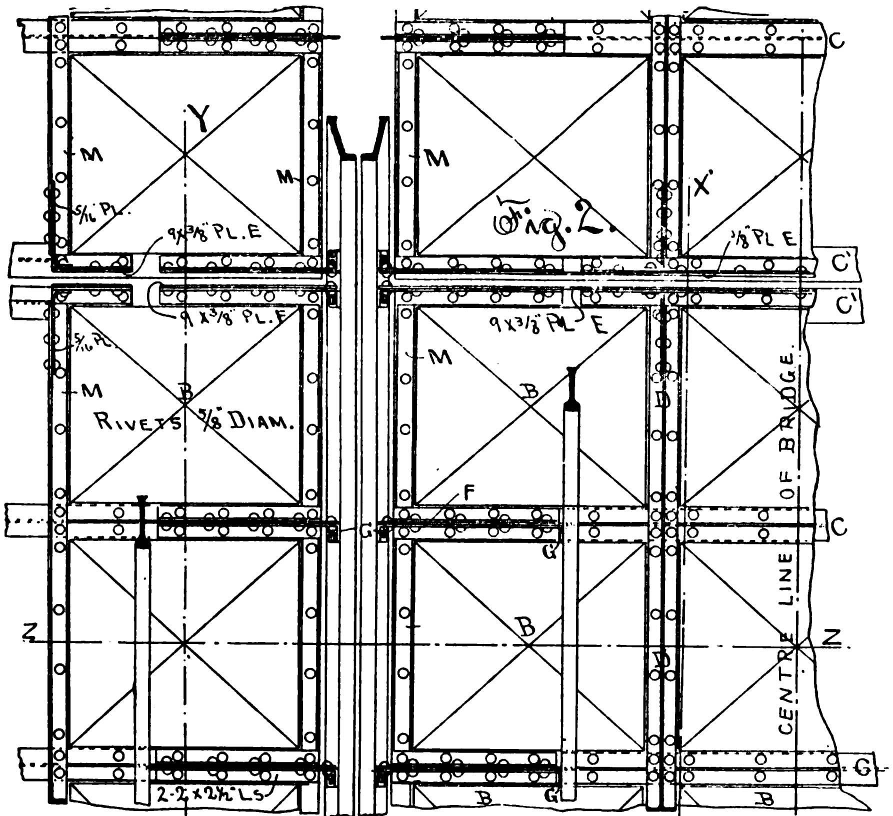


Fig. 2.

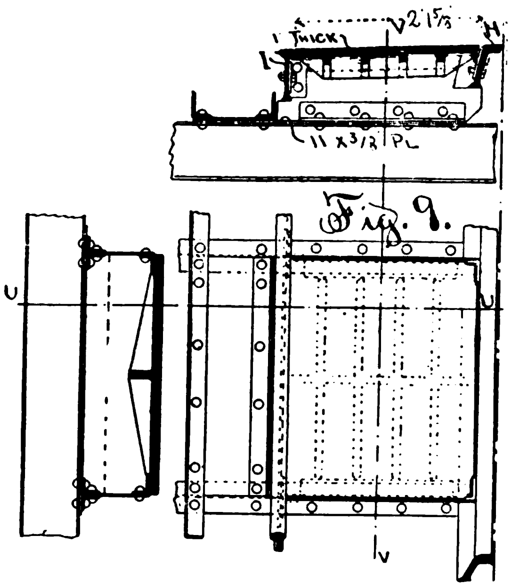


Fig. 9.

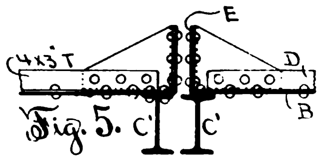


Fig. 5.

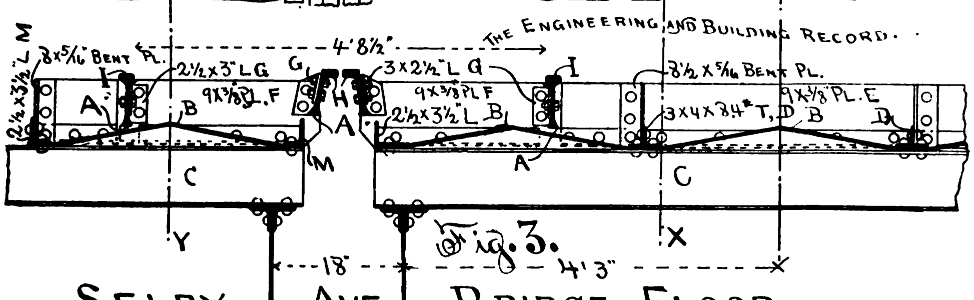


Fig. 3.

Selby Ave. Bridge Floor

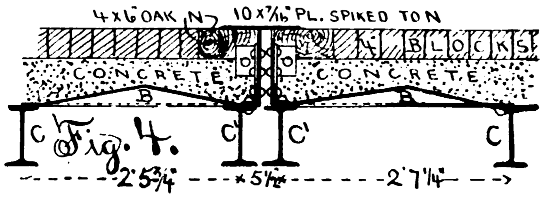


Fig. 4.

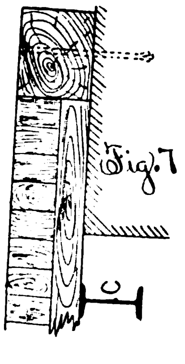


Fig. 7

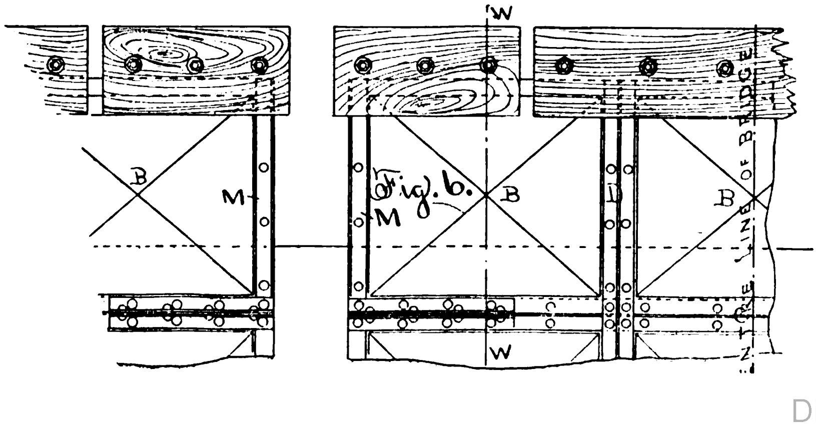


Fig. 6.

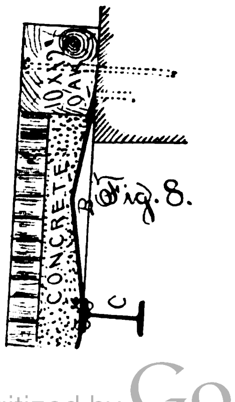


Fig. 8.

EXPERIENCE WITH ARTESIAN WELLS AT ROCKFORD, ILL,*

About 90 miles northwest of Chicago, with an elevation above Lake Michigan of 128 feet, and above sea level of 708 feet, on the banks of Rock River, running almost through its center, is situated the city of Rockford, a place of about 25,000 inhabitants, with a direct pressure system of water-works and 42 miles of mains.

The southern boundary of the collecting area, from which our wells draw their supply, is about 65 miles northwest of Rockford, and its extent, roundly estimated, is about 4,000 square miles; it has an effective elevation of 270 feet above Lake Michigan (although parts of it rise as high as 400 feet), and 850 feet above sea level.

In this area the Potsdam sandstone crops out at the surface. The difference in elevation between the two points is 142 feet, and the Potsdam sandstone being entered by the drill about 500 feet below the surface at Rockford, shows that water-bearing rock to have a dip of about 650 feet. Over this rock is a layer of magnesian limestone 100 feet thick, which, being impervious, confines the water to the lower rock.

Our first well was drilled 1,530 feet deep, with an 8-inch bore, and flowed at the surface about 1,000,000 gallons in 24 hours, the water rising by test 28 feet above the ground. This showed a friction loss of 114 feet between the basin and the well, or about 1.75 feet per mile.

We continued the work of sinking wells, and soon had four connected with the pumps, whose combined flow was about 3,000,000 gallons per 24 hours, but this flow was not permanent, and soon began to decrease, so that about 2,500,000 gallons per 24 hours was the limit. At this time a paper mill, situated one mile south of us on ground 17 feet lower, drilled a well which affected ours still more, and we drilled one more, but our own supply did not improve to the extent we desired or expected, and an investigation showed that the No. 1 well was flowing at the surface only 70,000 gallons, and at point of connection 210,000 gallons in 24 hours, and we decided to repipe and repack this well down through the upper stratas in the magnesian and note results. When finished, the result was a flow of 177,000 gallons of surface, and about 400,000 gallons at point of connection.

The same work on No. 4, resulted in an increase from 142,000 to 254,000 gallons at surface with a delivery at point of connection of about 700,000 gallons in 24 hours.

We are now at work on the other wells, and the total benefit cannot be determined until all wells are repiped.

We note that our wells were faulty in construction. The repiping shows conclusively that the wells were leaking badly in the upper stratas.

One well will under certain conditions affect another, the conditions in our case being a fine water-bearing sandstone, causing too much friction, and elevation.

A multiplicity of wells of small diameter, close enough together to make the conduit or suction of any value at point of delivery to pumps, will interfere with each other to such an extent as to limit the supply, and if to overcome this interference the distance one from another is increased, the friction in conduit is so great as to overcome any gain on account of non-interference. This we demonstrate in our No. 5, which is 700 feet distant from the nearest one of the other four.

The flow of our wells is not uniform. Extremely dry weather for any length of time at the basin affects the flow, decreasing it gradually, and it is months, frequently, before we notice a return to normal conditions. These wells, being all connected to one conduit and through the suction into the pit, are so arranged that any one of them can be piped out above ground and shut off from the main pipe, and by so piping either one of the five, and continuing pumping from the other four we find that the highest the water will raise above ground is eight feet, and this head will gradually lower as we increase the pumpage and lower the water in the pit, showing conclusively that we have more discharging capacity in the five holes than the porosity of the sand rock will supply in the area in which they are drilled.

Artesian wells at Galena, Ills.; Dubuque, Iowa, and Prairie DuChein, Wis., all supplied from the same basin, have a much stronger flow than ours, and investigation shows that at those places the Potsdam is much more porous, and in some instances delivers to the 8-inch hole more water than that hole can deliver at the surface. We also find that while the area of the collecting basin is about 4,000 square miles, only a small portion contributes toward our supply, owing to the dip of the rock preponderating toward the west and southwest.

SOME OBSERVATIONS AND SUGGESTIONS CONCERNING WATER-WORKS CONSTRUCTION.†

The Water Supply.—The first requisite of any system is, of course, an abundant supply of the best water. For supplies for small towns in the East ground water from collecting or driven wells is being largely used. Stored in covered reservoirs or tanks it gives almost universal satisfaction.

The Pipe System.—The pipes forming the distribution system should be of sufficient size to furnish good fire streams. With this in view, 6-inch pipe is small enough, except for short cross streets, where there are no hydrants, or to connect what might otherwise be dead-ends. If a pipe is a dead-end and has no hydrant upon it, or has one only to be used as a blow-off, there is this advantage in having it small, that less water is wasted in blowing it off, and the consumers get fresher water than from a large pipe.

If possible, there should be none of these pipes with plugged ends, but every pipe should be part of a circuit.

The size of pipes could be much reduced if only domestic service were to be provided for. A fire of any size requires immense quantities of water to extinguish it, and this must be applied quickly in large volumes. This requires large pipes.

Hose and Hydrants.—The recommendation of J. R. Freeman, in his valuable paper read before the American Society of Civil Engineers, of New York, and later, in a modified form, before the New England Water-Works Association, at Boston, that the size of fire hose be increased from 2½ to 3 inches in diameter, is worthy of the most serious consideration. It seems perfectly feasible that all, except the few lengths nearest the nozzle, which may have to be used from a ladder, should be of the larger size. The tables given in that excellent paper show the great decrease in friction due even to a slight increase in the diameter of the hose.

Of course this change would involve corresponding changes in the size of hydrants and hose fittings, but who that has watched the feeble streams thrown upon a great conflagration has not wished they could be increased in force and volume. Increasing the size of hose for a part of its length at least is no doubt the most economical way in which this result can be secured.

Hydrants in the thickly settled parts of a town should not be over 350 feet apart.

The loss from friction, especially in hose of the present size, is so great, that a good head at the hydrant or steamer is soon lost in forcing the water required for a good fire stream through a few hundred feet of ordinary hose. According to Mr. Freeman's tables, the least friction found was 10 pounds per square inch, and the greatest 27 pounds in 100 feet of hose.

Both were 2½ inches in diameter, the former being solid rubber, with "the interior free from ridges, and was intended to be as smooth as rubber could be made." The latter was unlined linen hose.

When it is considered that even with the best hose, such as is referred to above, and which is probably better than that found in most fire departments, the loss is 50 pounds for 500 feet of hose, we see the advantage of short lines.

Mr. Freeman gives 45 pounds at the base of the play-pipe as the proper pressure to discharge 250 gallons per minute through a 1⅛-inch smooth nozzle, and reckons it as a "good ordinary fire stream."

To obtain the same results with 500 feet of the best rubber hose would require 95 pounds at the hydrant or steamer. If the hose were such that there was a loss of 20 pounds in a 100 feet to produce a stream of the same efficiency would require a pressure of 145 pounds at the hydrant or steamer. All of which goes to show that good fire streams are dependent on short lines of smooth hose.

Hydrants should be set, if possible, just off the supply main, or else there should be a gate on the hydrant branch, which can be closed whenever it is necessary to repair the hydrant.

A saving in the cost of specials can be made by taking the hydrants off the smaller side lines near the main, and this will not increase the friction loss to any extent. The gate shutting off this branch line in connection with others beyond shuts off the hydrant without shutting off the pumping or supply main.

Location of the Pipes in the Streets.—There ought to be more uniformity in regard to the portion of the street in which the pipe is laid. The writer's practice has been to lay the pipes on the north or east side, and about one-third of the width of the street away from the street line.

There is apt to be more sun on those sides of the street in winter, and probably the frost goes to a less depth. This rule cannot always be followed, but as a general thing it is a good one. The center ought to be left for the sewer, if one has not already been built. The south or west side can be used for the gas pipe.

Sometimes the water pipes are laid from one side to another to avoid ledge or boulders. This is not good practice, and the man who follows with another system of pipes will not be happy.

Mr. Diven, in his excellent paper read at St. Louis last year, has spoken of the necessity of complete records of the location of all pipes, gates, branches, etc. The writer has adopted a method which has given excellent satisfaction on several works. The sketches are made in heavy India ink lines on tracing cloth within a rectangle 7¼ inches by 6 inches, with a margin of ½ inch on the side for binding. The sheet of tracing cloth might be 2 feet by 3 feet, containing 18 pages or rectangles.

Black India ink lines mark the boundaries of these rectangles and surround the outside. One or more sketches can be put on one space, but plenty of room should be allowed to make everything, and especially the figures, plain and intelligible.

A blue print is then made, and is cut up by following the division and outside lines.

This makes all the pages exactly the same size. For a small sum a bookbinder will bind them in substantial covers.

The advantage of this method is, that after the tracings are made, any number of blue prints can easily be taken, and if a book is lost, the original is still left. A complete alphabetical index, also made on tracing cloth, from which to take blue prints, makes it very easy to find any desired gate or branch.

A number of these books can be made, and one given to the Superintendent, one to each Water Commissioner, and one to the Town or City Clerk, to keep as a record.

Weight of Cast-Iron Pipe.—Much has been said and written on this subject, but there are two considerations which must be borne in mind in determining the required weight or thickness, and which make it difficult to depend much on theory. One is the fact that pipes must have a certain thickness to stand transportation, and the other is deterioration of pipes from corrosion or other causes. The latter is probably slight, but an accurate knowledge of it can only be obtained by many years' experience.

Much useful information could be obtained by the careful testing of old pipes, which have been in the ground many years. The bursting pressure, weight and thickness should be obtained. The comparison of the weight and thickness with those the pipe possessed when laid would furnish interesting data. If the bursting weight of a similar pipe from the original lot had been taken, this again would furnish interesting and useful knowledge.

For ordinary heads, not over 175 feet, the following weights of pipe will be found satisfactory.

4 inch	20 pounds per foot.
6 "	30 " "
8 "	45 " "
10 "	62 " "
12 "	80 " "

Taking into account the rough handling pipe is likely to receive in transportation, and the fact that it will certainly be no stronger, as successive years go by, the above weights are about right.

Bells and Joint Room.—Bells should be 3 inches deep for 4 and 6-inch, and 3½ inches for 8, 10 and 12-inch pipe. The joint room for the above sizes, should be about ⅜-inch.

Curves.—Curves can easily be laid to a radius of 300 feet, with straight pipe. By occasionally cutting a pipe and using a sleeve, the writer has laid 12-inch pipe on a curve of 80-feet radius. The pressure at the point is 90 pounds per square inch, and there have been no leaks, although the pipe has been laid nearly five years.

Tees or Y's.—Tees or right-angle branches are better than Y's in many localities, even though the angle in the streets differs considerably from a right angle. By putting the tee in at just the right place an easy curve can be made of short bell pieces, which often accumulate, and the pipe brought on to the proper side of the street. If the branch is from the force main, and is between the pump and the reservoir, the resistance to the passage of the water will be the same, whether the water is coming from the pump or from the reservoir.

Water and Sewer Pipes not to Interfere.—Especial attention ought to be given to the fact that if a sewerage system should be established in the future, manholes will be necessary at the street intersections, and as it is necessary to make the sewers straight from manhole to manhole, the required space should be left for them and the sewer pipe. This is especially true where there is much rock excavation.

Service Pipes.—Lead is no doubt the most durable, but there is a prejudice against it in some minds which makes the use of some good substitute desirable. Plain wrought-iron pipe, lined with pure cement, makes a service pipe which is very durable, does not fill up with rust, is capable of being bent to some extent, and is cheap. The cost of lining an inch pipe with cement, so as to make it three-quarters of an inch in diameter, need not be over one cent per foot, The tees and couplings can be lined with lead, or a mixture of lead and tin.

Samples which have been in the ground ten years are as smooth and clean inside as when put in; whereas tarred, enameled or even galvanized iron pipe in many cases would be completely filled with rust.

Gate Boxes.—Various forms of iron boxes are in use which give excellent satisfaction. In country streets they should be set about an inch higher than the street surface, and have a ring of stone paving around them, 12 or 15 inches wide.

ANNUAL REPORTS.

Annual Report of the Board of Water Commissioners of the City of Manchester [N. H.], for the fiscal year ending December 31, 1889.

This brief report of the Commissioners is accompanied by that of the Superintendent, Charles K. Walker, which gives the details. There were 676,135,583 gallons of water pumped during the year, and pumping expenses and repairs amounted to $4,429. There were 10,183 feet of cast-iron mains laid during the year, nearly all 6-inch, of which a part was to replace cement-lined sheet iron pipe. There were 15 hydrants set, making 441 in all, and 139 service pipes added, making 3,226 in all. There were 106 meters set during the year, making 951 in all. The total amount charged to construction account during the year was $30,232, and to current expense $17,006. The receipts were $86,700, including $52,381 for water by rate, and $33,596 for water by meter.

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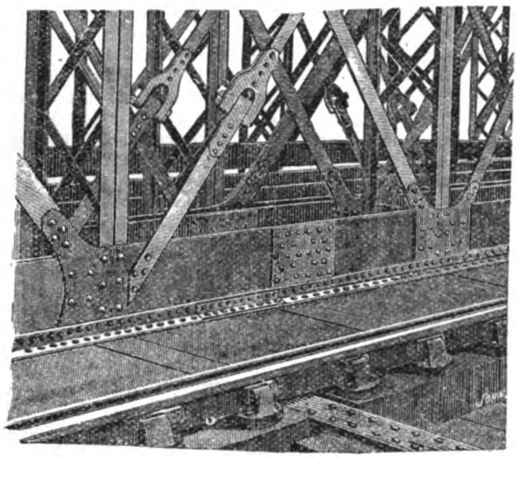
* From a paper entitled, "Our Experience with Artesian Wells," presented by J. T. Lakin, Superintendent of the Rockford, Ill., Water-Works, at the Chicago meeting of the American Water-Works Association, May 20-23.

† From a paper by F. L. Fuller, C. E., Boston, Mass., presented at the Chicago meeting, May 20-23, of the American Water-Works Association.

AN ASTONISHING DETAIL OF BRIDGE CONSTRUCTION.

A RECENT issue of the London *Engineer* has the accompanying illustration of construction of the Newark Dyke railroad bridge, which is being rebuilt with lattice girders of 265 feet span, and says that "Fig. 10 shows the gib and cotter connection in counterbraced bars made from flat bars bent round and cut to shape."

Comment is unnecessary. In this country adjustable diagonals are unknown in lattice girders, which for long spans are constructed for special rigidity, and in general have all diagonals of the same compressive strength. Destroying this would apparently be all loss and no gain for the essential characteristic of the bridge. If, however, it was determined to make a riveted bar adjustable, American constructors would probably weld on or upset stub ends and use a sleeve nut, as is customary for some pin connected flat bars.



Here the bent plate is shown ingeniously weak, whichever way of the grain it is cut, and the cotters are distinctly represented as *without fastenings*, held in place only by friction and continuous strain, and not only liable but almost sure to rattle out. The connection plates of the lower chord and diagonals have an amusing resemblance to short-sleeved underwear.

It is to be hoped that details of this kind are not of frequent occurrence in British practice.

NEW METHODS OF INVESTIGATING BRIDGE STRESSES.

To supplement the ordinary superficial inspection of iron bridges in service, M. Firmin Larroque, as appears by a paper published in the Proceedings of the Institution of Civil Engineers, has devised apparatus designed to afford comparisons between the effects produced by the application of the same load to a bridge at different times. Assuming the case of an elementary bridge of a single girder strained by the passage over it of a given rolling load at a certain velocity, he considers the bridge composed of an infinite number of vertical cross sections or laminæ, each of which receives a vibration wave from the passage of the load over every other lamina. These waves may be received by a microphone and transmitted electrically to a telephone. A record taken when the bridge is new may be compared with all future records, and the difference, if any, noted. Such difference would be an indication of deterioration. In order to compare the records they must be lasting; for this purpose the phonograph is used, and this is the key to the system. The author has used three different methods: (1) A string, stretched by a small weight, was passed over a pulley, the spindle of which was fixed to the vibrating body; the string was then carried to a spiral spring, and thence to the diaphragm of a phonograph, the spring being used to lessen the length of the vibration. (2) An india-rubber ball, with a small weight placed upon it, was connected by tubing to a drum, one face of which was the diaphragm of a phonograph; both these methods are of little use when the distance between the phonograph and the vibrating point is great. (3) The vibrations are received by a microphone which transmits them to a telephonograph which registers them, and this method is suitable for any distance. In order that the length of time occupied in noting vibrations may be always exactly the same, a contact forming part of the circuit to the two instruments is placed at each end of the bridge, the first of which is closed by the passing body as it comes upon the bridge, the other opened as it leaves it. For comparison of different records, the author prefers sight to hearing, and, for this purpose, has modified the phonograph as follows: In place of the diaphragm he uses a thin rectangular plate, fixed by one edge, and carrying at the other end a point on one side, and a very small mirror on the other, which latter reflects a ray of light on to a screen. The phonograph, if then made to travel parallel to the screen, produces a luminous zigzag line on it, and, if two instruments are used, and both are made to travel and revolve at the same speed, two records can be compared, or one phonograph may be used in a fixed position, while a sensitised paper is made to travel in front of it in place of the screen. Any number of different tests may then be compared by photography. The author has been able to discover, and to locate, hidden flaws in bridges by the above means, and the whole apparatus may be used for any number of bridges.

MARINE PARK, BOSTON.

AT the eastern extremity of South Boston, and about two miles from Boston proper, there has been laid out a unique pleasure ground, called the Marine Park. The accompanying illustrations show the manner in which it is proposed to complete it, provided permission can be obtained from the United States Government to lay out the Marine Garden on Castle Island, which is now occupied as a military station.

Among other things the Park was designed to furnish a sea beach sweeping around a bay, which might serve as a rendezvous for pleasure boats and a field for aquatic sports, and a pleasure walk and drive back of the beach, from which there might be an extended view of the harbor; also, a pier carried out far enough from the western headland of the bay to open to view two fine expanses of natural scenery not otherwise to be commanded from any public ground in the city, one towards the ocean and the other towards the head of Dorchester Bay. A marine aquarium was also designed to be a prominent feature of the Park.

The pier and pier-head shown in the lower part of the plan have been completed, as described in our issues of January 28, 1888, and September 21, 1889. The pier is of iron, and the pier-head is an artificial island somewhat pear-shaped in plan, built of gravel, with its outer line protected by a sloping wall of ballast and riprap, surmounted by a parapet of cut granite. In the center a circular wall has been built to serve as a foundation for the proposed building shown in Fig. 2.

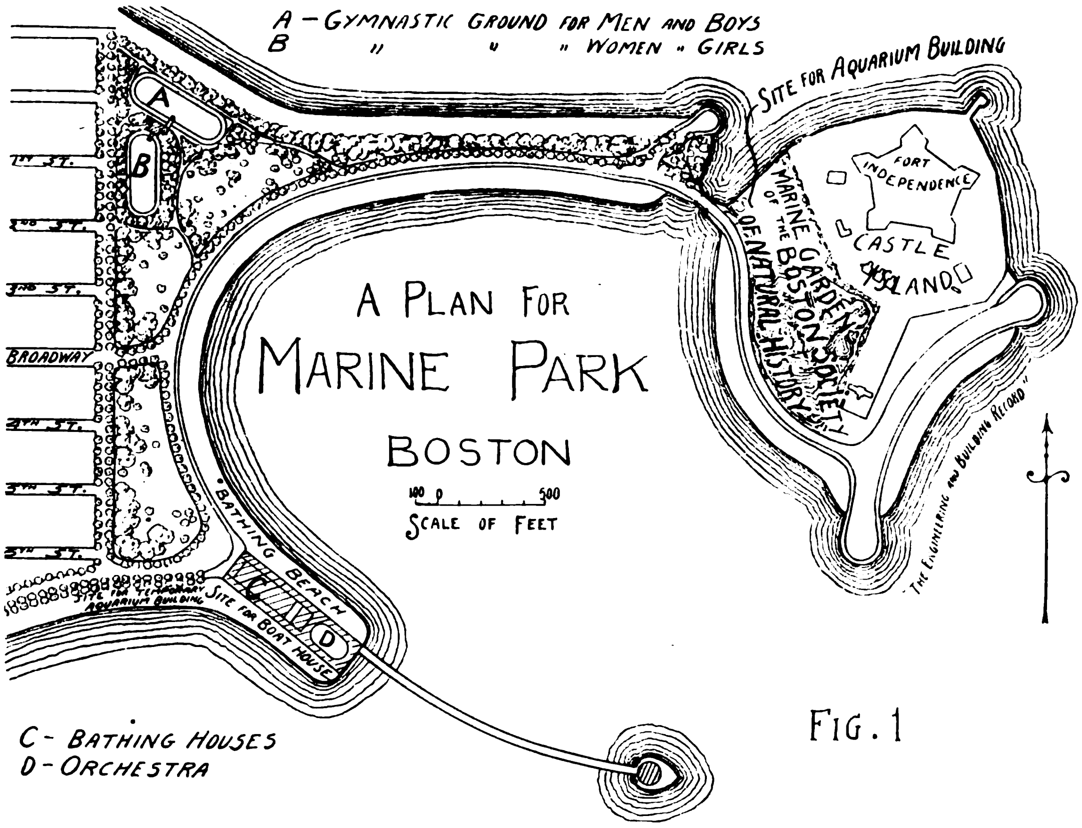
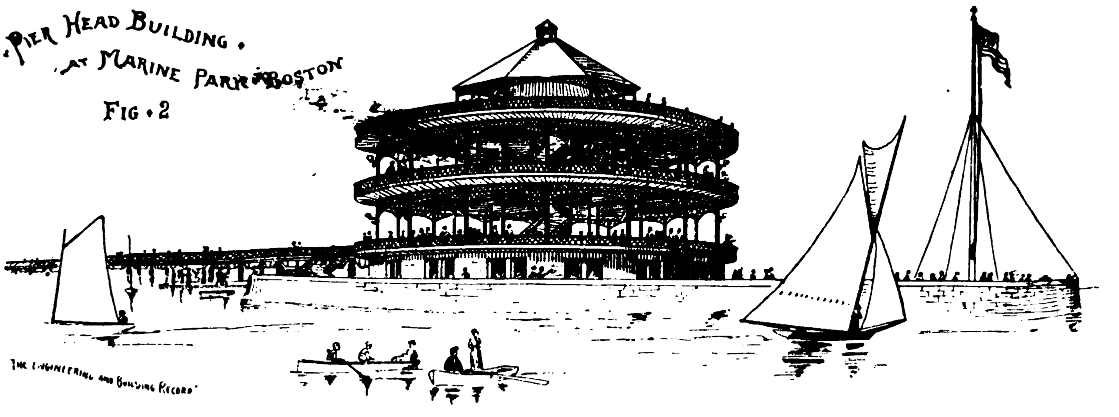

A – GYMNASTIC GROUND FOR MEN AND BOYS
B " " " WOMEN " GIRLS
SITE FOR AQUARIUM BUILDING
FORT INDEPENDENCE
CASTLE ISLAND
MARINE GARDEN OF THE BOSTON SOCIETY OF NATURAL HISTORY
A
B
1ST ST.
2ND ST.
3RD ST.
BROADWAY
4TH ST.
5TH ST.
A PLAN FOR MARINE PARK BOSTON
100 0 500
SCALE OF FEET
BATHING BEACH
SITE FOR TEMPORARY AQUARIUM BUILDING
SITE FOR BOAT HOUSE
C
D
"THE ENGINEERING AND BUILDING RECORD"
C – BATHING HOUSES
D – ORCHESTRA

FIG. 1


THE ENGINEERING AND BUILDING RECORD

PIER HEAD BUILDING, AT MARINE PARK, BOSTON
FIG. 2

ACTION OF GYPSUM ON MORTAR.

THE destructive action of gypsum on mortar in construction is illustrated by the condition of the exterior talus of the curtain of a stone wall in Paris, described by *La Semaine des Constructeurs*, which was built of blocks of mill stone faced with calcareous stones containing a large proportion of pieces of gypsum. It appeared on examination that the wall was disintegrated in many places to a thickness of 4 inches, and when taken down for renewal in 1886 the mortar had changed from white to rose color, and was found hard and white between two calcareous stones, but incoherent between a calcareous and a gypsum stone, especially nearest the gypsum, and between two gypsum stones, entirely pulverized. Furthermore, in the last case the powdered mortar was unctuous to the touch, burned the skin slightly as if partially unslacked, and, when retempered and made into bricks, would set in the open air, but remained plastic when immersed in water. The deduction seemed warranted that the presence of the gypsum had destroyed the strength of the mortar, or at least hastened its decomposition.

An analysis of samples of mortar taken from between two calcareous stones, from between two gypsum stones, and from between a calcareous and a gypsum stone, respectively, showed in all cases alike about 50 per cent. of sand, 20 per cent. of lime, 20 per cent. of shrinkage, or "loss by fire," and small amounts of alumina, peroxyde of iron, magnesium and insoluble residue, and a marked variation in the amount of sulphuric acid, which was, respectively, 0.40, 2.05 and 3.75 per cent. The composition of the gypsum stone was determined to be, lime 32, sulphuric acid $45\frac{8}{10}$, insoluble residue 1, alumina and peroxyde of iron $\frac{1}{10}$ per cent., a trace of magnesium and a shrinkage of $21\frac{7}{10}$ per cent.

The relation of the variable quantity of sulphuric to the decomposition of the mortar is thus explained by Captain Dolot: "Mortars exposed to irregular action of sea water are affected by the dissolved sulphate of magnesium in the water which acts on free lime, its alluminate, its sillicate, and in some cases on its double sillicate of lime and alluminum. The magnesium becomes inert, the lime is converted into a hydrate or soluble salt (chlorate or sulphate), or crystallized in mass in sulphate form, and the structure is at length transformed into a dry wall. Probably analogous phenomena occurred in this wall. Water, constantly filtering in and evaporating, attacked the gypsum and resolved it to sulphate of lime, which, every time the moisture diminished, expanded in the interstices of the water, evaporated, and formed crystals, which by their expansion burst the mortar that enveloped them. When the humidity increased these crystals were dissolved, afterwards reforming and breaking other cells, and so on, the mortar thus being mechanically disintegrated slowly but almost continuously.

The color was occasioned by a little hydrated peroxyde of iron, liberated by the sulphate of lime. The unctuousness of the crumbled mortar is attributable to the presence of dissolved sulphate of lime. The bricks hardened in the air because the sulphate of lime contained in them set, but remained pasty under water where the sulphate of lime could not crystallize.

These phenomena can be artificially produced by placing in a glass of water a piece of gypsum in contact with a piece of hard mortar. Experiments were made with mortar from Besse's lime, five months' old, and Portland mortar well set. No action was observed so long as the immersion was total, but allowing the water to evaporate sufficed to cause the formation of crystals of sulphate of lime on the emerging portions, and the cracking of the mortar which finally fell to pieces.

The conclusions point to the prohibition of the use of gypsum stones in constructions exposed to humidity, but if a controlling reason imposes their employment, they should be built exclusively separate in one section by themselves."

A LARGE RAILROAD BRIDGE IN INDIA.

Indian Engineering, in describing the just-completed Chittravati Bridge, between the Kondapuram and Tadpatri stations on the northwest line of the Madras Railway, says:

It is the finest bridge yet built in Southern India, being over half a mile long, divided into 19 openings of 140 feet each from center to center of piers; these are spanned by double-intersection Whipple-Murphy girders, each 139 feet 8 inches long, 20 feet wide, and 17 feet deep, supported on cast-steel fixed and roller bearings at alternate ends; the distance between the center of these or effective span being 136 feet. Each girder weighs 146 tons 12 cwt.; the rails are bolted to longitudinal teak beams, laid on wrought-iron trough rail runners supported by cross girders placed 8 feet apart, and riveted to the lower chords of the main girders, which are connected at top by massive plate overhead struts, riveted to the top flanges.

The 18 piers are each formed of a pair of cast-iron cylinders 12 feet in diameter, placed 18 feet apart. These extend from the bottom rock to within 10 feet of the river surface, where their diameter is reduced to 9 feet by a conical taper piece 7 feet 6 inches high; from this up to their top the cylinders are 9 feet in diameter; above the river surface the pair of 9-foot cylinders forming the pier are joined by massive wrought-iron bracing boxes, firmly bolted thereto and filled with concrete.

Each 12 feet cylinder is formed of rings 6 feet deep, each made up of six segments 1½ inches thick, strengthened by vertical and horizontal internal ribs, all joints are planed or turned, and the segments and rings are joined together by 1¼-inch bolts, a space being left which is calked with iron rust cement to form water and air-tight joints. The metal in the 9-foot diameter cylinders is reduced in thickness to 1¼ inches. The rock of the ancient river bed was found at from 18 feet to 78 feet below the present sandy bed.

At half the piers there was found over the rock a layer of trap boulders often cemented together by kunker, varying in thickness from 6 to 22 feet; sinking the piers through these boulders was by far the most difficult and tedious part of the work, and required 27,988 hours of diver's work; 255 lineal feet of 12 feet cylinders and wells were sunk through these boulders.

One cylinder took eleven and a half months to sink it through 22 feet of large boulders, and the other of the same pier eight and a half months. One of the boulders removed contained 35½ cubic feet or nearly three tons. The foundations of this one pier took as long as all others.

Large loads of rails were used to force the cylinders down aided by the firing of small charges of dynamite in the bottom of the excavation. The largest load used was 1,300 rails or 290 tons.

When sunk and bedded the cylinders were filled with concrete made of one volume English Portland cement, two and a half sand, and six of stone, measured dry, which came to one of mortar to two of stone, mixed wet.

This was lowered through the water by self-acting skips, till a sufficient depth to keep the water out was put in; when this concrete had set the water was pumped out and the rest of the cylinder filled dry, the concrete being carefully rammed in 6 inch layers as deposited.

From river bed to within 2 feet of the top the cylinders were filled with stone masonry in surki mortar, the last 2 feet being of one Portland cement to two sand, on which the cast steel bearings were set.

In erecting the girders they were built on Camber blocks under the shipment joints *laid on the river bed* in the dry season, service bolted and riveted complete; after which they were lifted up bodily by four 60-ton hydraulic jacks placed two at each end.

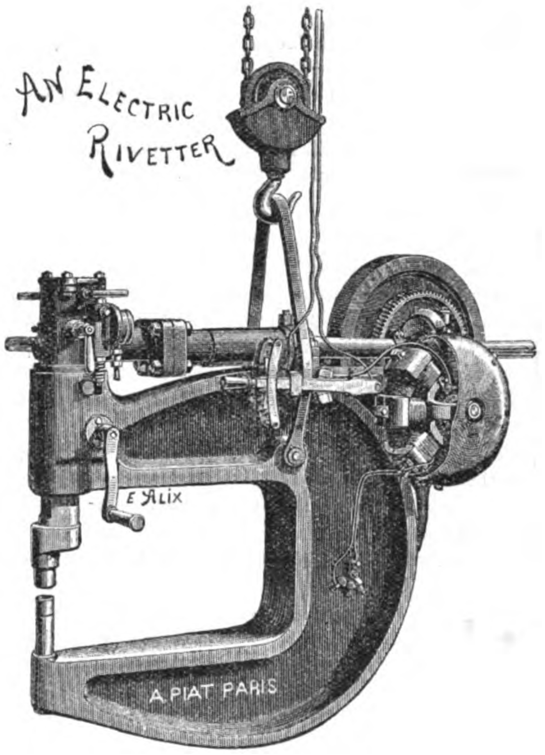
By this system the bulk of the riveting work was done by men standing on the river bed, and the use of all false works and temporary staging avoided.

The bridge was built in a little over 22 months, including interruptions by freshets and the floods of *two* wet seasons.

For a great part of the time 1,200 men a day were employed, and of these only two men were killed, and these by unavoidable accident.

AN ELECTRIC RIVETER.

THIS portable riveter, illustrated in the Paris *Genie Civil*, has been recently designed by A. Piat for general use where riveting is to be done in places supplied with dynamos for electric lighting, etc., and said to be easily driven anywhere that the work requires it and at any distance from the source of power.



THE EFFICIENCY OF AUTOMATIC SPRINKLERS.

IN the course of a discussion on automatic sprinklers at the Cincinnati meeting (May 13–17) of the American Society of Mechanical Engineers, C. J. H. Woodbury said that although the first automatic sprinklers were invented early in the century, yet the production of practical devices and their introduction on a large scale has been limited to the last 12 years.

The efficiency of such devices is shown by a compilation of the fires occurring on property insured by one insurance company, from January 1, 1877, to January 1, 1890. These fires are divided into two classes; the first including those where automatic sprinklers formed a portion of the apparatus in service over the origin of the fire, and the second including those which lacked the service of such apparatus. At 290 automatic sprinkler fires only 122 of which reached sufficient amount to be followed by a claim, the losses amounted to $127,665.44, the average cost of each fire being $433.32. The other losses amounted to $7,388,503.25 at 947 fires, 400 of which were followed by a claim; the average cost of each fire being $7,802.01, or 18 times the average less occurring at fires under automatic sprinklers. It is but fair to say, however, that these figures deal with full automatic sprinkler systems, and from them have been eliminated such instances as where the water was shut off from the automatic sprinklers, or where they were not provided with a proper static supply in the usual manner. An automatic sprinkler system is not different from other mechanical devices in requiring frequent inspection.

But these results were reached by a very few automatic sprinklers, although the whole number of such devices is very great. Mr. Woodbury stated that he had in his possession 165 different forms of automatic sprinklers, most of which would not be reliably operative in case of fire, or they are so constructed as to be especially prone to leakage or to disability by corrosion.

FRENCH FORESTRY DEPARTMENT.*

AT the Paris Exposition the exhibition of the Department of "Eaux et Forets" is made in a special building of its own. The exterior is covered with slabs showing the bark in such a way as to resemble tree trunks and has rustic decoration. This appropriateness of style is a minor illustration of the æsthetic taste which characterizes the French exhibition. Different portions of the interior of the Forestry Building are assigned each to a single kind of tree, and for each kind there is exhibited the surface with the bark on, sections transverse, radial and tangential, and the goods into which it is manufactured; as, for instance, one kind is made into wooden shoes, another into boxes, a third into bottle-stoppers, etc. This simplicity by which facts are made as clear as possible, even to untrained minds, is also very characteristic of the French exhibition; further illustration of it will be found in what I am going on to speak of. Another portion of the Forestry exhibition shows the work of the Department in the mountain regions, the French Alps and Pyrenees, in protecting the steeply sloping territory. Where a mountain side was liable to landslides or avalanches of rock, a series of retaining walls is built, and loose boulders are supported, and the growth of vegetation is started to hold the soil. In valleys which torrents of water have occasionally devastated, some very extensive improvements are made. The injury by flood is not only the washing out of the upper valley, but the overwhelming of arable land in the flatter portion below with the detritus, destroying its fertility, and the cutting off of communication over government roads, which, near the frontier, are important from the military point of view. The cure for these evils is of the nature of substituting for the inclined bed of the stream a series of steps, so that, instead of acquiring such destructive velocity, the water may fall nearly dead from one pool to another. More practically speaking, the fundamental work of protection consists of building dams at short intervals on all the steep parts of the channels. These dams, however, are of several classes; in the upper and smaller channels they are merely little rough stone walls of the simplest character, while on the lower and larger portions of the streams some are fine masonry structures with waste ways, comparable with the best that are built here for water power. It is not uncommon to put a hundred or more dams on a single stream. Besides, the beds of the streams are improved by removing their irregularities and establishing a smooth and approximately uniform cross section, so as to facilitate steadiness of flow. The banks, which may have been denuded, are replanted with whatever is suitable to grow. This work of caring for the whole length of the channels has cost in the aggregate millions of francs; and to an American who is accustomed to seeing mountain streams left in a state of nature, it is very striking, and suggests that in this country it is high time that more general interest were awakened in the preservation of existing forests at least. The most conspicuous part of the exhibition consists of three handsome paintings, such as are called dioramas, giving very natural representations of three of the works as they would look to an actual spectator from a well chosen point of view. They show mountain summits and landscape and possess merit as works of art. In one of the scenes the spectator seems to be looking out of a smithy; in another out of an engineer's shanty fitted up in realistic style. In alcoves adjoining are collected maps on a large scale of the areas drained by the streams, photographs for comparison taken from nearly the same standpoints before and after the execution of the works, and monographs describing the work in detail and giving its cost, also plans and sections, pictures of scenery and full information.

THE water-works report of Mansfield, O., for the 12 months ending April 30, 1889, William Ritter, Superintendent, shows that there were 1,430 feet of 4 and 6-inch mains laid during the year, making 94,345 feet in all; three hydrants added, making 130 in all, and 75 services added. There were 456,562,500 gallons of water pumped during the year, the total cost of fuel was $2,072, the average domestic pressure was 95 to 100 pounds and the fire pressure 100 to 125 pounds, and the total running expenses were $5,914. The amount charged to construction account was $4,067, and the receipts from water rents $8,999.

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* Some Notes of Foreign Travel, by Fred. Brooks, read before the Boston Society of Civil Engineers, and published in the *Journal of the Association of Engineering Societies*.

Questions and Answers.

All questions relating to building construction, paving, sewerage, water supply, or kindred subjects, will be welcomed in this column provided they relate to matters of general interest and are not such as should properly be referred to a consulting engineer. Answers will be carefully prepared and a proof of both question and answer mailed to the inquirer as early as proper consideration will permit. They will be published for the benefit of other readers as soon as convenient. The full name and address should be given, not necessarily for publication, but as a guarantee of good faith, and to facilitate further correspondence in case the question is not sufficiently explicit.

Inquiries of the Editor, in order to secure prompt attention, should *not be written on the same piece of paper as a communication* to the *Publishing Department*. Letters renewing subscriptions are sent to a clerk in the publishing office, and matter for the Editor, if in the same enclosure, is likely to be overlooked unless it is on a separate piece of paper, so that it may be promptly sent to the Editor.

TOWNS SEWERED ON THE FRANCHISE PLAN

GEORGE E. WARING, JR., Consulting Engineer, of Newport, R. I., writes: "Referring to your discussion as to franchises for the sewerage of towns by private corporations, it may be of interest to you to consider the inclosed prospectus of a company which had a contract with the city of New Orleans.

The interests of the city seemed to be well guarded, and the cost to householders would have been less than the cost of vault cleaning by the expensive system there in vogue.

The capital for the company could not be raised, at the time the effort was made, because of a lack of faith in the Legislature and Courts of Louisiana on the part of Northern investors—an objection which probably no longer exists."

THE NEW ORLEANS DRAINAGE AND SEWERAGE COMPANY.

The New Orleans Drainage and Sewerage Company offers for subscription $1,000,000 of its capital stock (10,000 shares of $100 each).

The company is organized under the general Incorporation Act of the State of Louisiana as amended by an act approved April 10, 1880. It is incorporated for the period of 99 years, and its charter contains the following provision:

"No stockholder shall ever be held liable or responsible to or through said corporation for its contracts or faults in any further sum than the unpaid balance, if any there be, due on the share or shares owned by him and standing in his name."

The capital of the company is $1,500,000, (which may be increased to $5,000,000.) Of this $500,000 is common stock, which may be issued in payment for services or property. The remainder, now offered for subscription, is preferred stock, the entire proceeds of which are to be applied to construction account.

The preference is as follows:

"The preferred stock shall be entitled to dividends from first profits up to 8 per cent. per annum, by preference over said common stock. If there be in any year profits to be divided over 8 per cent. on the amount of such preferred stock, the same shall be declared as dividends on the common stock, up to 8 per cent. per annum on the same; and if there be in the same year further profits to be divided, the same shall be declared equally and pro rata on both common and preferred stock."

The funds now to be subscribed are to be used for the construction of a complete system of sewerage and soil drainage in the city of New Orleans, on the plan now in operation in Memphis, Tenn.

After a most carful examination of the subject, and on the urgent recommendation of the New Orleans Auxiliary Sanitary Association, and of the Louisiana State Board of Health, of leading engineers and physicians of New Orleans, of the City Engineer, and of a Committee of the Council, sent to Memphis to investigate the system, the Council passed an ordinance (approved by the Mayor April 19, 1881), granting to this company a franchise for the laying of sewers and sub-soil drains for a period of 99 years, subject to the city's right of purchase at appraised valuation at any time after 20 years, and directed the Mayor to make a contract with the company, which binds the city to the above conditions and engages that the city of New Orleans will not adopt any other system of sewerage for a period of 25 years after the execution of the work, say 30 years in all, and that "the city will at all times, by a proper exercise of its police powers and other powers, protect the pipes and other property of the company from obstruction and injury, and will, by every lawful means, promote and enforce the adoption and proper use of the system herein provided, and will at all times, during the term of the said contract, provide and enforce the provisions and prohibitions contained in the second section of this ordinance, or their equivalent, with diligence and in good faith.

By the terms of the contract, as fast as the company's sewers are made ready to receive the drainage of houses, it becomes unlawful for householders along its course to maintain any privy vault, cesspool, surface gutter or other means of disposing of household wastes, except through closets, sinks, drains, etc., connected with the Company's sewers. That is to say, the use of the sewers is compulsory for the entire population, as the facilities are furnished. The company is not required "to accept or furnish an outlet for any drain not of its own construction, nor unless the fixtures used in the house shall have been approved by it; its approval or refusal to approve being subject to the sanction of the State Board of Health, whose decision shall be final, as of safe and proper construction; nor to accept any connection with any property until its owner shall have executed the contract contemplated by Section Second of Act No. 125 of 1880, providing for securing proper compensation to the company by privilege or servitude." By this provision the claims of the company for unpaid sewer rates take precedence of all mortgages and may be collected by summary process.

The rates to be charged vary for dwelling houses according to size, from 85 cents per month to $2 per month. Corresponding rates are fixed for business establishments, hotels, etc. These rates are subject to considerable discounts for payments in advance. If paid annually in advance, the charge for dwelling houses is from $6 to $17 a year.

There are now in New Orleans about 25,000 dwellings, and it is estimated the rates from these will be sufficient to pay 15 per cent. dividends on the cost of the work, beyond operating expenses. There are about 10,000 other buildings.

It is worthy of note that the rates provided to be paid for the removal of all domestic wastes are less than the present cost of compliance with the municipal regulations concerning the emptying of privy vaults alone. Indeed, the scheme on which the company is based has all the advantages enjoyed by companies for furnishing illuminating gas, with the important modification that every member of the community will become, as a matter of sanitary regulation, a patron of the works, while the company has no manufacturing expenses to pay. The city is not now closely built up, and its anticipated early and considerable increase of population will add to the revenue of existing sewers, by occupying vacant lots along the line.

The directors of the company are leading business and professional men of New Orleans, and the entire work is to be under the consulting engineer of the company, Col. George E. Waring, Jr., the originator of the Memphis system of sewerage.

Condition of Subscription.—The first installment, 10 per cent., to be paid on subscribing; and the second installment (5 per cent.,) becomes payable November 15, 1881, and the remainder in installments of not more than 10 per cent. each, and at intervals of not less than 30 days, as called. The 10 per cent. paid on stock subscribed for in excess of allotment will be credited on the next assessment on the alloted shares. Shares will be alloted in proportion to subscriptions in all cases, except that single-share subscriptions in New Orleans will be allowed in full.

During construction, and prior to the earning of dividends, interest on moneys actually advanced will be paid, from revenues received, at the rate of 5 per cent. per annum, and charged to construction account. It is estimated that not more than 65 per cent. of the subscription will be called. Of the dividends declared, 8 per cent., on the amount paid in, will be paid to holders of preferred stock in cash, and the remainder will be credited as the payment, on account of the unpaid subscription on the stock, until the full amount, 100 per cent., shall have been paid up. J. H. OGLESBY, President.

AIR CUSHIONS ON A WATER-MAIN.

"T. B. S.", of New York, writes: "In your reply to 'City Engineer,' under the head of 'Air Cushions on a Water-Main,' page 394, you refer to and explain the disappearance of the air from air chambers. Will you explain how this loss may be compensated for? Would also like your opinion as to the proper sizes of air chambers."

[To renew the air in the chamber without drawing the water from the pump or main a small air pump is often arranged to be worked by hand, or, better, by some moving part of the engine. Sometimes a small air cock is placed on the suction but this should be very carefully looked after, for the admission of too much air, and very little is enough, not only reduces the capacity of the pump by the expansion of the air on the suction stroke, but in a pump without a fly-wheel the sudden compression of the air on the return stroke permits the plunger to acquire undue velocity at the start causing unpleasant and sometimes, perhaps, even dangerous shocks. Another way would be to have an auxiliary chamber connected to the air chamber top and bottom by two pipes with valves, and enough lower than the air-chamber so that when the auxiliary chamber was filled with air, and the valves were opened in the connecting pipes, the air and water in the two chambers would change places, which operation could be repeated as often as necessary. Care should always be taken to so place the air-chamber that any free air in the water current could rise into it and the connection with the air chamber should be equal to the size of the force main.

How large the air chamber should will be depend on the character of the pump and the speed and pressure at which it is run. As the office of the air chamber is to equalize the flow in the force main it is obvious that the more irregular the delivery of the pump the more work the air chamber has to do, and hence the larger it must be. A single-acting pump would therefore require a larger air chamber than a double-acting one of the same capacity, and a duplex or rotary pump less than either, in fact the two latter would hardly need an air chamber at all. A fly-wheel pump would need more air chamber than a direct-acting one, on account of the greater variations in speed of plunger which the fly wheel introduces. Obviously, too, the faster a pump runs the more air chamber it needs, since any pump, if run slow enough, can get along without an air-chamber. The pressure also must be considered, as the only efficient part of the air-chamber is that occupied by the air, and its volume will be inversely as the total pressure. For instance, the same air at 15 pounds pressure, or 30, including atmosphere, will occupy three times the space and give three times as much cushion as it would at a pressure of 75 pounds, or a total of 90 pounds. If air is artificially supplied to the chamber its effective capacity will, of course, be independent of the pressure, which then does not make so much difference, except as the strains on the metal are more severe and their equalization therefore of more importance. The length of the force-main and the average velocity of the water in it should also be considered, since both these things increase the liability to water hammer and the danger resulting from it.

By preparing a diagram showing the relative speed of the pump plunger at different parts of its stroke, or the aggregate speeds if there is more than one plunger, and comparing it with the average speed, an air-chamber can be so proportioned that the variations of pressure in the force main shall not exceed a given amount. Ordinarily the effective capacity of the air-chamber should not be less than twice, and need not be more than four times the displacement of one stroke of one plunger, but it will usually be wise to give the air-chamber the benefit of any doubt, and make it as large as a due regard for economy and other considerations will permit.

Sometimes a stand-pipe is better than an air-chamber for reasons explained on page 346, but it has the disadvantage that it cannot usually be placed so close to the pump, and therefore an air-chamber is commonly used even with a stand-pipe, but it need not be so large in that case.

ANNUAL REPORTS.

MISSISSIPPI RIVER IMPROVEMENT OF NAVIGATION BETWEEN MINNEAPOLIS AND DES MOINES RAPIDS, including improvements at special localities between those points; operating and care of the Des Moines Canal. Officer in charge, Major A. Mackenzie, Corps of Engineers, U. S. A.

The annual reports of Major A. Mackenzie, Corps of Engineers, U. S. A., of the work under his charge for the year ending June 30, 1889, constitute appendix A A, of the report of the Chief of Engineers, who first mentions that $549,600 has been expended altogether for snag boat service on the upper Mississippi, and that as a result accidents and damage from snags, wrecks and such obstructions have become very rare. He also notes the completion, for $125,000, of a dry dock 400 feet long and 100 feet wide at the Des Moines Rapids Canal.

Major Mackenzie gives the work of the snag boats more in detail, and also gives abstracts of proposals received for various items of shore protection and dam construction. The lowest bids for loose stone in place in lots of from 14,000 to 22,000 cubic yards varied in different places from $1.19 to $1.54 per cubic yard, and for brush from 40 to 50 cents per cubic yard. The highest prices were $1.95 and 85 cents respectively.

Assistant Engineer C. W. Durham, complains of the dumping in the river of large quantities of refuse from the city of St. Paul. It is said that 500 tons of refuse are dumped into the river every day from Minneapolis, which has a crematory of 200 tons daily capacity, and if St. Paul contributes 500 more it would be sufficient in 25 years, taking a ton of refuse to equal one cubic yard, to completely fill the river bed to one foot above low water for a distance of 30 miles.

The materials for river improvement works cost, rock on barges 62½ to 64½ cents per cubic yard; brush on barges 25 to 28 cents per cubic yard; material in place costs from $1.14 to $1.23 per cubic yard, or exclusive of plant charge, 79 to 86 cents, and, exclusive also of general superintendence and office expenses, 66 to 72 cents; cost of material on barge was from 33 to 45 cents, and of towing and putting in material 27 to 34 cents.

Gen. T. L. Casey, Chief of Engineers, indorses the recommendation of Major Mackenzie, that the rapids at Rock Island be improved for a distance of some 13 miles at a cost of $330,000, in preference to constructing a lateral canal for that distance, at a cost of $4,000,000, which he does not think the present requirements of navigation will warrant. A map of the rapids and details of the proposed improvements are given.

SECOND ANNUAL REPORT OF THE BOARD OF WATER COMMISSIONERS OF LITTLE FALLS, N. Y., 1889.

The greater part of the report is given up to a detailed financial statement for the year ended January 1, 1890. The report of the engineer, Stephen E. Babcock, refers to the work of maintaining and extending the system, water vents, etc., and gives also a record of fires for the year. The annual water rates for 1890–91, as adopted by the Board of Water Commissioners, are published in the concluding pages of the pamphlet.

ST. AUGUSTINE, FLA., has decided to establish a garbage cremator, to be managed by a contractor.

DOMESTIC PLVMBING HEATING LIGHTING & VENTILATION ENGINEERING

PLUMBING DETAILS IN THE MECHANICS' BANK BUILDING.

THIS building, at 33 Wall Street, New York City, just completed, is designed for an office building and to accommodate the Mechanics' Bank, which occupies all of the first floor. The building is about 30 feet front by 70 deep and is nine stories high, exclusive of basement and janitor's apartments on the roof.

The plumbing includes the following fixtures: one basement toilet room for the bank employees, containing 4 water-closet sinks, 3 urinals and 5 wash basins. One private toilet room on the first floor for the bank officers, containing 1 water-closet, 1 bath-tub, 1 wash-basin and 1 urinal. One general toilet room on the ninth floor that contains 8 water-closets, 3 urinals and 1 wash-basin. On the ninth floor there is a ladies' toilet room containing 3 water-closets and 1 wash-basin.

The eighth floor has a small toilet room with one wash-basin, and there is a slop sink on every floor above the basement, and on each floor from the second to the seventh inclusive there is a toilet room, 1 water-closet, 1 wash-basin and 1 urinal. The janitor's apartments contain 1 bath-tub, 1 water-closet, 1 wash-basin, 1 pantry sink, 1 kitchen sink and 13 tray laundry tubs. In the basement engine room are the hot and cold water distribution drums, a drip sink and a water-closet.

Figure 1 shows the distribution system in the basement near the pumps. Y is the cold and Z is the hot water drum, each about 2 by 5 feet, made of galvanized iron and supported by the gas-pipe table X X, etc., set in the footing of the foundation walls. The drum Z contains a 2½-inch pipe *a*, supplied with live or exhaust steam through a pipe S.

The arrangement of the pipe *a* is similar to that made by Byrne & Tucker for the Mills and the Duncan Buildings in New York, described, respectively, on p. 203, Vol. VI, and p. 296, Vol. VIII. The pipe S passes through a stuffing-box *b*, and is screwed into a wrought-iron head plate that is welded into the top of the pipe *a*. The return steam-pipe *s* is screwed into a hollow rivet that is cast on the bottom of the cap *c* that is screwed into the bottom of the boiler and tapped to receive the pipe *a*. The stuffing-box permits the pipe S to slide back and forth through it with the expansion movement, which is taken up by the spring of the horizontal branch S S. The large pipe *a* is used instead of the usual steam coil to prevent noise when the full head of steam is turned on, and to heat the water rapidly. Cold water under tank pressure is received through the 2-inch* pipe C and supplied to the distributing drums through branches W and W. Q is a 1½-inch pipe supplying water under street pressure. Ordinarily its valve V is closed, but by opening it the drums Y and Z may be filled directly from the street mains, or the basement fixtures, which are branched from Q, may be supplied from the tank.

Cold water is distributed through the building from the drum Y through the 1½-inch pipe D and the 1-inch pipes E, F and G to different lines of wash-basins, and through the 1-inch pipes N, O and P to the various flushing cisterns.

Hot water is delivered from the drum Z through the ¾-inch pipe R to the engine room sink and through the 1½-inch pipe A to all the slop sinks and to the officers' toilet room. B is a ¾-inch return circulation pipe, H is a 2-inch safe waste from the roof tank and I, J, K and M are 1-inch safe wastes from the toilet rooms. L is a 2-inch delivery pipe from the pumps to the roof tank. V is a drip-pipe through which all the rising lines may be drained by opening their cocks T T, etc. The drums Y and Z may also be drained into it through their emptying pipes U, U.

Figure 2 shows the roof tank, built of ¼-inch iron plate and 2 by 2-inch angles with ⅝-inch tie rods A A, and Tee bar stiffeners B B, etc. The tank is filled through the 2-inch pump pipe G, overflows directly upon the tiled roof through the 3-inch pipe D and may be emptied also directly upon the roof through the 1½-inch pipe E. F is a 3-inch fire line with hose couplings on every floor C is the 2-inch supply pipe to the distributing drums Y and Z (Fig. 1), H is a 1½-inch supply pipe direct to the janitor's apartments, and I is a 2-inch supply pipe direct to the ninth floor toilet room. K, K, K are vent-pipes to facilitate the discharge of all the water in the supply lines C, H and I, after their valves J J J are closed. L is a vent pipe from the hot-water drum Z, Fig. 1. M is a float whose chain N operates the index of the tank gauge in the pump room. The float M is made of a butler's pantry copper sink with a sheet of copper tightly soldered over the top.

Figure 3 is a diagram of the ninth floor toilet room which is about 12 feet wide by 22 long, and contains 8 water-closet sinks, 3 urinals and 1 wash-basin. It has a tiled floor, oil finished wood-work, and white marble wainscoat and panels A A, etc. The irregular shape of the room made it necessary to arrange the urinals as shown, two of them, U U placed back to back opposite the entrance and screened by a 7-foot marble slab B. C is a marble safe.

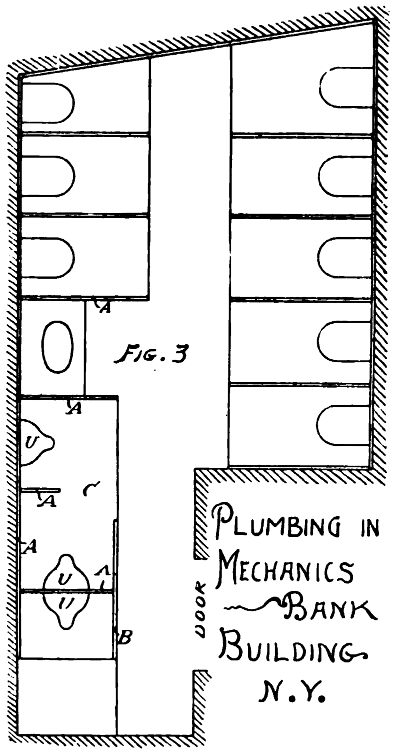

Figure 4 shows the suspended horizontal boiler in the janitor's kitchen. Cold water is received through the pipe C and hot water through the pipe H; the branch B supplies the kitchen sink and the branch A supplies the laundry tubs, bath-room, etc. The janitor's bath-room is finished with unusual elegance, having marble wash-basin table, royal porcelain bath-tub, ivory finished water-closet and nickel-plated exposed brass pipes. The floor and wainscoat are finished with white and tinted ceramic tiles.

Figure 5 shows the drip-sink S in the engine room. It is supported on pieces of 1-inch gas pipe A A, leaded into the footing of the foundation wall over which it is set so as not to occupy much floor space. An adjacent water-closet

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* The sizes given for pipes are correct but the sketch is not drawn to scale.

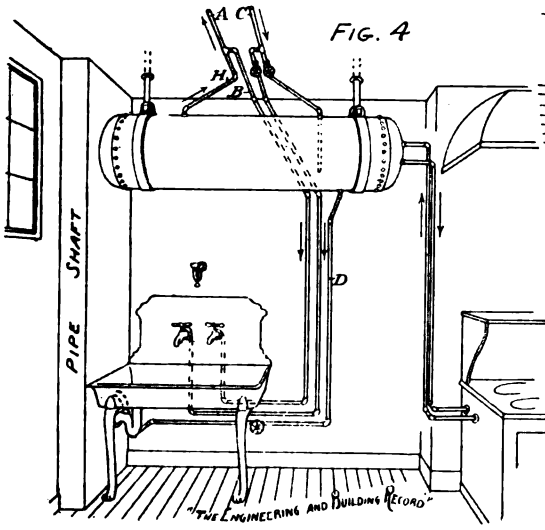


FIG. 4

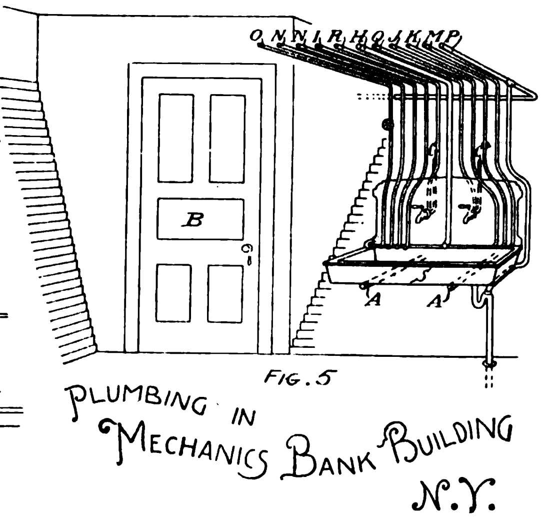


FIG. 5

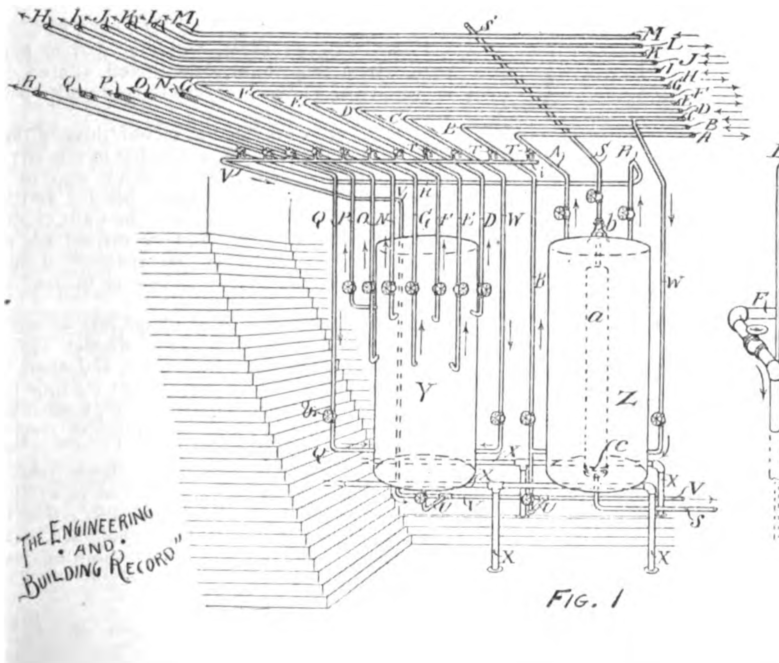


FIG. 1

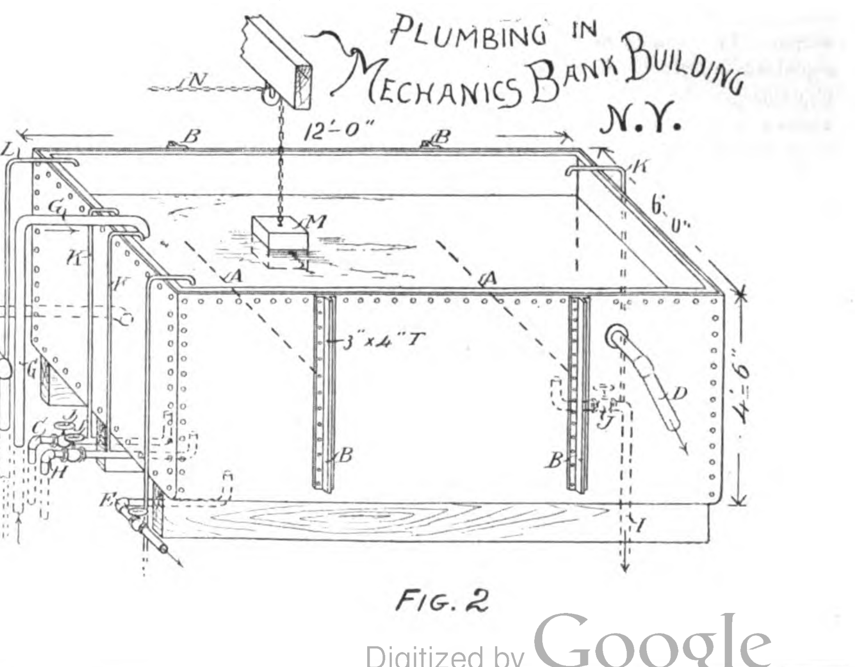


FIG. 2

at B is also arranged so as to be convenient for the firemen, etc., and not take up unnecessary floor space. Q is the drip-pipe from the roof tank safe, and H, I, J, K and M are drip-pipes from toilet room safe wastes. R is the hot and Q the cold supply (Fig. 1), N N are safe wastes, P is a trap vent-pipe and O is the drip-pipe from the steam radiators.

C. W. Clinton, of New York, was the architect of this building, and Byrne & Tucker, also of New York, did the plumbing.

COMPARATIVE TESTS OF RADIATORS.

At the Cincinnati meeting of the American Society of Mechanical Engineers, Charles E. Emery directed attention to the fact that it is possible, in testing many devices, to state correctly the actual results obtained in detail when, on account of the methods employed, the tests do not show the true comparative value of competing devices.

For instance, experts know, what house owners and many steam-fitters do not, that the efficiency of a radiator depends upon the freedom with which air can circulate over the radiating surfaces; so engineers can be found who will make a careful test of a client's radiator with a given surface distributed over considerable length; for instance, with only two rows of small pipes, and test in comparison an opponent's wide, short radiator arranged, say, to put the same surfaces in pipes four or five rows deep. The long, thin radiator will condense more water every time, and if the engineer in his report makes a correct drawing of the radiators tested, so that on the face of the report he does not appear to deceive the public, but is careful not to mention the principle involved, the client has an opportunity of extolling the merits of his particular radiator in comparison with his opponent's, and to gain a commercial advantage not entirely warranted by the actual relative values of the goods themselves.

RECEIVING TANKS ON STEAM HEATING SYSTEMS.

The return of drips in heating systems that take steam directly from low pressure boilers may be easily managed, but when high pressures must be maintained in the boilers for furnishing power and the steam for heating has to be passed through reducing valves new elements of difficulty come up for consideration. The *Locomotive*, in a recent issue, gave illustrations of receiving tanks applied to such systems.

It appears that a certain heating plant was giving much trouble from pounding and rattling. The returns entered the receiving tank through a pipe which passed horizontally through the head near the bottom of the tank. The supply for the pump was taken from the bottom through another pipe at right angles to the return pipe. An escape pipe was placed in the top of the tank to relieve the pressure. Cold water was also admitted, when necessary, through another pipe which entered the top of the tank. The cause of the trouble was at once apparent. The return pipe entering below the level of the water in the tank, a considerable portion of the steam that was returned was condensed at once upon striking the cold water, and the noise so produced was communicated through the piping to every one of the buildings heated. The pump also would occasionally refuse to work, although it was placed properly below the tank level so that the water would flow into it of its own weight. The trouble here was that the return pipe, as explained, entered close by and at right angles to the pipe through which the pump was fed, so that the steam which entered through the return, along with the water of condensation, broke the current in the suction pipe.

To remedy the trouble the return pipe was arranged to enter the tank at the top, discharging the water of condensation upon the surface of the water already in the tank. The escape pipe was removed so that the vapor collecting over the water could not pass off. By this removal of the escape pipe a great saving of heat, and therefore of fuel, was effected. When the pressure from the accumulating vapor in the tank equalled that in the heating system, the water of condensation flowed into the tank only as fast as it accumulated in the pipes. The connections and returns could thus be kept flooded so that all noise in the pipes was prevented.

In referring to this point further the *Locomotive* remarks that when all the pipes to the radiating surfaces are of good size, and the pressure throughout the heating system is uniform, it is well to run a small pipe from the steam main to the tank so as to prevent the water from being blown out of the return pipe. This will make the flooding of the connections certain, and the small pipe may be very easily arranged so as to remove the drip from the main steam pipe, as well as to keep up the pressure in the tank. A drip valve should be placed at the lowest point of the return pipe for draining it when it is not in use, and one should also be placed on the receiver to remove air and prevent an air bond in first starting up the system.

Where there are some radiators so nearly on a level with the water in the tank that they will not return their drips freely through the return pipe entering the upper part of the tank, it is often advantageous to allow such radiators to return their water through a separate pipe which enters the tank 8 or 10 inches or a foot lower than the surface of the water in the upper return pipe. This will give the ill-conditioned radiators the advantage of a correspondingly less static pressure to return against, and will equalize the circulation all over the buildings.

Notes and Queries

on Domestic Engineering.

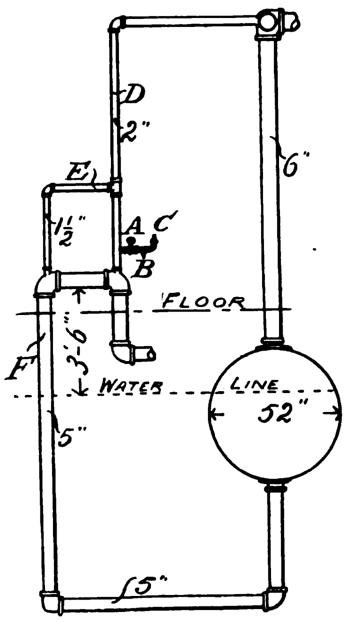
Communications relating to the practical details of plumbing, heating, lighting and ventilation will be welcomed in this column. The writer's true name and address must always be given, but an assumed name may be used for publication if preferred.

TROUBLE WITH A STEAM HEATING PLANT

Guy Tilden, architect of Canton, O., writes: "I inclose you herewith a blue print showing the arrangement of the artificial water line of steam heating job in this city, which is giving some trouble. The job contains about 2,000 feet of direct radiation, is a two-pipe job, with separate return from each radiator which connect with the main return. There are straight-way stop valves in the main supply and main return but no check valve in the return.

The trouble is that the water syphons out of the returns with considerable force, which takes about half a minute, and then everything is quiet for 15 or 20 minutes, then it will syphon again, finishing with snapping, cracking and a little pounding, then all is quiet again.

The 2-inch pipe D we had put on first and, thinking that this choked when syphoning began, I had the 1½-inch pipe E put on. This helped it some, but only a little. Then I had the pipe E disconnected from D, and increased to 2 inches and run direct to the boiler. This helped still more. I also had a 1½-inch pipe connected with the return at F and run direct to the boiler, but this did no good at all. I also had a ½-inch pipe and stop valve connected at A, a compression gauge cock at B and a check valve at C, and found that when syphonage occurred with eight pounds pressure on the boiler the check would momentarily open, and if we opened the gauge cock B, water and steam, principally water, would flow through at a great rate."



[We have known of trouble similar to yours in an apparatus arranged with an artificial water-line. The cause of it was never satisfactorily explained, but it was remedied by using a swing check valve and stop valve in the pipe D as close to the top of the syphon as it was possible to place it. The check valve, of course, should open from the main steam pipe towards the return pipe. The stop valve was used simply to vary the size of the passage through the pipe D and is probably not essential. It, however, may save further trouble to put it in when the alteration is made for the check valve. We believe that the engineer in charge found the contrivance to work best when nearly closed. It will be necessary to alter the pipe D above the branch E so as to use a horizontal check-valve. This, however, is a matter of detail which any fitter should understand.]

NATIONAL PLUMBERS' ASSOCIATION MEETING.

The eighth annual convention of the National Master Plumbers' Association will be held at Denver, Col., June 17, 18 and 19.

ADVANTAGE OF PLUMBING AND VACCINATION LAWS.

A. R. Carter, Secretary of the Health Department of Baltimore, Md., in sending information regarding plumbing regulations adds the following suggestive information regarding the advantage to the city of a compulsory vaccination law and a plumbing law · "From January 1 to December 31, 1882, 2,825 cases of small-pox were reported in Baltimore, 617 of the number being removed to the Quarantine Hospital, 1,496 had been vaccinated and 1,329 exhibited no signs of vaccination; 551 died in the city and 188 at the Quarantine Hospital. From January 1, 1883, to July 7 of the same year, no cases being reported after the later date, 2,114 cases were reported, of which number 395 were removed to the Quarantine Hospital, where there were 109 cases remaining from 1882, making a total of 504 cases. Of the 2,114 cases reported 1,363 had been vaccinated and 751 exhibited no signs of vaccination. Six hundred and thirty three deaths occurred in the city and 353 at the hospital, making a grand total of 4,939 cases, of which number 2,859 had been vaccinated and 2,080 exhibited no signs of vaccination, 1,729 having died during the epidemic, a very large majority being unvaccinated.

During the period from January 1, 1882, to July 7, 1883, our corps of vaccine physicians, made 300,000 vaccinations, besides many thousand by family physicians. Only bovine virus was used by our vaccine physicians. One death only during the entire period was reported by the attending physician as being caused by vaccination, the decedent being a child, during the month of March, 1883.

The cost of the epidemic to our municipal government was $190,000 in expenses, 1,725 lives, and millions of dollars to the trade of our city, nearly all of which could have been saved by a compulsory vaccination law and a timely appropriation of $50,000; but the warnings of the Health Department were unheeded, until October, 1882, when our prayers were answered by the "City Fathers," the law was enacted, appropriations were made, extra vaccine physicians appointed, the law enforced in all cases, and by July 7, 1883, the disease was stamped out entirely, and not a case has originated in our city since that date. One case was brought here in 1884 and one in 1886.

October 22, 1883, an ordinance to provide for the inspection of soil, waste and drain pipes, and all other sanitary plumbing was approved by our Mayor, which went into effect January 1, 1884. From 1830 to 1883, inclusive, a period of 54 years, scarlet fever had averaged 226 deaths, whilst for the past six years, 1884–1889, inclusive, the average has been 59 deaths. In 1830 the population was 81,000, and there were 149 deaths; in 1889, population 500,343, 71 deaths. Diphtheria for seven years prior to ordinance averaged 469 deaths; for the past six years, 1884–1889, inclusive, the average has been 145 deaths. In fact all zymotic diseases have exhibited a marked diminution since the enactment and enforcement of the two good ordinances.

YONKERS BUILDING ORDINANCE.

The following is the building ordinance of Yonkers, N. Y., adopted October 28, 1889:

I. No wall, structure, building, part or parts thereof shall hereafter be built, constructed, altered or repaired in the city of Yonkers, except in conformity with the provisions of these regulations.

II. Except as provided in section three of these regulations, all buildings hereafter erected in this city shall have all walls constructed of stone, brick, iron, or other hard incombustible material, properly bonded and solidly put together, with close joints; and the walls of all buildings shall be built to a line and be carried up plumb and straight, and the several component parts of said building shall be built and constructed in such manner as is herein provided.

III. Frame or wooden buildings may be erected in this city, provided that such frame or wooden buildings shall not exceed three stories in height, and shall not have a frontage of over 45 feet, and that at the time of the erection of said frame or wooden buildings an open space of 3 feet intervenes between the building so erected and the nearest adjacent building.

IV. The basement walls of dwelling houses not over 36 feet in height, and not over 25 feet in width, shall not be less than 12 inches thick if of brick. The other walls (not including foundation walls) shall not be less than 8 inches thick; but no party wall shall be less than 12 inches thick. The walls of dwelling houses over 36 feet in height, and not over 50 feet in height, shall not be less than 12 inches thick above the foundation walls, except the top story, the wall of which may be 8 inches.

V. No wall of any building now erected or hereafter to be built or erected, shall be cut off below or altered, without permission so to do having been first obtained from the Inspector of Buildings. Every temporary support placed under any structure, wall, girder or beam, during the erection, finishing, alteration or repairing of any building or structure, or any part thereof, shall be of sufficient strength to safely carry the load to be placed thereon. The walls of every building, during the erection or alteration, shall be strongly braced from the beams of each story, until the building is inclosed, and the roof tier of beams shall be strongly braced to the beams of the story below until the floors in the said building are laid.

VI. In no case shall the wall or walls of any building be carried up more than two stories in advance of any other wall except the front wall.

VII. In all buildings every floor shall be of sufficient strength in all its parts to bear safely upon every superficial foot of its surface 75 pounds; and if used as a place of public assembly 120 pounds; and if used as a store, factory, warehouse, or for any other manufacturing or commercial purpose, from 150 pounds and upwards; and every floor shall be of sufficient strength to bear safely the weights aforesaid, in addition to the weights of the materials of which the floor is composed; and every column, post or other vertical support shall be of sufficient strength to bear safely the weight of the portion of each and every floor depending upon it for support, in addition to the weight required as above to be supported safely upon said portions of said floor.

VIII. The planking and sheathing of the roof of every building other than frame, erected or built as aforesaid, shall in no case be extended across the front, rear, side, end or party-wall thereof unless filled in between with brick and mortar level to the top of the beam.

IX. No building already erected or hereafter to be built in said city shall be raised, altered or built upon in such manner, that were such building wholly built or constructed after the passage of this act, it would be in violation of any of the provisions of these regulations. Before any building shall be enlarged, raised, altered or built upon the same shall be first examined by the Inspector of Buildings to ascertain if the building or buildings are in good and safe condition to be enlarged, raised, altered or built upon, and no such building shall be enlarged, raised, altered or built upon until after such examination shall have been made and a decision thereon rendered by the Inspector of Buildings; and the decision of said inspector after such examination shall be made without delay.

X. Before the erection, construction or alteration of any building or part of any building in the city of Yonkers is commenced, the owner or his agent or architect shall submit to the Inspector of Buildings a detailed statement, in writing, of the specifications, and a full and complete copy of the plans of such proposed work, which shall be accompanied with a statement in writing, giving the full name and residence (street and number) of the owner, or of each of the owners of said building or proposed building. Such statement may be made by the agent or architect of the person or persons hereinbefore required to make the same, said statement and detailed statement and copy of the plans shall be kept on file in the office of the Inspector of Buildings, and the erection, construction or alteration of said buildings, or any part thereof, shall not be commenced or proceeded with until said statements and plans shall have been so filed and approved by the Inspector of Buildings. Ordinary repairs may be made without notice to the Inspector, but such repairs shall not be construed to include the cutting away of any stone or brick wall, or any portion thereof, the removal or cutting of any beams or supports, or the removal, change or closing of any staircase.

XI. The drainage and plumbing of all buildings, both public and private, hereafter erected in the city of Yonkers, shall be erected in accordance with plans previously approved in writing by the Board of Health or its authorized agent. Suitable drawings and descriptions of the said plumbing and drainage shall in each case be submitted and placed on file in the Health Department.

XII. The Inspector of Buildings shall attend at his office each day between the hours of 11 o'clock A. M. and 12 o'clock M.

XIII. The Inspector shall keep a constant supervision of all buildings in the course of erection, and report in writing to the Mayor any violation of the law of the State or of any of these regulations, and the Mayor is authorized upon such report to take such legal proceedings as shall be necessary to enforce compliance with the law of the State and the regulations of the Common Council and of the Inspector of Buildings.

XIV. Any person aggrieved at the decision of the Inspector of Buildings may appeal, in writing, to the Mayor, who shall decide the question involved, and report at the next meeting of the Common Council his action in the premises. And the Common Council shall have power to review the action of the Mayor, and may overrule the same by a two-thirds vote.

XV. The Inspector of Buildings shall examine all buildings deemed by him to be unsafe in any particular, or reported to him to be unsafe, and within 24 hours after such examination deliver duplicate reports of the condition of said buildings, one to the Mayor and one to the Common Council, by leaving the same with the City Clerk.

XVI. Fire escapes shall be erected upon such buildings whenever, and in such manner as shall be required by the Inspector of buildings.

XVII. These regulations shall take effect December 1, 1889.

Novelties.

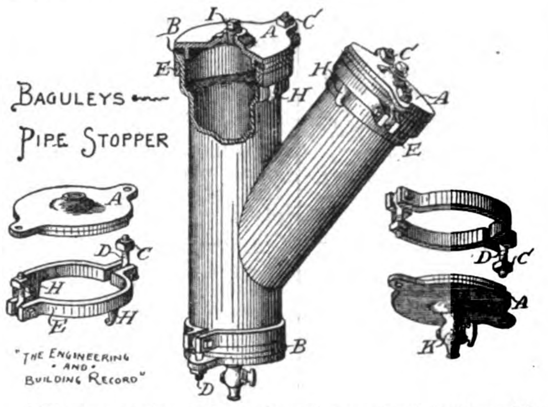
Devices are described under this head purely and strictly as news; because believed to be new and calculated to interest readers.

In no case is pay accepted, directly or indirectly, for publishing a novelty notice.

As the subjects are selected for their supposed novelty and interest merely, it will, of course, be understood that the selection does not imply endorsement.

BAGULEY'S PIPE STOPPER.

THIS device consists of a cast-iron disk, A, that can be tightly screwed to the end of a pipe by nuts C C of the bolts D D attached to the malleable iron collar E, which may be clamped to the pipe above the bead of either end. B is a rubber gasket. Hub clamps have also the hooks H H, that catch the shoulder and are sufficient to hold it without bearing on the bead. Every cover plate has a boss in the center, tapped to receive either a plug I or a stop-cock K.



This stopper is made in five sizes, 2 to 6 inch, and is specially designed to close waste and soil pipes, etc., for the application of a pressure test. It is claimed that it is easily applied, economical and durable, that it takes up so little room that it can be used in close places where there is very little clearance, etc., and that it has been tested to 130 pounds steam pressure.

This device has been patented by William Baguley, 504 Park Avenue, New York City.

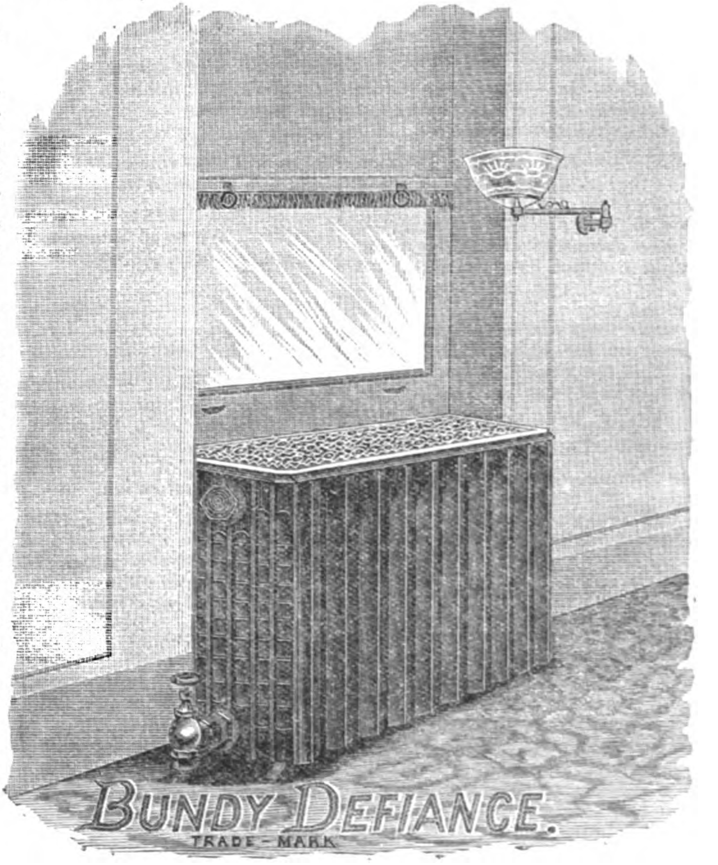
IMPROVED STEAM AND HOT WATER RADIATOR.

THE accompanying cut shows the latest modification of one of the A. A. Griffing Iron Company's steam and hot water radiators recently brought out at their works, Jersey City, N. J., and called the "Bundy Defiance."

The special features of it are its adaptation for use under windows, in recesses, or wherever a low radiator is required, and also its compactness, giving a large surface in a limited space. In placing this radiator under windows, the window sill often serves as a top finish, or a marble slab resting on brackets over the radiator can be used.

There are two sizes of "Defiance" sections, 8 by 13 and 11 by 18 inches, respectively, the first figure representing the width of the sections or radiators, while the last shows the height. Its total height can be increased when the radiator is set on legs, and here a special feature is observed in the great variety of heights in which the legs are furnished. They can be had ½, 1, 1½, 2, 2½, 3, 3½, 4, 4½, 5 and 5½ inches high, so that the radiators can be furnished in different heights, varying by half inches, from 13½ to 23½ inches. When no height is specified in ordering, the 1-inch legs are always shipped.

The larger section has 7 square feet of heating surface, the smaller one 4, and in either case each section increases the length of the radiator 4 inches. All sections are interchangeable.



NATIONAL CONVENTION OF BUILDING INSPECTORS.

PURSUANT to general desire on the part of a large number of the building inspectors of the United States, a convention is called to meet at the Grand Pacific Hotel in Chicago, on Wednesday, June 18, 1890, at 2 o'clock P. M., for the purpose of organizing a National Association of Building Inspectors, appointing committees, and mapping out our work, after which we will adjourn to meet at some future time and place to be at that time decided upon. A general invitation is extended to all inspectors of buildings in the United States, with an earnest desire that you be present at our initial meeting.

Every city that has now, or contemplates having in the near future, building laws, should be represented.

Committee of Inspectors of Buildings: J. M. Hazen, Minneapolis, Minn.; Gates A. Johnson, St. Paul, Minn.; George C. Whitlock, Omaha, Neb.; J. M. Dunphy, Chicago, Ill.; T. J. Brady, New York City; Arthur Bates, Milwaukee, Wis; E. W. Simpson, Detroit, Mich.; Frank H. Jackson, Denver, Col.; Emil G. Bueckert, Cincinnati, O.; Spencer B. Hopkins, Providence, R. I.; Roy McDonald, Louisville, Ky.; L. W. Hanson, Portland, Me.; G. T. Woodward, Lowell, Mass.; J. Theodore Oster, Baltimore, Md.; John S. Damrell, Boston, Mass.; George Wharton, Philadelphia, Penn.; M. A. Lytel, St. Joseph, Mo. May 31, 1890.

TRADE PUBLICATIONS.

THE COMBINATION GAS MACHINE.

AN attractive catalogue, entitled "Light for Evening Hours," just issued by the Detroit Heating and Lighting Company, of Detroit, Mich., sets forth in a pleasing manner the advantages and claims to general recognition of the "Combination' gas machine. The latter, as may be known, is intended for factory or other buildings, in city or country, of such extent as to warrant the establishment of an independent lighting plant. The catalogue contains illustrations of the machine itself, and of a number of buildings where it is said to be in successful operation. The last two pages of the catalogue are devoted to the Bolton hot-water boiler, made by the Company, a sectional perspective and general descriptive particulars being given.

PUBLICATIONS RECEIVED.

FIFTH ANNUAL REPORT OF THE STATE BOARD OF HEALTH STATE OF MAINE; for the fiscal year ending December 31, 1890; pp. 304.

FIFTH BIENNIAL REPORT OF THE BOARD OF HEALTH, OF THE STATE OF IOWA; for the Fiscal Period ending June 30, 1889; pp. 276.

EIGHTEENTH ANNUAL REPORT OF THE LOCAL GOVERNMENT BOARD; 1888-89; Supplement, Containing the Report of the Medical Officers; pp. 524; London; [Government publication] 1889.

REPORTS OF THE COMMITTEE OF ONE HUNDRED ON STREET PAVING, AND OF MR. CODY STALEY, CONSULTING ENGINEER, ON SEWERAGE AND DRAINAGE; City of Dayton, O; [F. M. Turner, City Civil Engineer] pp. 45.

TWENTIETH ANNUAL REPORT OF THE TRUSTEES OF THE DAYTON [O.] WATER WORKS; for the year ending December 31, 1889; pp. 56.

CONTRACTING NEWS DEPARTMENT.

A WEEKLY RECORD

OF SPECIAL INTEREST TO CONTRACTORS, BUILDERS AND MANUFACTURERS OF ENGINEERING AND BUILDING SUPPLIES.

CONTRACTING INTELLIGENCE

Persons who make any use of the information they find in these columns we trust will not omit to mention The Engineering & Building Record as the source

Our readers will oblige us by notes, clippings, or any information which will put us in the way of obtaining early and reliable news for our "Contracting Intelligence." *Information of importance sent to us exclusively, and not elsewhere published will be liberally paid for.*

For works for which proposals are requested see also the "Proposal Columns," pages i-ii-x-15.

WATER.

For Additional Water Items see Proposal Columns.

Santa Ana, Cal. — City Clerk Edward Tedford writes: "The Board of Trustees of this city advertised for plans and specifications for water-works. They accepted plans and specification for a stand-pipe system May 23, the system not to cost over $50,000. Now they will call an election to vote bonds, and if the bonds are carried will be ready to accept bids on the plans and specifications they have adopted. We will know in about six weeks."

Richmond, Ky.—City Clerk J. E. Greenleaf writes: "We have signed contract with Richmond Water-Works Company to build and operate a system of water-works. Work to begin within 60 days from May 7, and to be completed within 12 months from that date."

Rochester, N. Y.—J. Nelson Tubbs, Chief Engineer, writes: "It is pretty well settled that an additional supply of 15,000,000,000 gallons per day from Hemlock and Canadice lakes will be provided in the near future. Actual work will not probably be commenced until 1891. The cost will be nearly $2,000,000."

Humboldt, Neb.—City Clerk E. W. Elwell writes: "There is some talk of establishing water-works in our city, but as yet have taken no steps in regard to the matter further than to have plans, specifications and estimate drawn; we have not received them from the engineer yet. Do not know what the result will be till after the election."

Owosso, Mich.—The City Clerk here writes: "June 9th we vote to bond the city for $20,000, run 20 years at 5 per cent., to complete our water-works already begun."

Walthowville, Ga.—The Town Clerk at this place contradicts the published report that water-works were to be established.

Hinton, W. Va.—Recorder J. T. Hoffman writes: "The Hinton Water-Works Company has been granted a charter with a capital stock of $50,000 and a privilege of increase. The stock is on the market, and being taken up rapidly. A contract has been submitted by the town of Hinton to this company for approval on 90 days. The company will pump the water from the Greenbrier River into a reservoir on the side hill at 100 feet elevation. It is the desire of the town to have the work in as soon as possible."

Shelton, Wash.—This place is to have a system of water-works.

Falls of Rough, Ky.—Town Clerk L. Green writes: "There has not been anything done yet towards establishing water-works here, and I hardly think will be very soon."

Brooklyn, N. Y.—The Aldermanic Committee on Water and Drainage has decided to report to the Board for adoption the budget for the Water Department proper during the year ending April 30, 1891. The total amount is $762,368.

Antwerp, N. Y.—The citizens of this village, at the special election May 29, voted in favor of appropriating the sum of $10,000 for putting in a system of water-works. The Water Commissioners will at once perfect plans for putting in the works.

Salt Lake City, Utah.—A proposition from the Utah Water Company to purchase the water-works plant now owned by the city has been presented to the City Council and referred to the Committee on Water-Works.

Zanesville, O.—The City Council, May 26, passed a resolution declaring it necessary to issue bonds to the amount of $50,000 for the improvemement of the water-works of the city by the laying of a 30-inch pipe from the reservoir to the foot of Market street, to supply the heart of the city with more water.

Marblehead, Mass.—The following proposals for laying cast-iron water pipes, rock excavation, etc., were opened April 29, by the Marblehead Water Board. F. L. Fuller, Engineer:

J. Erwin Hillpot, 1719 Sydenham Street, Philadelphia, $21,586.26; John C. Coates, 31 Exchange Street, Boston, $25,670.82; E Eugene Eglee, Flushing, N. Y., $26.816.48; N. J. Dean, 10 South Street, Salem, $27,393.58; Gore, Little & Co., Cambridgeport, $27,705.59; Frederick E. Show, Providence, R. I., $27.869.87; Geo. W. Mantle, New York, $29,064.87; J. T. Langford, Boston, $29,364.75; J. J. Newman, Providence, R. I., $30,431.50; T. William Harris & Co., New York, $31,764.18; F. D. Mayo, Lynn, $33,610.83; Ferris & Halliday, Jersey City, N. J., $35,068-66; Dennis O'Connell, Dorchester, $35,103.39. The contract was awarded to N. J. Dean, Salem Mass.

Lebanon, O.—Charles B. Stevens, of this place, proposes to supply the town with water on the franchise plan. His proposition provides for six miles and a half of cast-iron pipe, two horizontal duplex compound engines, and the town to rent 65 hydrants for a period of 30 years, at an annual rental of $3,250.

Bentonville, Ark. — Mayor W. D. Mauck writes: "The matter of water-works has been postponed until October."

Norristown, Pa —The managers of the Pottstown Gas and Water Company has awarded the contracts for their new reservoir above town, with pumping station, water mains, etc., which will cost about $125,000. There were eight bidders for the reservoir, seven for the pipe laying and for the pumping machinery. The contract for laying over three miles of water mains was awarded to Howard E. Ahrens, of Reading. The reservoir and pumping station contracts were deferred for the present. The company has awarded the contract for manufacturing 1,500 tons 20, 24 and 30-inch iron pipe for the water mains to the Mellert Foundry and Machine Company, of Reading.

Cleveland, O.—It is proposed to extend the water-works tunnel two miles further under the Lake. Address City Engineer Force for particulars.

Woodstown, N. J.—The people of this place will soon vote on the question of establishing a system of water-works.

Trenton, Tenn.—Mayor Oppenheimer writes: "We voted May 29 to build a system of water-works, the cost not to exceed $20,000.

Lynn, Mass.—The Common Council has allowed an appropriation of 75,000 to be used in the Water-works Department.

Lowell, Mass.— Among the improvements proposed for the water-works system at this place are a filtering plant and new pumping engines. The estimated cost of the engines is $40,000. City Engineer Evans can furnish information.

Mohawk, N. Y.—Proposals will soon be wanted for the construction of a system of water-works at this place. For details address Valentine Brown, Chairman Water-works Committee.

Woburn, Mass.—The City Council has voted to recommend the construction of another supply main to the reservoir, at an estimated cost of $0,000.

Davenport, Iowa.—The water company has decided to put in a filtration plant of six million gallon daily capacity. The issuance of bonds to cover this expenditure and for an extension of mains is under consideration.

Hamburg, N. Y.—Extension and improvements will be made to the plant of the Hamburg Water and Electric Light Company at this place.

Calvert, Tex.—The water mains at this place are to be extended. For particulars address L. T. Fuller, Water-works Superintendent.

Huntington, Ind.—John W. Hill, C. E., of Cincinnati, O., has been engaged to prepare plans, etc., and to superintend the construction of a system of water-works at this place.

Circleville, O.—Extensions will be made to the water mains of this place.

Oconto, Wis.—This place is to have a system of water-works at an estimated cost of $125,000. H. J. Hilbert, C. E., of Milwaukee, Wis., can furnish details.

Xenia, O.—An extension to the water mains will undoubtedly be made the coming season. The superintendent of the water-works is G. F. Cooper.

St. Marys, O.—This place is to have a system of water-works. For particulars address John W. Hill, C. E., Cincinnati, O.

Oshkosh, Wis.—The water-works system at this place is to be remodeled. John W. Hill, of Cincinnati, O., is preparing the plans.

Denver, Col.—The Denver Water-Works Company has awarded a contract for two 15,000,000 gallon triple expansion pumping engines to E. P. Allis & Co., of Milwaukee, at a cost of $170,000.

Bel Air, Md.—The contract for the construction of a system of water-works at this place, has been awarded to James H. Harlow & Co., of Pittsburg, Pa.

Millvale, Pa.—James H. Harlow & Co., of Pittsburg, Pa., have been awarded the contract for constructing a system of water-works at this place.

Water-Works.—See our Proposal Columns for information regarding water-works and water-works furnishings at the following places: St. Paul, Minn.; Brooklyn, N. Y.; Columbus, O.; Waycross, Ga.; New Rochelle, N. Y.; Ogden, Utah; Denver, Col.; Binghamton, N. Y.; Cedar Rapids, Iowa; Nebraska City, Neb.; East Liverpool, O.; Ottawa; Fargo, N. Dak.; St. Louis, Mo.; Providence, R. I.; Milwaukee, Wis.

SEWERAGE.

For Additional Sewerage Items see Proposal Columns

Dayton, O.—At a meeting of the City Council, the resolution declaring it necessary to sewer the city was reconsidered and referred to the Committee on Drains and Sewers,

Brunswick, Ga.—An election will be held here June 7, on the question of issuing $300,000 sewerage bonds.

Clinton, Iowa.—The City Engineer is preparing plans, etc., for the construction of numerous stoneware sewer-pipe extensions.

Port Huron, Mich.—Numerous tile sewers are to be constructed at this place. Address Alderman O'Sullivan, the Chairman of the Sewer Committee, as above.

Norristown, Pa.—Sewer mains are to be constructed in numerous streets of this city. Address the City Clerk, as above.

Williamsport, Pa.—A bill has passed the City Council which authorizes the Highway and Sewer Committee to employ Carroll Philip Bassett, C. E., to prepare plans, specifications, etc., for a system of sewers and appurtenances for this place. For particulars, address Mayor Keller, as above.

Boston, Mass.—Our correspondent writes: "Referring to the proposals for building Sections A and B, Metropolitan Sewer, Henry C. Ayer, Chester, Pa., has been notified that his bid has been accepted and to comply with the conditions of the contract by filing bonds, etc., but no award will be made until said bonds are accepted by the Board of Commissioners. This matter will probably rest as it is, until the meeting of the Board on Saturday next."

Orange, Mass.—The contract for building the new sewer system at this place, has been awarded to Lucian A. Taylor, of Boston, for $62,954.

Springfield, Mo.—On May 27, the citizens of this place voted in favor of issuing bonds in the sum of $150,000 for constructing a separate sewerage system. The plans, which were furnished by George E. Waring, call for over 19 miles of mains.

Troy, N. Y.—Numerous sewer extensions have been ordered by the Public Improvement Commission. Commissioner Thompson can furnish information.

Wilmington, Del.—The Directors of the Street and Sewer Department, have voted the sum of $27,000 for continuing work on the intercepting sewer branches. President Farra can give details.

Kingston, Jamaica.—The Legislature of the Island of Jamaica has adopted Colonel Waring's plans for the sewerage of Kingston, and the work is to be carried out by Messrs. Waring, Chapman & Farquhar, of Newport, R. I., in preparation for the International Exposition to be held in Kingston in 1891.

Columbus, O.—The Board of Public Works of this city has engaged Col. George E. Waring as consulting engineer to revise the plans for an intercepting sewer for that city, and to report on a general scheme of interior sewerage.

Boston, Mass.—The following proposals for the construction of Section A, main sewer, were opened May 28 by the Metropolitan Sewerage Commission: Edward F. Brigham, Cambridge, $90,835; Moulton Mahoney Trumbull, Lawrence, $89,862.50; John Cavanagh & Co., Boston, $87,565; William H. Ward, Lowell, $84,990; Harry P. Nawn, Boston, $81,470; Perkins & White, Boston, $81,435; Everson & Liddle, Yonkers, N. Y., $72,273.75; National Construction Company, Boston, $70,681; Orrin P. Roberts, Cambridge, $65,794.25; Charles Linnehan, Cambridgeport, $64,083.75; Henry C. Eyre, Chester, Pa., $63,150.

Boston, Mass.—The following proposals for the construction of Section B, main sewer, Boston and Brookline, were opened May 28 by the Metropolitan Sewerage Commission: Henry C. Eyre, Chester, Pa., $41,745; Orrin P. Roberts, Cambridge, Mass., $47,928.45; Everson & Liddle, Yonkers, N. Y., $50,950.25; National Construction Company, Boston, $51,640.50; Edw. F. Brigham, Cambridge, Mass., $54,813.75; William H. Ward, Lowell, Mass., $60,609.

Springfield, Mo.—The citizens of this place, on May 27, voted on a proposition to issue $150,000 bonds for constructing a separate sewerage system, according to the plans of George E. Waring, with about 19 miles of mains. The proposition was carried.

North Tonawanda, N. Y.—The following bids for the construction of about six miles of sewers were received by T. E. Warner, Village Clerk, May 19: E. H. Rogers, Jr., Tonawanda, $110,935.15; J. M. Smith, Buffalo, $101,762.60; Franklin & Olson, Buffalo, $90,919.30; A. D. McConnell, Buffalo, $71,471.77; McGregor & Green, Buffalo, $67,601.99; George B. Allen, Buffalo, $64,953. The contract was awarded to A. D. McConnell at $71,471.77.

Parkersburg, W. Va. — J. S. A. Farrow, City Engineer, writes: "Our city expects to lay 2½ or 3 miles of sewers and 40,000 yards of brick pavement, which will be let, as soon as I can complete profiles, plans, etc."

BRIDGES AND IRON STRUCTURES.

For Additional Bridge Items see Proposal Columns.

Milwaukee, Wis.—Contract for superstructure for Michigan Street draw-bridge has been awarded to the Milwaukee Bridge and Iron Works, at $14.955.

Wheeling, W. Va.—Plans for the Main Street bridge are to be prepared by F. O. Dodge. Estimated cost of the structure, $90,000.

Birmingham, Ala.—Reports say that this city will again advertise for bids for building the 21st Street bridge.

Fort Worth, Tex.—It is proposed to take immediate steps towards repairing the damaged bridge over the Trinity River, at Main Street. Mayor Fraser can furnish information.

St. Louis, Mo.—The Skinka Construction Company, which received the contract for the masonry on the new bridge to be built over the River des Peres, at Broadway, has failed to comply with the terms of the contract, and will forfeit the contract. The estimated cost of the work was about $16,000. The work will probably be readvertised.

Cleveland, O.—City Engineer Force will make an effort to secure two or three new bridges over the river as soon as possible. One of the smaller bridges has already been pronounced unsafe.

York, Canada.—The Dominion Parliament has appropriated $30,000 towards the construction of an iron bridge over the Grand River, at this place.

Terre Haute, Ind.—The following bids for the construction of a wooden viaduct were received by George H. Simpson, Engineer, May 30: Lafayette Bridge Co., Lafayette, Ind., $4,489.15; Pittsburg Bridge Co., Pittsburg, Pa., $6,200; Missouri Bridge Co., Leavenworth, Kan., $5,249; Wrought Iron Bridge Co., Canton, O., $5,902; R. C. Thompson & Co., Terre Haute, Ind., $5,593.

Cheyenne, Wyo.—Frank Dana, City Clerk, writes: "Our viaduct contract has not been let yet, but will be shortly."

Chicago, Ill.—The following bids for the erection of a swing bridge at Northwestern Avenue were received by the City Engineer, May 25: King Iron and Bridge Co., $14,950; Chicago Bridge and Iron Works, $14,115; Schaler & Shinglaw, $14,930; Bruder & Seifert, $14,000; Lane Bridge and Iron Works, $17,387; Wrought Iron Bridge Co., $15,644.

Minneapolis, Minn—The County Commissioners have received bids for the substructure of the Cedar Avenue bridge as follows: Ring & Tobin, $18,626.99; E. F. Comstock & Co., $18,399.42; W. D. Van Norman, $15,966.55; Minnesota Lake Stone Company, $17,879.61. A bid by R. M. Douglas & Co. was withdrawn, because of its excess over other bids.

The following bids for the iron work of the bridge were received. Wisconsin Iron and Bridge Company, $15,246; S. M. Hewitt, $14,974; King Iron Bridge Company, $15,764; Wrought Iron Bridge Company, $15,200; Clinton Bridge Company, $15,465; Olaff Hoff, $16,100; Chicago Bridge and Iron Company, $15,645; A. Y. Bayne & Co., $15,520; Milwaukee Bridge and Iron Company, $15,300.

Baltimore, Md.—A bill to appropriate $80,455 for the completion of the Light Street bridge, has been favorably reported to the City Council.

Bridges.—See our Proposal Columns for information regarding bridge construction at the following places: Cincinnati, O,; Columbus, O.; Trenton, N. J.; Reading, Pa.; Lamar's Mill, Ga.; Mitchell, Dak.; Boston, Mass.; Lynchburg, Va.; Oil City, Pa.; Eureka, Col.; Alder Point, Cal.

NEW DEPOTS.

Rockville, Conn.—A new depot is to be erected at this place by the New York and New England Railroad Co.

Havelock, Neb.—A depot, together with shops, etc., will be erected here at an estimated cost of $300,000.

STREET-WORK AND PAVING.

Clinton, Iowa.—The City Council has instructed the City Engineer to prepare plans, specifications and estimates for about 20,000 square yards of vitrified brick or cypress block pavement, to be contracted for, for Fourth Street.

Gloucester, Mass.—The sum of $10,000 has been appropriated by the City Council for paving East Main Street.

Lima, O.—The officials of this place have authorized the improvement of numerous streets. Details can be had by addressing J. V. Smiley, as above.

Lynn, Mass.—The sum of $125,000 has been appropriated by the Common Council for street improvements.

Lyndhurst, N. J.—The Union Township Committee has issued a call for an election on June 10, to decide whether the town should be bonded for $42,500, the money to be used for macadamizing streets.

Elizabeth, N. J.—The paving of numerous streets of this city is being agitated. Particulars can be had by addressing Mayor Rankin, as above.

Newport, Ky.—The property owners on Tenth Street propose to have the street improved by grading, paving, etc.

Troy, N. Y.—The Public Improvement Commission is making efforts to establish a boulevard in this city. For details address Commissioner Murry, of the Commission, as above.

Tiffin, O.—Considerable paving is to be done at this place. For particulars address John McCartney, Chairman of the Street Committee, as above.

Valparaiso, Ind.—A stone highway, 11 miles in length, is to be constructed from this place to Chesterton. It is to be 20 feet wide and 14 inches deep. Address Jerome Carter, as above, for particulars.

Readers of **THE ENGINEERING AND BUILDING RECORD** interested in the Contracting News Department of that paper are respectfully requested to examine those columns every week, and advise the Editor of any item which they may find that, in their judgment, is of no value to any one other than the person mentioned.

GAS AND ELECTRIC-LIGHTING.

Gordon, Pa.—This place is to have electric lights, at an estimated outlay of $10,000. Hon. D. D. Phillips can furnish particulars.

Washington, D. C.—A charter has been granted the Volta Electric Light and Power Company, for the purpose of introducing and supplying light and motive power for private dwellings, mercantile establishments and street vehicles. The secretary is H. K. Simpson.

Fredonia, N. Y.—The question of establishing an electric lighting plant here, to cost, estimated, $10,000, is to be settled at a public election to be held at an early day.

Rutland, Vt.—The electric light company of this place is to increase its plant.

Huntington, Ark.—The Huntington Cotton Company of this place will establish a 750 incandescent isolated electric light plant.

St. Joseph, Mo.—This place is to have electric lights; $500,000 is to be invested. Address O. M. Spence, as above.

Penn Yan, N. Y.—This place has appropriated the sum of $1,500 for electric lighting purposes.

Grafton, W. Va.—The Globe Contract Company has closed a contract with the Grafton Electric Light, Heat and Power Company of this city, consisting of 25 arc lights and 500 incandescent plant, installed complete for the sum of $11,000.

Denver, Col—The Portable Electric Light and Power Company has been incorporated at this place. Capital stock, $1,500,000. Henry R. Wolcott can be addressed.

Brunswick, Ga.—It is probable that an electric lighting plant will be erected at this place by the Brunswick Light and Water Company.

Anderson, S. C.—The Anderson Electric Light and Power Company has been incorporated here with a capital stock of $10,000. John F. Roddy, of Rock Hill, can furnish particulars.

Albany, N. Y.—The Erie and Niagara Electric Light Company has been incorporated here. Capital stock, $30,000.

Medina, N. Y.—The Syracuse Electric Construction Co. has been awarded the contract for lighting this village with 41 electric lights, which will be operated until midnight, at a cost of $60 per light. The work of putting in the plant will begin at once.

Rockford, Mich.—This town will have an electric plant.

Holyoke, Mass.—The Holyoke Electric Light Company will establish a plant here to cost $10,000. Address F. A. Wyman, president, as above.

Columbus, O.—The Board of Public Works will take steps to secure a new service for lighting the city.

Blacksburg, S. C.—The Blacksburg Land and Improvement Co, will erect an electric light plant here.

Atlantic City, N. J. The following proposals for gas and electric street lighting were opened at a recent meeting of the City Council: Atlantic City Gas and Water Company will light Atlantic, Arctic and Pacific Avenues, each with 23 arc lights or more, at the rate of $91.25 per lamp for the year; Thomas Grimwood will light Atlantic Avenue with arc lights for $164.25 per light per year, and Pacific and Arctic Avenues for $142.35 per light per year. For furnishing the gas lights the only bid was from the Atlantic City Gas and Water Company, agreeing to furnish the lights for $18 per light per year. The contract for both the gas and electric lighting was awarded to the Atlantic City Gas and Water Company.

Chicago, Ill.—The Fort Dearborn Light and Power Company has been incorporated here. Capital stock, 25,000. Incorporators, A. L. Baker, E. F. Bunyan, and others.

Yazoo, Miss.—City Clerk E. J. Pomsine, writes: "The chairman of Committee on Street Lighting, Mr. Charles A. Collins, has been instructed by the Board of Mayor and Aldermen of Yazoo City, to correspond with different electric light companies, to ascertain probable cost of lighting the city with arc lamps, and no doubt that a proposition for water-works to be run in connection with the lights would be favorably entertained."

Chicago, Ill.—The Worrall Electric Construction Company has been incorporated here, with a capital stock of $500,000, to construct and maintain electric plants. Incorporators, E. Gaylord, M. J. Frost and C. Y. White.

Electric Railways.—New electric railways will be established, and improvements will be made to those already built, at the following places: Beatrice, Neb,; Flushing, N. Y.; Milford, Mass.; Hopedale, Mass.; Holyoke, Mass.; Newburyport, Mass.

GOVERNMENT WORK.

Camden, N. J.—Synopsis of bids for erection and completion of the U. S. Post-Office, Custom House, etc., here (except heating apparatus):

	Amount per specification.	Amount, if faced with stone instead of brick.	Amount to be added if oak is substituted for white pine.	Amount to be added if American plate glass, ¼-inch thick, is used instead of sheet glass.
Wm. Gray & Son, Philadelphia, Pa	$71,413.00	$83,333.00	$1,597	$1,897
R. C. Ballinger & Co., Philadelphia, Pa	72,761.50	87,475 75	4,139	1,100
Robt. S Johnston, Philadelphia, Pa		88,489.00	3,625	1,050
J. E. & A. L. Pennock, Philadelphia, Pa	73,400.00	99 400.00	1,100	1,200
James Bradley, Philadelphia, Pa	73,769.00	97,524.00	3 449	4,449
D. J. Curtis, Spokane, Mo	70,000.00	78,000.00	6,000	2,000
Darling Bros., Worcester, Mass	67,000.00	87,000.00	4,000	1,200
Campbell & Wood, Ithaca, N. Y	93,000.00	98,500 00	2,400	850
Wm. Leverus	97,725.00	113,865.00	2,485	1,340

Washington, D. C.—The following proposals for the work named were opened on the given dates by the Supervising Architect of the Treasury Department:

Fort Smith, Ark.—Iron vault doors for the United States Court House and Post Office at this place, opened June 3. Bidders: National Safe and Lock Company, $345; Mosler Bank Safe Company, $525; Hall's Safe and Lock Company, $570.

Denver, Col.—Brick and terra cotta floor arches, wall furring, partitions, column covering, etc., for the United States Court House and Post Office at this place, opened May 31. Bidders: Wright Fire-Proof Company, Chicago, Ill., $20,786.60; Thomas P, Lee, Chicago, Ill., $16,064; Pioneer Fire-Proof Construction Co., Chicago, Ill., 21,000; Tobias Johnson, $31,833.

*INDUSTRIAL.

Philadelphia, Pa.—The Board of Port Wardens is considering the question of extensions to Pier 30, of the Philadelphia Warehousing and Cold Storage Company.

Xenia, O.—A brick rope walk, to cost over $50,000, will be built here. Eli Millen and Judge E. Munger are interested.

PROPOSALS.

(Continued from page x.)

Notice to Contractors.

SEALED PROPOSALS WILL BE RECEIVED by the Board of Directors of the North Hudson Driving Park Association, at their office, No. 113 Hudson Street, HOBOKEN, N. J., until 7.30 P. M., June 12, for **GRADING** the infield of the Guttenberg Race Track at North Bergen, N. J. Plans and specifications can be seen, and all information obtained at the office of Messrs. BEYER & McCANN, Civil Engineers and Architects, Hudson Place, Hoboken. 1

JUNE 4, 1890.

SEALED PROPOSALS WILL BE RECEIVED at the office of the Supervising Architect, Treasury Department, Washington, D. C., until 2 o'clock P.M. on the 28th day of June, 1890, for all the **LABOR AND MATERIALS** required in the erection and completion of the U. S. Court-House and Post-Office building at TEXARKANA, ARK.-TEX. (heating apparatus and approaches not included), in accordance with the drawings and specification, copies of which may be had on application at this office or the office of the Superintendent. Each bid must be accompanied by a certified check for $500. The Department will reject all bids received after the time fixed for opening the same; also, bids which do not comply strictly with all the requirements of this invitation. Proposals must be sealed and indorsed "Proposal for the erection and completion (except heating apparatus and approaches) of the U. S. Court-House and Post-Office building at Texarkana, Ark.-Tex.," and addressed to JAS. H. WINDRIM, Supervising Architect. 2

SEWERS, St. Paul, Minn.—Proposals are wanted until June 9, for constructing sewers in certain streets at this place. Address J. T. Kerker, Clerk Board of Public Works, as above.

SEWERS, Nebraska City, Neb.—Proposals are wanted until June 20, for the construction of a vitrified clay pipe sewer. Address A. F. Mines, City Engineer, as above.

MACADAMIZING, Westminster, Md.—Proposals are wanted, no date specified, for macadamizing about five miles of roads. Address F. K. New, Mayor, as above.

ROADS, Elizabeth, N. J.—Proposals are wanted until June 19, for the improvement of certain roads in this vicinity. Address F. A. Dunham, County Engineer, as above.

PAVING, Columbus, O.—Proposals are wanted until June 11, for improving certain streets by grading, paving, etc., Address F. M. Seuter, Clerk Board of Public Works, as above.

SEWERS, Columbus, O.—Proposals are wanted until June 11, for constructing brick and pipe sewers. Address Board of Public Works, as above.

PIER, New York City.—Proposals are wanted until June 20, for the construction of numerous piers. Address the Department of Docks, Pier A, N. R., as above.

ELECTRIC LIGHTING, Milwaukee, Wis.—Proposals are wanted until July 1, for furnishing, erecting and maintaining 300 or more electric lights, for a term of 3 years. Address Fred. F. Wilde, Deputy Comptroller, as above.

SCHOOL, Peru, Ind.—Proposals are wanted until June 17, for the erection of a brick school building at this place. Address C. E. Emsviler, Secretary School Board, as above.

PAVING, ETC., Des Moines, Iowa.—Proposals are wanted until June 18, for paving certain streets. Address the Board of Public Works, as above.

PUMPING MACHINERY, East Liverpool, O.—Proposals are wanted until June 25, for furnishing additional pumping machinery. Address East Liverpool Water-Works, as above.

BRIDGE, Mitchell, Dak.—Proposals are wanted until July 17, for erecting a bridge at this place. Address R. Robinson, as above.

PAVING, Bradford, Pa.—Proposals are wanted until June 16, for paving certain streets at this place with vitrified brick. Address James A. Lindsey, City Clerk, as above.

BRIDGE, Pembina, N. Dak.—Proposals are wanted until July 8, for the erection of a bridge over the Tongue at this place. Address Mr. Kabernagle Auditor, as above.

STREET WORK, Springfield, O.—Proposals are wanted until June 26, for paving with brick or asphalt certain streets at this place. Address W. H. Linn, City Engineer, as above.

BRIDGE, Pennigton, N. J.—Proposals are wanted until June 23, for the erection of a high truss wrought iron bridge over Jacobs Creek, on the road leading from Pennington to Titusville. Address John O. Ege, as above.

PROPOSALS.

BRIDGE, Forsyth, Ga.—Proposals are wanted until June 17, for the construction of a bridge over the Towaliga River, at Lamar's Mill. Address J. A. Daniel, as above.

SEWERS, Binghamton, N. Y. — Proposals are wanted until June 16, for constructing sewers, drains, etc., in certain streets at this place. Address W. J. Flanigan, City Clerk, as above.

LIGHTING, Camden, N. J.—Proposals are wanted until June 23, for lighting the streets of this city for a term of three years. Address City Clerk, as above.

WATER WORKS, Fargo, Dak.—Proposals are wanted until July 7, for constructing a complete system of water works at this place. Address A. O. Rupert, City Auditor, as above.

SEWERS, Cedar Rapids, Iowa.—Proposals are wanted until June 16, for constructing sewers at this place. Address A. St. Clair Smith, Chairman Committee on Sewers, as above.

STREET WORK, New York City.—Proposals are wanted until July 1, for the improvement of certain streets. Address the Department of Public Works, as above.

GULLY WELLS, Quebec.—Proposals are wanted until June 11, for the construction of certain gully wells. Address W. D. Baillairge, Assistant City Engineer, as above.

STREET WORK, Cleveland, O.—Proposals are wanted until June 11, for the improvement of certain streets. Address C. G. Force, City Civil Engineer, as above.

PUMPING PLANT, Ottawa, Ont.— Proposals are wanted until June 27, for furnishing the pumping plant at the Kingston Dry Dock. Address A. Gobeil, Secretary Department of Public Works, as above.

WATER MAINS, ETC., Carthage, Ill.—Proposals are wanted, no date specified, for 4,000 feet additional water mains and ten fire hydrants. Address S. W. Merrill, City Clerk, as above.

SEWERS, St. Paul, Minn.—Proposals are wanted until June 12, for constructing sewers in certain streets at this place. Address J. T. Kerker, Clerk Board of Public Works, as above.

DREDGING, Brooklyn, N. Y.—Proposals are wanted until July 2, for dredging at Navy Yard at this place. Address N. H. Farquhar, Navy Yard, as above.

BRIDGES, Oil City, Pa.—County Commissioners of Venango Co., Pa. (office at Franklin), invite proposals, up to June 19, for four single-span iron bridges, 64, 57, 42 and 36-foot span Also, up to June 18, they invite proposals for stone abutments for each of said four bridges.

Building Intelligence.

NEW YORK.

228 Rivington st, br and stone flat; cost, $18,000; o, J Korn; a, A I Tinkle.

323 e 10th st, br and stone flat; cost, $24,000; o, H F Ayers; a, B F Lowe.

9 Washington pl, br, iron and stone warehouse; cost, $40,000; o, L and S Sachs; a, R Berger; m, Deeves & Bro; c, J F Moore.

457 w 17th st, br flat; cost, $20,000; o, J M Curley; a, F Jenth.

8th av, n w cor 28th st, br flat; cost, $15,; 000; lessee, A Leary; a, J W Cohn; m, J T Brady; c, Hayes & Hassels.

8th av, w s, 18.3 n 28th st, br flat; cost, $12,000; lessee, P Vollmer; a, m and c, same as above.

96th st, s s 36 w Lexington av, 4 br and stone flats; cost, $75,000 all; o, F J Schnugg; a, L Entzer, Jr.

S s 115th st, 94 w Av A, 5 br and stone flats; cost, $18,000 each; o, M Coogan; a, Cleverdon & Putzel.

1st av, n w cor 90th st, 2 br flats; cost, $53,000 all; o, T J Jenkins; a, J Henderson.

314–18–20 w 76th st, 3 br and stone dwells; cost, $18,000 each; o, E J Nellis; a, R S Townsend.

316 w 76th st, br, stone and terra cotta dwell; cost, $18,000; o, H A Van Lieu; a, R S Townsend.

322 w 76th st, br, stone and terra cotta dwell; cost, $18,000; o, A Shiland, Jr; a, R S Townsend.

N s 120th st, 150 w 8th av, 2 stone flats; cost, $20,000 each; o, Annette Shannon; a, J C Burne.

Convent av, n w cor 143d st, 5 br and stone dwells; cost, $17,500 each; o, Louise M Hartwell, a, H E Hartwell.

43–5 College pl, br and stone office bldg; cost, $15,000; o, Mrs A E Leycraft; a, R S Townsend.

N s 148th st, 125 e Brook av, br flat; cost, $12,000; o, M Kirchner; a. A Pfeiffer.

179th st, s s, 150 w 4th av, 4 br dwells; cost, $16,000 all; o, S D Bonfils; a, C S Clark.

BUILDING INTELLIGENCE.

NEW YORK.—Continued.

337 E 16th st, br ten; cost, $14,000; o, S F Morris; a, E T Little.

339 E 16th st, br ten; cost, $10,000; o and a, same as above.

79 Spring st, br shop; cost, $13,000; o, M L Carhart; a, C Ware.

74th st, n s, 400 w 9th av, 7 br dwells; cost, $140,000 all; o, M Clark; a, E L Angell.

421 E 53d st, br stable; cost, $7,000; o, C Fountain; a, E Wenz.

249–253 Henry st, br flat; cost, $46,000 all; o, M Levy; a, Schneider & Herter.

14 E 128th st, br dwell; cost, $18,000; o, L Block; a, Buman & Tryon.

S S 124th st, 90 e Park av, 2 br flats; cost, $40,000 all; o, J Browning; a, A B Ogden & Son.

S s 187th st, 75 e Arthur av, br ten; cost, $7,000; o, J Faiella; a, J A Webster.

S w cor 4th and Cornelia sts, br flats; cost, $25,000; o. W Rankin; a, G Keister.

S s 4th st, 76 n Cornelia st, br ten; cost, $10,000; o and a, same as above.

2 8th av, 2 br ten; cost, $26,000 all; o, J H Woods; a, J W Cole.

W s 8th av, 35 s 29th st, 2 br tens; cost, $26,000 all; o, W D Dubois; a, as above.

S w cor 12th av and 77th st, br dwell; cost, $10,000; o, Margaret O'Briece; a, W A O'-Hea.

N s 95th st, 300 e 10th av, 5 br dwells; cost, $75,000 all; o, J Brown; a, D J Mackae.

N e cor Creston av and 184th st, fr dwell; cost, $8,000; o, P Ryan; a, French, Dixon & De S.

S w cor Lenox av and 134th st, br flats; cost, $25,000; o, Elizabeth V. Feniter; a, J A Webster.

Pier B, foot of 63d st, N R; iron sheds; cost, $70,000; o, N Y C & H R R; a, E W Katte.

S s 68th st, 175 w 10th av, br stable; cost, $21,000; o, N G Bowne; a, G H Giebel.

ALTERATIONS—NEW YORK.

54 E 56th st, br dwell; cost, $8,000; o, Emma B Richardson; a, G H Budlong.

S w cor 125th st and Madison av, br dwell; cost, $25,000; o, M Cohen; a, French, Dixon & De S.

83 Park av, br dwell; cost, $12,000; o, Emma D Hart; a, C S Luce.

110 e 25th st, cellar, basement and 2-story extension; cost, $8,000; o. E Hauselt; a, B Silliman; m, B Sheridan.

BROOKLYN.

W s St James pl, 201 s Gates av, 3 br dwells; cost, $7,500 each; o, Morris Building Co; a, B Wright.

W s Hamburg av, 50 s Myrtle st, 2 br filled tens; cost, $9,000; o and b, Geo Leoffler; a, T Engelhardt.

S s Madison st, 20 e Putnam av, 5 br tens; cost, $20,000 each; o, a and b, Moores & Le Quesne.

E s Gunther pl, near Atlantic av, 6 fr dwells; cost, $24,000 all; o, T B Bartholomew; a, J L Young.

W s Jay st, 50 n Water st, br dwell; cost, $17,000; o, Waterby & Force; a, T B Johnson.

178–180 S 9th st, 2 br dwells; cost, $20,000 all; o, C Friedman; a, C Kentz.

E s Broadway, 75 s Schaffer st, br warehouse; cost, $10,000; o, G Koch; a, F J Helmle.

N s 10th st, 175 e 8th av, 6 br dwells; cost, $57,000 all; o, T Brower; a, W M Coots.

S s Pacific st, 300 w New York av, br dwells; cost, $15,800 all; o, W S Ray; a, J C Cody.

N s 11th st, 28 e 8th av, 2 br dwells; cost, $9,000 all; o, F O Peterson; a, not given.

E s Adams st, 150 s Myrtle av, br dwells; cost, $11,000; o, Jas Howell; a, W A Mindell.

N s Macon st, 260 w Patchen av, 2 br dwells; cost, $9,600 all; o, Mary A Burnes; a, I D Reynolds.

W s 4th av, from 13th to 14th st, 7 br dwells; cost, $100,000 all; o, Norris & Bowers; a, W H Norris.

N s Decatur st, 80 w Sumner av, 3 br dwells; cost, $18,000 all; o, Hannah E Stoutenburg; a, J L Young.

BUILDING INTELLIGENCE.

BROOKLYN—Continued

87 Seigel st, fr dwell; cost, $7,500; o, Lena Rosenweig; a, E Dennis.

S s Bergen st, 310 w Kingston av, 5 br dwells; cost, $50,000 all; o, The Dingelden & Co.; a, J Mumford.

S s South 8th st, 66 e Wythe av, br dwell; cost, $8,000; o, J Hoeft; a, B Finkenseiper.

N s Jefferson av, 175 w Knickerbocker av, 2 fr dwells; cost, $9,000 all; o, G A Heumann; a, as above.

S s Stockholm st, 100 w Evergreen av, 3 fr dwells; cost, $11,000 all; o, W Wolf; a, Th Engelhardt.

W s 4th av, 40 N 20th st, 2 br dwells; cost, $14,000 all; o, D Ferry; a, G D Reynolds & Son.

N s Putnam av, 100 E Bushwick av, fr dwell; cost, $10,000; o, C Zenrick; a, Th Engelhardt.

N s Cornelia st, 100 E Bushwick av, fr dwell; cost, $10,000; o, J Wetz; a, as above.

ALTE ATIONS—BROOKLYN.

N e cor Arlington and Schneck avs, br church; cost, $10,000; o, Trinity Church of East New York; a, R M Aspinall.

N e cor 7th av and 9th st, br ten; cost, $10,000; o, J McLaurieu; a, M Thomas.

381 85 Fulton st, br theatre; cost, $20,000; o, F Campbell; a, J B McElfatneck.

N w cor Richard and Seabrang sts, br shop; cost, $15,000; o, H R Worthington; a, H C Harmon.

S s Dean st, 110 e 5th av, br dwell; cost, $7,500; o, Pauline DeComps; a, R Dixon.

S e cor Park and Marcy avs, br church; cost, $10,000; o, Tompkins Avenue Congregational Society; a, Geo P Chappel.

F s Peiffer st, 100 e Bedford av, br church; cost, $9,000; o, St Bartholemew's Church; a, as above.

S w cor Clinton and Layfayette avs, br church; cost, $50,000; o, Clinton Avenue Congregational Church; a, not given.

S w cor Reid av and Monroe st, br church; cost, $25,000; o, Janes M E Church; a, J E Brown.

MISCELLANEOUS.

CHICAGO, ILL. — 2 W Washington, br warehouse; cost, $28,000; o, Henry F Bellings; a, Thomas & Rapp; b, L Daegling.

111 Walton pl, br flats; cost, $8,000; o, Fred Max; a, Bellinghoffer & Herman; b, Lotz & Thompson.

241–45 Clark, br addn; cost, $22,000; o, E Grace; a, J M Van Osdel & Co; b, Jno Angus.

130 Barclay, br flats; cost, $8,000; o, Kund D Boldat; a, Lutken & Thieslen; b, H Rasmussen.

78 S Sangoman, br flats; cost, $17,000; o, C A Webb; a, J M Van Osdel; b, O Lundquist.

182 S Green, br flats; cost, $9,000; o, a and b, as above.

2601–07 Prarie av, br dwell; cost, $35,000; o, C B Foot; a, C H Frost; b, J S Price.

299–303 S Clark, br storage; cost, $70,000; o, Henning & Speed; a, W L B Jenvey; b, G H Fox.

2131–33 Dearborn, br dwell; cost, $14,000; o, Mrs E Williams; a, Ed Snyder; b, J T Hall.

177 Larrabee, br store and flats; cost, $8,000; o, Frank Leodson; a, Ostling Bros; b, Lendgsen & Nelson.

568–70 Washington boul, br dwell; cost, $20,000; o, J F Cabott; a, C L Stiles; b, A Landquist.

Ford and 77th, br dwell; cost, $10,000; o, A Nord; a, P W Anderson; b, N M Berquist.

Buena and Evanston, br dwell; cost, $10,000; o, J M Rogers; a, W L B Jenney; b, J J Morghan.

58 W Wright, br dwell; cost, $8,000; o, W O Budd.

Emerald av and 53d, br flats; cost, $12,000; o, O Adams; a, L C Hallberg.

122d and R R, fr factory; cost, $35,000; o, Mahla & Chaffel; a, Hy Raeder.

213–15 State, br store and dwell; cost, $18,000; o, Hy Siegel; a, Furst & Rudolph; b, Thos Mickelson.

2601–13 Calumet av, br store and flats; cost, $150,000; o, Engles & Co; a, H Meissner; b, F Johnson.

BUILDING INTELLIGENCE.

CHICAGO, ILL.—393–95 Illinois, br barn; cost, $10,000; o, Dr J S Young; a, Alf Smith.

Morgan & Congress, br flats; cost, $14,000; o, Mrs C White; a, J H Moore; b, N Provost.

48 Nebraska, br addn; cost, $8,000; o, C B Riley; a, O W Marble; b, M Connelly.

2340–42 Calumet, br flats; cost, $18,000; o, G D Tyler; a, R G Penhcost; b, O E Anderson.

180 Henry, br store and flats; cost, $9,000; o, F Freeberg; a, H. Olzenski; b, H Schoeing.

3352–58 S Park av, br dwell; cost, $45,000; o, W H Pruyn; a, Wilson & Marble; b, H Morgan.

4106 Vincennes av, br dwell; cost, $8,000; o, Reuben Gosling; a, P Hale; b, P G Pendergast.

1016 Park av, br dwell; cost, $8,000; o, A Ambuster; a, F Fuhringer; b, C Mueller & Co.

172 buildings costing less than $7,000 each.

DAYTON, O.—Arthur G Erdmann, architect, will prepare plans for a brick factory, to cost about $15,000. It will be heated by steam, and have the latest improvements.

MADISON, WIS.—Cor Wisconsin av and Dayton st, church, red pressed br and stone trimmings; cost, $35,000; o, Presbyterian Society; a, Chase, of Minneapolis.

MILWAUKEE, WIS.—Cramer and Bradford sts, church; cost, $15,000; o, St Peter and Paul's congregation; a, H Messmer; b, J Zeisler.

PUT-IN-BAY, O.—The Put-in-Bay Hotel Company have completed arrangements to build a mammoth hotel to be called Hotel Victory. It will cover six acres of ground, and be equipped with every modern improvement.

SIOUX CITY, IOWA.—109 and 111 Pearl st, 2-story br addn to store; cost, $7,000; o, A Geoninger; a, G G Baldwin; b, J Sulzbach.

SO. BETHLEHEM, PA.—4th st, br bldg; cost, $12,000; o, Borough of So Bethlehem; a, A W Leh; b, no contract let.

ST. LOUIS, MO.—Cabanne av, 3-story br bldg; cost, $9,000; o, J Taylor.

Olive st, 2-story br bldg; cost, $12,000; o, D Arnold.

Market st, 3-story br bldg; cost, $8,000; o, J A Niles.

Chestnut st, 3-story br bldg; cost, $7,500; o, F C Davis.

Broadway, 2-story br bldg; cost, $52,500; o, St Louis R R Co.

Bell av, 3-story br bldg; cost, $15,000; o, Paramore Investment Co.

Bell av, 2-story br bldg; cost, $12,000; o, J D Paramore.

Magazine st, 2-story br bldg; cost, $20,000; o, Schuchmann.

STOCKTON, CAL.—A $40,000 hotel and theatre will be erected here. For particulars address S W Newell, as above.

ST. PAUL, MINN.—A power house will be erected by the City Railway Company at Hill and Ontario sts, for the proposed electric line.

Ashland, nr Kent, 3-story br dwell; cost, $18,000; o, John E Williams.

Selby, nr Dale, 3-story br dwell; cost, $17,000; o, same as above.

Selby av, dwell; cost, $18,000; o, John E Williams.

Colorado nr S Robert, 4-story st bldg; cost, $50,000; o, Xavier S Pierre.

6th, cor Wabasha, 5-story br block; cost, $150,000; o, P J Kavanagh.

State nr Concord, 2-story br dwell; cost, 18,000; o, Peter Rohantsen.

YORK, PA.—Mr J A Dempwolf, architect, has been employed by the York Hotel Company to design a 6-story hotel with all the modern improvements; elevators will run to the dining room on sixth floor; drawings are being made; cost, $82,000.

YPSILANTI, MICH.—3-story stone warehouse; cost, $8,000; o, N W Glover; a, M L Smith & Son; b, not let.

THE ENGINEERING & BUILDING RECORD

AND

THE SANITARY ENGINEER.

A JOURNAL FOR THE ARCHITECT, ENGINEER, MECHANIC, AND MUNICIPAL OFFICER.

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THE PROPOSED WORLD'S FAIR AT CHICAGO.

CHAUNCEY M. DEPEW, who recently returned from a trip to Chicago, gives, in the New York *Tribune*, an encouraging account of the prospects for the World's Fair to be held in that city in 1892. Mr. Depew reports the greatest enthusiasm all through the West over the project, and announces to doubters in other parts of the country that the city has already $5,000,000 in cash and that they will get $5,000,000 more from the Legislature. He very properly urges that the United States Government should give moral support to the enterprise to make it as successful as it should be, since without this Governmental recognition foreign exhibitors are not likely to consider the enterprise a sound one. He thinks the fair will be a great thing for the West, and that it should double Chicago's population within ten years, and that it will be of great advantage to the Western railroads. It, of course, is to be expected that in an undertaking of this sort there will be during its inception and progress more or less local friction. It is to be hoped, however, that critics will profit by Mr. Depew's example, and not hasten to magnify every local criticism to the injury of the project and thus unnecessarily increase the heavy burdens of those who will be responsible for the carrying on of the undertaking, which should have the sympathy and encouragement of all sections.

CROTON AQUEDUCT CONTRACTORS' CLAIMS.

THE bill passed by the New York Legislature giving claims of the Croton Aqueduct contractors now pending precedence over all other cases in the courts of the State has failed to become a law by the refusal of Governor Hill to sign it.

Though less outrageous than the bill which preceded it and was passed by one branch of the Legislature, creating a special tribunal for determining the claims, it was still plainly wrong in principle, and had it become a law would have made a bad precedent, to say nothing of direct mischief possible under it. The first named bill, referred to in the issue of this journal for April 19, was withdrawn, and for its disappearance the community is specially indebted to the New York *Tribune*, which denounced it early and late, and was in a position to be especially influential with the Legislature.

The Aqueduct Commissioners may be depended on to interpose no needless delays to the prosecution of any suits, nor will the city's law officers. We have no doubt the contractors will collect all just and equitable claims, if not by agreement with the Commissioners, then through the medium of the courts of the State.

DRAINAGE OF LOUGH ERNE, IRELAND.

AT a recent meeting of the Institution of Civil Engineers a paper was read by a member, James Price, Jr., on the drainage of the Lough Erne district in Ireland, of which work he was the resident engineer.

The district comprises over a million acres and the works which have been carried out were designed by James Price, Sr., also a member of the Institute, in 1878. They consisted in cutting a channel through a rocky barrier at Belleek on the River Erne below the Lower Lough Erne, controlling the discharge through this channel by large sluice gates and improving the channel above Belleek and also between the two loughs. The channel at Belleek was excavated under the protection of clay dams.

The sluice gates when closed retain the water at its normal summer level, but when a heavy rain commences in the upper part of the district they are raised so as to permit the 27,643 acres in the lower lough and the 9,453 acres in the upper lough to be drawn down six inches. Thus the flood is provided for before it arrives and the overflow of adjacent land is prevented. Allowance was made for a discharge of 600,000 cubic feet per minute, but by opening in advance a discharge of 500,000 cubic feet per minute proved sufficient.

These sluice gates, four in number, were designed by F. G. M. Stoney, M. Inst. C. E. They are 29 feet 2 inches wide, 14 feet 6 inches high with a lift of 9 feet. Each gate weighs 13 tons, but as it bears on a train of 8-inch live rollers one man can easily raise it the full height in 45 minutes, and a turbine can lift the four gates simultaneously in half an hour.

The total cost of the gates, exclusive of masonry, was £4,000. The total cost of the entire works was £180,000, of which £30,000 was for navigation and £150,000 for drainage. Large compensation had to be paid for anticipated injury to fishery rights, although the works have actually improved the salmon fishery.

Observations of the rainfalls, lough levels and sluice discharges for four years showed that the storage in the loughs affected but little the summer flow and indicated that the great reservoir for the summer flow of a river was the ground water. The general effect of the drainage works had been to keep the level of the loughs more uniform, higher in summer and lower in winter, and by preventing the flooding during a wet summer of fifty square miles of adjacent low land not only was the loss of that year's crop of hay avoided, but also injury to the following crop, which was apt to be damaged by the decayed grass of the previous season. These extensive tracts of damp land also so chilled the air as to interfere with the ripening of neighboring crops, to say nothing of their injurious effect on the health of the community.

The author advocated the following general principles in designing drainage works: First, that the cross-section of the enlarged channels should be hyperbolic instead of trapezoidal, thus increasing the discharge in proportion to the section, obviating slips by flattened slopes next the land, facilitating dredging and confining the low-water channel so that the sides could be cleaned. Second, that the channels should be given a fall of only one or two feet per mile, with embankments and back drains where necessary and accumulating any excess of fall at certain points where the discharge might be effected along paved channels. While embankments were generally avoided in Ireland, it was, in the opinion of the author, clearly a mistake to lower a large river to avoid flooding a small area, and, though not applicable to the Erne, embankments should be used for the Barrow drainage. The extension of arterial drainage in Ireland would, he thought, render large areas of ground available and would raise the mean summer temperature, which at present is only 58° Fahr.

The initiation of such schemes can, however, no longer be left to the landowners, who, under their altered conditions of tenure, have lost their former interest in the improvement of their estates.

A SUBWAY FIRE IN NEW YORK.

A FIRE started from a leak in a gas main on Broadway at the intersection of Fulton Street, New York City, Thursday morning, and burned all day. The New York Steam Company had a trench in the street at this point to its pipes, which run under the gas mains, and at 2:30 o'clock Thursday morning a workman dropped his lantern in such a way as to ignite gas escaping from one of the latter, a fierce flame finally followed, and it was not until 7 o'clock in the evening that the fire was under control. The wooden curb of the trench caught fire, the heat melted the lead in other gas mains, of which there are a large number crossing at the place, and every leak added fuel to the flame. Attempts were made to put the fire out by filling the trench with earth, but the volume of gas escaping had become so great that this was unavailable. Then the gas companies set to work to shut off the gas by air or water bags introduced in the mains on all sides of the fire. This made about 24 pipes to stop in all, from 8 to 16 inches in diameter, as there are probably 12 mains crossing at the point indicated, it was not known just which ones were making the trouble, and each one must be stopped on both sides of the fire. The rubber air-bags, it should be understood, are introduced when empty in the mains through plug holes, and then filled with air by a force-pump until they expand and stop the pipe. In like manner an oiled cotton cloth bag of larger diameter than the main is introduced to the larger pipes and filled with water, and a static pressure maintained sufficient to stop the passing of gas.

After about ten hours' work with air and water bags the escape of gas was reduced so that the flames were extinguished by throwing wet clay on the leaks. The electric lighting conduits and cables on the east side of Broadway were destroyed by the heat, and it was feared that the telephone cables in the subway on the west side of the street would be ruined, but, so far as can be ascertained, they were not injured.

RAPID TRANSIT SCHEMES IN BOSTON.

A BILL has just become a law in Massachusetts directing that any railroad or street railway company in the State may build the Meigs system of elevated road, provided that cities and towns in which the lines run assent. The assenting in the case of cities is to be by a majority of all the members of the Council, and in towns by a majority of the voters present at a special town meeting, besides which the location in Boston shall be first approved by the Board of Railroad Commissioners. The Meigs Company has sent a petition to the Board of Aldermen which contemplates laying out an elevated railroad system in this city extending to Charlestown, Brighton, Roxbury and South Boston, with branches to Cambridge and Somerville, and several other rapid transit schemes are being pressed in the city.

THE COLUMBIA COLLEGE SCHOOL OF MINES.

AT the Columbia College Commencement this week degrees were conferred in the School of Mines as follows:

Engineer of Mines.—Alexander L. Black, Edwin M. Blake, William M. Davis, Albert L. Levy, Manuel R. Montenegro, Howard F. Welsh.

Civil Engineer.—George A. Beckwith, Romeo T. Betts, Dwight D. Book, Joseph Carson, Diego L. Clark, Hewlett R. Connell, Thomas C. Coykendall, Andrew E. Foyé, Charles E. Gudewill Charles H. Hart, John S. Hoyt, Elisha D. Hurlbut, Jr., Louis F. Massa, Thomas M. R. Meikleham, José Portuondo, Albert C. Fowler, Alger C. Gildersleeve.

Metallurgical Engineer.—Frederick I. Cairns, George J. Hicks Frank C. Hooper, Thomas J. Jones, William H. McKleroy, Thomas M. St. John.

Bachelor of Philosophy.—(Course of Analytical and Applied Chemistry.) Joseph A. Deghuée, George A. Ferguson, Bertrand C. Hinman, Herschel C. Parker, James R. Steers.

Bachelor of Philosophy.—(Course of Architecture.) Samuel W. Andrews, Jr., Herman Behlen, Will A. Buckland, William R. Clayton, Frederick G. Colton, Lloyd W. Fisher, James Monroe Hewlett, Meyer Jarmulowsky, Robert D. Kohn, Edward G. Lichtenstein, William S. Lowndes, Horace B. Mann, William Stone Post, William L. Thorne, Charles Peck Warren, Alexander M. Welch.

A MOVEMENT is started in Wilmington, Del., to establish free public baths.

ANNUAL CONVENTION OF THE AMERICAN SOCIETY OF CIVIL ENGINEERS.

PAPERS to be read at the convention of the American Society of Civil Engineers, which opens at Altoona, Pa., June 26, are announced as follows:

"On a Method of Taking Cross-Sections of Deep Rock Cuts by Triangulation," F. W. Watkins.

"On the Littoral Movements of Inlets along the Coast of New Jersey," Lewis M. Haupt.

"The Designing and Erection of the Oakley Arch," J. Foster Crowwell.

"The Stability of Loaded Masonry Arches," A. S. C. Wurtele.

"Irrigation in India," Herbert M. Wilson.

"Construction and Maintenance of Track," Julien A. Hall.

"Street Electric Railways," O. H. Landreth.

"The Ventilation of Tunnels," N. W. Eayrs

"Inland Sewage Disposal with Special Reference to the East Orange, N. J., Works," Carrol Ph. Bassett.

"The Three River Spans of the Bridge Recently Completed Across the Ohio River at Cincinnati," William H. Burr.

"The Beginnings of Engineering with Special Reference to Early Engineering Science in America," J. Elfreth Watkins.

"On Truss Bridges," Onward Bates.

"One Way of Obtaining Brine," Charles B. Brush.

"The Self-Registry of Effects of Strain in Metals," Robert H. Thurston.

"Comparison of Water Supply Systems from a Financial Point of View," J. Leland FitzGerald.

RADIATOR MANUFACTURERS' MEETING.

THE Association of Steam Radiator Manufacturers held a meeting at Buffalo this week, with about 15 delegates present representing many of the large works. A press report says that the old prices were re-adopted, and that an effort to reduce the cash discount from 2 to 1 per cent. failed.

Among the concerns represented were the A. A. Griffing Iron Company, Jersey City; Detroit Radiator Company, Michigan Radiator and Iron Manufacturing Company, Detroit; the Crane Company, Chicago; T. H. Brooks & Co., Cleveland; Nason Manufacturing Company, New York; The H. B. Smith Company, Westfield, Mass.; Gurney Heater Company, Boston; T. C, Joy, Titusville, Pa.; and Pierce Steam Heating Company, Buffalo.

FACTS ABOUT BRIDGES WANTED.

O. CHANUTE, F. C. Carter, J. F. Wallace, M. Seifert and W. E. Williams, a committee appointed by the Western Society of Civil Engineers to report as to the regulation of the construction and maintenance of bridges, have issued a circular asking for information upon the following points·

Foreign custom and laws in regard to the construction and inspection of railway and highway bridges.

The manner in which this question has been treated and any legislation had thereon in the United States.

The points in bridge designing and construction which need special attention.

Former bridge accidents and their causes.

Standard plans and designs of railway bridge floor systems.

Information should be sent to the Committee on Bridge Legislation, Western Society Civil Engineers, 78 La Salle Street, Chicago, Ill.

WORK ON THE NICARAGUA CANAL.

SOME details of the beginning of work on the Nicaragua Canal are given in a dispatch to the New York *Times*. Work on the canal itself has been confined to clearing a track over the course proposed for it through the forest from Greytown 16 miles to the top of a rocky ridge. This clearing is 1,000 feet wide at Greytown, but soon narrows to 500 feet. It is here that some very expensive work on the waterway will come. Near this clearing, and nearly parallel with it, another narrower way has been cut for a railroad to the Silico Lagoon. A contract for 12 miles of this line has been let to C. P. Treat, and ground was broken upon the work May 20.

The jetty to improve the harbor has been extended about 500 feet, and the outer end is now in 11 feet of water. Work had been suspended for some time from want of material, but had recently started again. The jetty is 43 feet wide, with four rows of piles eight feet apart, inclosed with sheet piling, and the space filled. The piles are sunk 15 to 18 feet in from 3 to 5 minutes with a water jet, and then driven to 20 feet. For filling mattresses of brush are put down and secured in place by broken rock, when the sand drifts in very fast, and has even piled up by the side of the jetty so that the shore line seems to follow the work. Rock is so scarce that the same pieces have been used for fixing the mattresses over and over again, but when the railroad reaches the "divide" an abundant supply will be available, with which it is proposed to supplement and strengthen the structure. Frank P. Davis, divisional engineer, is now in charge of the work, assisted by civil engineers Hunt, Holcomb and others.

THE CHESAPEAKE AND OHIO CANAL.

THE receivers appointed by a Maryland court to take charge of the Chesapeake and Ohio Canal have reported against repairing it for use as a waterway, on the ground that it could not be operated profitably in the face of railroad competition. The total cost of necessary repairs is put at $268,698. The report says that by ordinary competition in rates it would not be possible to operate the canal, and that therefore the receivers applied to the owners of Allegheny coal mines to give guarantees of enough shipments to warrant opening the canal and so maintain a check upon the railroads. All that could be got, however, was a promise of shipping 450,000 tons of coal annually for four years and, basing their calculations upon this, the receivers made an estimate of the total income of the canal of $189,963 per year for the period indicated as an outside figure, while the running expenses are put at $135,106 and the interest on certain bonds would increase the outgo to $193,700. After the four years expired the report intimates that the canal could not possibly be operated, and the substantial conclusion is that all thought of it as a waterway must be abandoned.

THE CHICAGO DRAINAGE LAW UPHELD.

A PRESS dispatch says that the Illinois Supreme Court has affirmed the validity of the act known as the Chicago Drainage Law, which has for its general purpose the taking of the city sewage and the water of Chicago River along the line of the Illinois and Michigan Canal and thence to the Illinois and Mississippi Rivers by gravity.

SENATOR EVARTS, of New York, has introduced in the United States Senate a bill authorizing the construction of a bridge over the Hudson River, under what is known as the "Greene" charter, located anywhere between Tenth Street and One Hundred and Eighty-first Street, New York City. The incorporators have organized and voted to open stock subscription books, but the time for doing this was not fixed.

AT the Commencement of the University of the City of New York this week, the degree of Civil Engineer was given G. W. Bond, G. T. McNab, A. D. Phillips and A. B. Samuelson.

OBITUARY.

W. H. HARRISON, Superintendent of Bridges of the Chicago, Santa Fe and California Railroad, died suddenly at Scranton, Ill., June 5.

WILLIAM BUCHANAN, of Cedar Rapids, Iowa, Treasurer of the Cedar Rapids Water Company, died Tuesday, at the age of 59 years.

JOHN W. TAYLOR, of Somerville, N. J., who supervised the construction of the Raritan Water-Works in 1839 and had since been in railroad and banking business, died June 7, at the age of 68 years.

PERSONAL.

L. H. CRAMER has just been re-elected Village Engineer of Saratoga, N. Y. This was Mr. Cramer's eighteenth successive election to the place.

FRANK L. SUTTER, architect, Dayton, O., has moved from the Barney Block to room 15 in the new Jefferson Block.

WILLIAM S. BACOT, of New York City, has been given the honorary degree of Civil Engineer by Princeton College. Mr. Bacot graduated at Princeton in 1881.

E. P. RIPLEY, General Manager of the Chicago, Burlington and Quincy Railroad, has sailed for Europe, to be absent a short time. Upon his return he will assume the duties of Vice-President of the Chicago, Milwaukee and St. Paul Road.

S. H. HARRINGTON, has resigned his position as Mechanical Engineer of the Erie Railroad at Susquehanna, Pa., and accepted a position with the Gould Manufacturing Company, of Buffalo, N. Y.

J. D. MOLER, until recently City Engineer of Springfield, O., has taken his son, William G. Moler, C. E., formerly Superintendent of Schools at Greenfield, O., into partnership, and the firm will do a general engineering and contracting business, with headquarters at Springfield.

COMING MEETINGS.

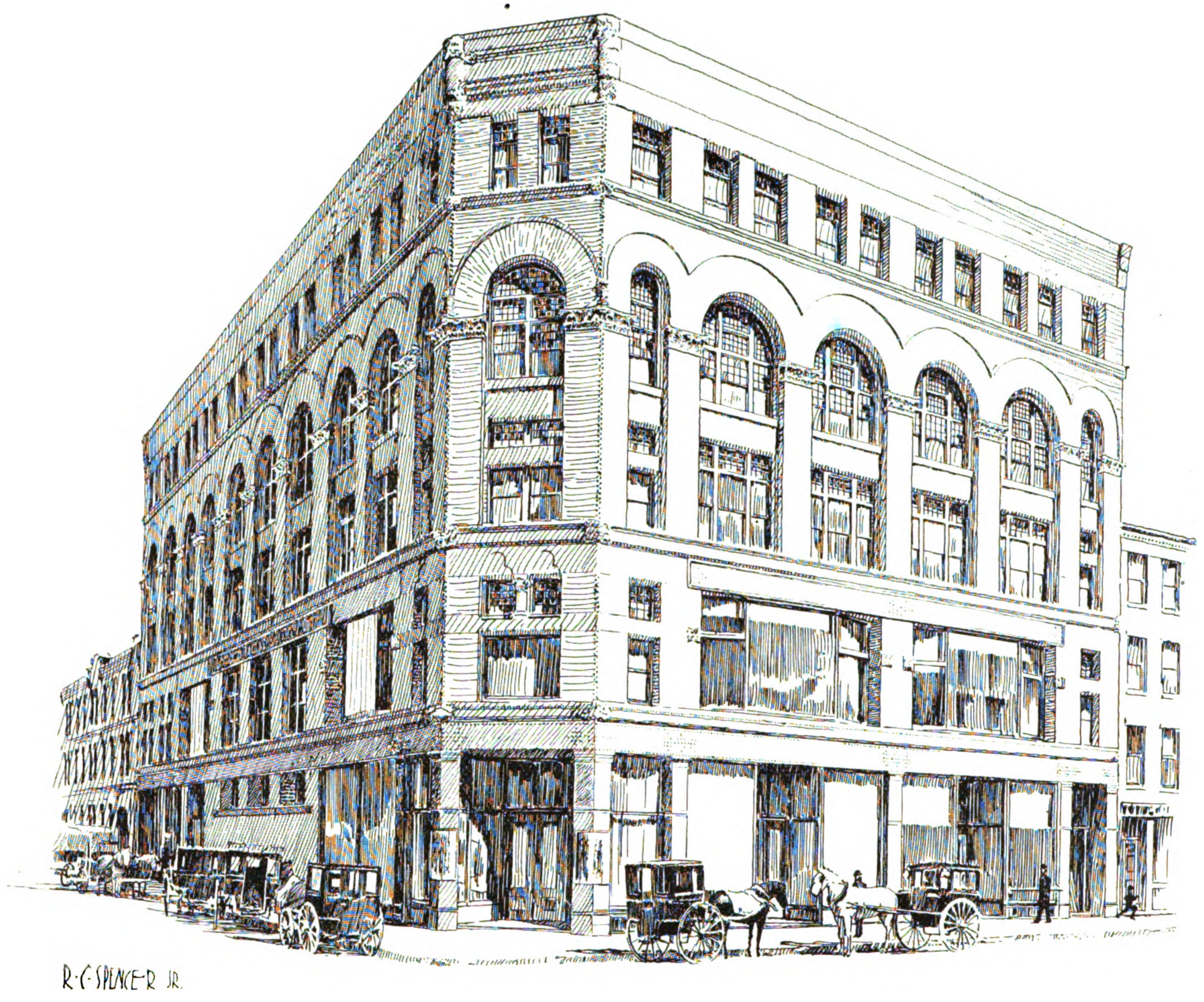
THE annual convention of the American Society of Civil Engineers will open at Cresson, Pa., at 10 o'clock Thursday morning, June 26.

OUR ARCHITECTURAL ILLUSTRATIONS.

A COMMERCIAL BUILDING, BOSTON MASS.

HARTWELL & RICHARDSON, ARCHITECTS, BOSTON, MASS.

WROUGHT-IRON WORK.—FIGURES 1 AND 2 BY JOHN WILLIAMS, NEW YORK CITY. FIGURE 3 IN SOUTH KENSINGTON MUSEUM.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ENGINEERING SOCIETIES.

THE CLEVELAND CIVIL ENGINEERS CLUB held a meeting Tuesday evening, with W. H. Searles in the chair. Albert H. Porter was elected Secretary. Dr. Herman Poole read a paper on "Ferroid," which he described as a new composition stone made of sulphur, iron and silicon, about one-third as heavy as iron, and of a deep slate color.

THE ENGINEERS' CLUB OF ST. LOUIS held a meeting June 4, with President Nipher in the chair, W. H. Bryan, Secretary, and 30 members and 3 visitors present. J. G. Jennings was elected a member.

Mr. Russell, Chairman of the Committee on Local Data, presented his report. The nature of the matter collected was explained, and it was ordered that the committee be continued, with authority to employ expert assistance, if necessary, to edit the report, and to get for the club estimates on the cost of publication.

The report, which is intended to be printed as a handbook for the club, gives the cost of different kinds of masonry and foundations, cost of railway construction and railway location, steam heating, street reconstruction, the amount of rainfall, etc.

Professor Nipher called attention to the fact that rainfall in the State of Missouri was almost exactly equivalent to the river discharge at St. Louis.

A DIRECT ACTING HYDRAULIC PUMPING ENGINE.

KNIGHT & Co., Engineers, of Sutter Creek, Cal., have brought out a type of direct acting pump designed to be driven by water pressure under heads of from 300 to 500 feet or more if desirable.

The main cylinder is 12 inches diameter, and is of wrought iron, and the side pipes are steel castings. The principal feature, and the one that finally led to noiseless and successful working, is the use of independent exhaust valves. The induction valves are moved from an auxiliary cylinder. The working of the machines is said to be quite noiseless and without jar, even when 500 feet of heavy pump rod is connected with the engine. Four of these large pumping engines are now working with driving "heads" as follows: one with 336 feet, two with 460 feet, and one with 720 feet. The efficiency of the engines, it is claimed, reaches 75 per cent.

SLOW-BURNING CHARACTER OF WOOD POSTS.

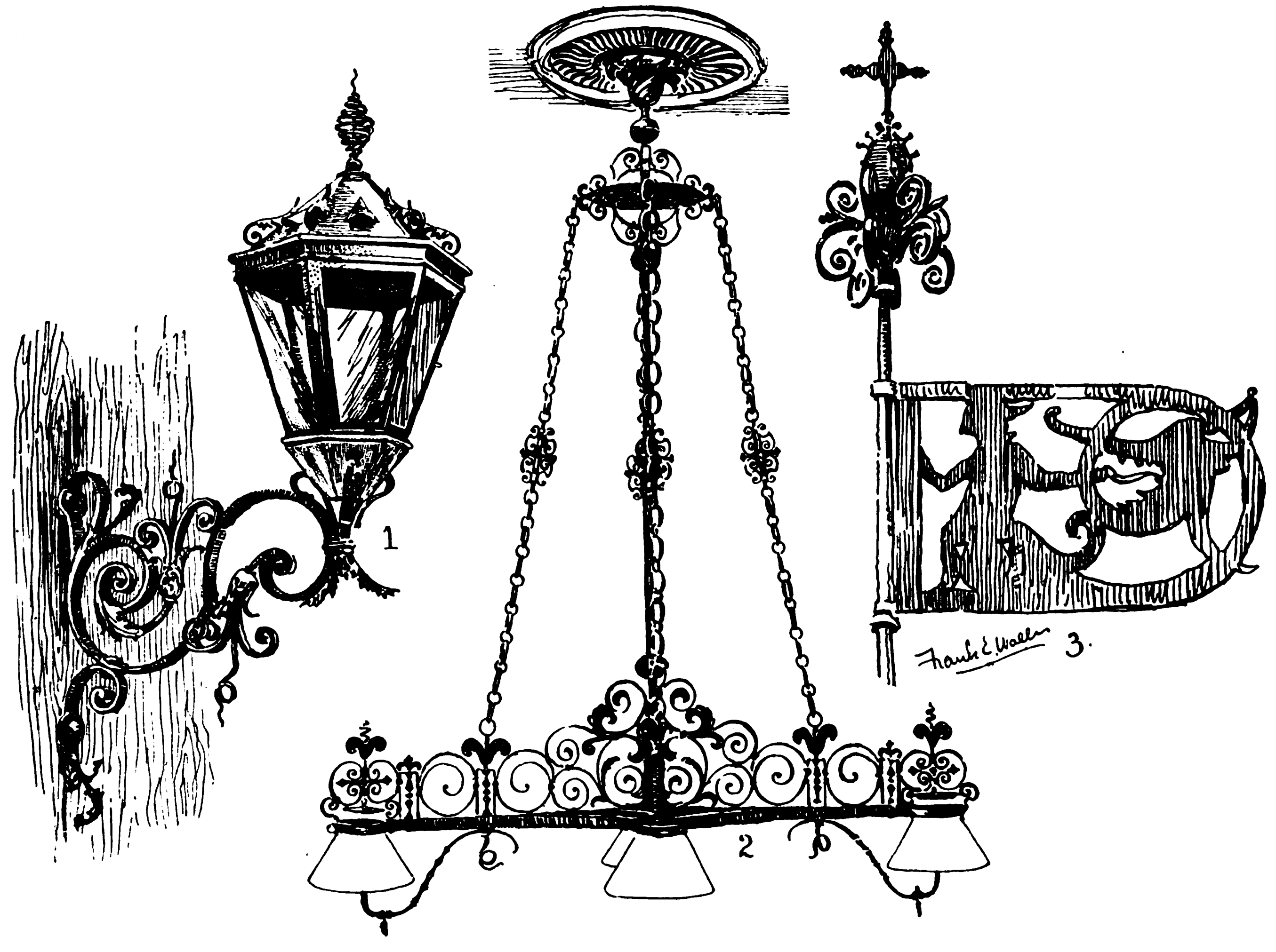
THE endurance of wooden posts when subjected to fire is commented upon by the London *Architect* in referring to a fire which occurred in a large warehouse and raged with great fury for five hours, at the end of which time it was extinguished.

The warehouse was built with brick walls. It had wooden floors supported on wooden beams, which, in their turn, were carried on wooden story posts about 12 inches thick, and, although serious damage was done, not one portion of the heavy woodwork was destroyed. After the fire the proprietors allowed the chief of the fire brigade to remove one of the story posts, with a section of the beams and other parts surrounding it above and below. This post had been subjected to the full action of the fire during the whole of its duration, or, making full allowance for everything, including the delay of the fire attacking the particular spot on which it stood and the time at which the cooling process commenced, certainly not less than four and a half hours. As large quantities of water had been used and it was probable that everything had been saturated, the wood was carefully dried before a strong fire until not a trace of moisture remained in it. It was then set on end in an open yard, exactly as it had stood in the warehouse, with the pedestal underneath, the cap above, and the beam across the cap. More than a ton of shavings, light wood and heavy wood were placed around it, and, after the whole heap was saturated with petroleum, a light was applied to it, and after this large quantities of petroleum and turpentine were pumped on it. At the end of two and one half hours the post, beam and other parts were withdrawn from the fire, and within a few minutes of the time they were withdrawn they ceased to burn. A few feet were then sawed off horizontally, at that part which had suffered most from the flames, and afterward the same place was split longitudinally with steel wedges, in order to examine its condition. The post was of pitch pine—about the most inflammable wood known—and yet, after exposure for seven hours to fire, the fury of which could not be exceeded except in blast furnaces, it contained a quantity of perfectly uninjured and apparently fresh wood, probably capable of supporting the whole weight which the post was designed to carry. Immediately after the saw cut, and again after the cleaving with steel wedges, the center was carefully examined, and found to be just perceptibly warm to the touch, but nothing more, thus proving that the fiber, in which the strength lay, was quite uninjured.

ELECTRIC POWER FOR CRANES.

ONE of the English papers directs attention to the fact that in one of the most extensive timber yards in England an electric moter is attached to the frame of one of the cranes and geared with friction gearing to a central shaft, which, by means of three levers and a foot brake, performs the operations of hoisting and slewing and propelling the crane. The current is conveyed to the electric motor by two copper tubes laid along the tramway on which the crane runs, and taken off by suitable contacts. In other respects the crane is of the ordinary build. The power is derived from an 18-unit Crompton dynamo, which supplies 300 incandescent lamps employed in lighting a factory. It gives a current having an electromotive force of 110 volts, and some 30 amperes are used for working the crane. It was specified that the crane should lift 15 cwt. as a maximum load, and raise 10 cwt. at a speed of 80 feet per second, and slew at the same speed. It, however, lifts 18 cwt., and in other respects, also, is said to improve upon the specifications.

In connection with this it is of interest to note that at the Alliance, O., shops of the Morgan Engineering Company a traveling crane is driven by a single electric motor, which has all the usual movements.



WROUGHT IRON WORK.—FIGS. 1 AND 2 BY JOHN WILLIAMS, NEW YORK CITY. FIG. 3 IN SOUTH KENSINGTON MUSEUM.

NEW ENGLAND WATER-WORKS ASSOCIATION CONVENTION.

(From our Staff Correspondent.)

PORTLAND, ME., June 12.

FIRST DAY'S SESSION.

THE ninth annual convention New England Water-Works Association opened here yesterday. Headquarters were provided at the Falmouth Hotel, and the meetings were held in the City Hall.

The convention was called to order at 2.45 o'clock, with President Dexter Brackett in the chair and R. C. P. Coggeshall Secretary, and 102 members and visitors present. In his opening address President Brackett made a brief statement of the work of the association, its aims and purposes, and referred to its growth as shown by its increase in membership from 43 at the second convention to 335 now. Two-thirds of its active members are residents of New England, but it has representatives from 25 States and territories outside of New England.

He dwelt upon the advantages of encouraging excursions and social meetings as favoring an interchange of ideas between members as to the practical discharge of their duties in the management of water-works. Brief reference was made to the various papers presented to the members at their several meetings during the winter, especially the papers by John R. Freeman on "Fire Streams"; that of F. F. Forbes, of Brookline, Mass., on "Algæ in Reservoirs and Ponds," and to the various short experience papers on matters pertaining to the management of water-works, given at the meetings in February and March. He suggested a few subjects which he thought should be brought up for future discussion, as follows: "How to Preserve and Improve the Quality of Water," "Cast or Wrought-Iron Pipe, its Thickness, etc.," and "Waste of Water." The careful consideration of these and kindred subjects is one of the chief objects of the association. In closing his remarks Mr. Brackett referred to the valuable work rendered to the association by the Secretary, Mr. Coggeshall, and thanked the society for the courtesy and attention extended to him as President during the past year.

The Secretary's report was next presented and accepted. It shows an increase in membership from 277 in June, 1889, to 335 at this time, consisting of 257 active, 4 honorary, and 73 associate members. The report of the Treasurer, Hiram Nevon, of Cambridge, Mass., and that of the Finance Committee were presented and accepted. They showed total receipts, $3,475.95; expenditures, $2,346.65; balance on hand, $1,129.30. It was voted that a committee of five be appointed to nominate officers for the ensuing year. The President announced that he had a telegram from Mayor Clark, of Toronto, inviting the association to hold their next annual convention at that place, and it was voted that a committee of five be appointed to consider this invitation and the general question of the place of the next annual convention.

On behalf of the Committee of Registrars appointed at a previous meeting to report upon "Classification of Water Rates," J. C. Whitney, Registrar of Newton, announced that from the 450 answers to circulars sent out by the committee they had received no data which would enable them to come to any definite conclusion on account of the almost total want of uniformity in these rates as tabulated. The committee, however, indorsed the report of the committee of 1887, and requested an extension of time to further investigation. It was voted that this committee be continued and report at a future meeting.

A paper by Charles W. Morse, Superintendent of the Water-Works at Haverhill, Mass., was presented, in which the writer maintained that water-works built and conducted by a private company yield greater benefit to the people than is possible under municipal control, and he endeavored to show how greater economy and efficiency can be attained under the former than under the latter management. In the discussion that followed several members participated.

F. L. Fuller, of Boston, referred to his experience with the water-works of four towns, where in each case the commissioners appointed were entirely competent, reliable men, selected with special reference to carrying on their special work, and in each case the work as done was better than would have been possible under a private company. Many water-works are constructed by towns which would not be attempted by a private company.

Mr. Hawes, of Fall River, thought that municipalities should own and operate water-works, and all works which concern the public good. This can be done much cheaper under municipal than under private control. The best works and the lowest rates are obtained from municipal management, and not from private corporations.

E. W. Cato, of Newton, Mass., said that he considered the question both from a theoretical and practical point of view. To start with, it should be assumed that both the city and the private company have honest and competent officials. All works for public use should be constructed and operated by public officials. Municipalities have greater resources and more extended legal rights than private corporations, and, therefore, can more economically and efficiently construct and operate public works. Theoretically, municipal management is the best. Practically, the merits of each individual case should be determined independently.

Mr. Holden, of Nashua, N. H., spoke of a number of towns as "progressing backwards" on account of their unwillingness to build water-works, which encouraged manufacturing. In a number of cases the development of the manufacturing industries of towns was due entirely to the building of water-works by private companies when the town itself would never have done the work.

The paper was also discussed by F. W. Whitlock, of Waterbury, Conn., and Solon M. Allis, of Malden, Mass.

NEW MEMBERS.

The following new members were elected:

Resident Active Members.—James Burnie, Superintendent of Water-Works, Biddeford, Me.; Francis W. Dean, Hydraulic Engineer, Boston, Mass.; Charles R. Dyer, Superintendent of Meter Department, Portland, Me.; Eben R. Dyer, Superintendent of Construction, Portland, Me.; W. J. Goldthwaite, Water Commissioner, Marblehead, Mass.; F. W. Gow, Assistant Superintendent, Medford, Mass.; Arthur W. Hunking, Hydraulic Engineer, Lowell, Mass.; James T. Murphy, Water Commissioner, Marlboro, Mass.; William McNally, Water Registrar, Marlboro, Mass.; William Jackson, City Engineer, Boston; A. F. Crockett, President Camden and Rockland Water Company, Rockland, Me.

Non-resident Active Members.—William Hamilton, Superintendent, Toronto, Ont.; Charles W. Pratt, Superintendent, Utica, N. Y.; J. Nelson Tubbs, Chief Engineer of Water-Works, Rochester, N. Y.; E. M. Treman, Superintendent, Ithaca, N. Y.

Associate Members.—James C. Bayles, Hydraulic Engineer, East Orange, N. J.; King & Goddard, Pipe Fittings, etc., Boston; Perrin Seamans & Co., Water-Works Supplies, Boston; Rensselaer Manufacturing Company, Water Valves, etc., Troy, N. Y.; Standard Thermometer Company, Instruments, Peabody, Mass.; Taunton Locomotive Manufacturing Company, Machine Works, Taunton, Mass.; J. N. Winslow, President Stoneware Company, Portland, Me.; E. B. Winslow, General Manager, Stoneware Company, Portland, Me.

[This report will be continued next week.]

MAYOR ALGER, of Taunton, Mass., has sent a special communication to the Common Council urging at length the immediate construction of a system of sewers. He gives many details showing the inadequacy of the present sewers and the pressing need for replacing them with something better, and favors carrying out a comprehensive sewerage scheme submitted some time ago by Phineas Ball, C. E., of Worcester, Mass.

ARTESIAN WELLS IN NEW ENGLAND.

A TABLE showing the artesian wells in New England is given in the report of the Water Commissioners of Taunton, Mass., for 1889. This table shows that of 34 New England wells ten yield 70,000 gallons or more, and seven yield more than that at Taunton; three yield 200,000 gallons or more, but none yield as much as 500,000 gallons. All the wells in New England more than 1,000 feet deep have been failures.

Four are flowing wells, but two of these require pumping to be of any use. Sometimes wells are exploded in the hope of opening a water vein near the bore, but not more than one in three of these shots is successful, and sometimes matters are made worse.

Samples of the material were taken from every 6 or 7 feet of depth, from which George F. Chace, the Superintendent of the Taunton Water-Works, has made a large chart showing the geological formation passed through and the dip of the strata, which was about 40 degrees. The table is as follows:

LOCALITY.	Diameter in inches.	Depth in feet.	Gallons in 24 hours.	Rock strata.	Depth at which rock was first reached.	Does well flow?	Quality of Water	Result of exploding.	Remarks.
York Beach, Me....	6	51	120,000	* Hard sandstone.	2	Yes.	Good.	No shot.	* Sometimes called "blue granite."
Bennington, Vt........	....	1000 1000	....	.. ..	100 20	... .	....	"	Failures.
34 Providence St., Boston.	7⅝	2503	Inexhaustible.	Granite and slate.	159	5 ft. of surface.	Too much sulphuret of hydrogen	"	Good water: 459 to 484; well spoiled by going too deep.
Boston Gaslight Co.	....	1750	....	Slate. and Conglomerate.	80	No.	Much mineral and vegetable matter.		
Dorcester	....	870 900							
Dighton, Mass...	6	50	200,000	....	15	5 ft. of top.	Salt.	"	J. C. Jessup & Co.
Hopkinton, Mass... ...	6 6 6 8	58 65 75 119	50,000 58,000	Broken granite.	18 14 8 2½	No. " " "	Fine. " " "	" " " "	
Clark's Cove Guano Co. New Bedford, Mass ..	6	510	5,000	Granite and limestone.	12	"	Too near salt water.	Good results.	
North Adams, Mass...... Belden Silk Mill.....	8 8	500	900,000	Limestone.	80	4 ft. of surface.	Good, but very hard.	No shot.	
Northampton, Mass......	8	3700	7 gals. per min.	Conglomerate sandstone.	150	No.	Not good.	"	700 lbs. dynamite; total failure.
Lowell Hosiery Co., Lowell, Mass..... ...	6-4	303	24,000	Trap or mortar stone.	15	"	Poor.	"	Twice gained 25 per cent.
Malden, Mass	8	650	93,600	Quartz.	70	"	Fair.		
Stockbridge, Mass.	8 8	300 650	40,000 to 60,000	Limestone and mica schist.	50	"	"	"	This well an utter failure.
Fall River, Mass....	6	180	43,200	Granite.	13	No.	Fair.	No shot.	
Taunton, Mass., Lunatic Hospital	6	89	90,000	* Blue granite.	27	"	Good.	"	* Called by geologists sandstone.
Taunton, Mass., Morton Laundry...	6	96	20,000	Slate and sandstone.	26	1 or 2 gals per min.	"	"	
Taunton Water-Works ...	8	975	75,000	Slate and sandstone.	85	12 ft. of surface.	"	"	
West Cummington, Mass.	8	625	3,600	....	10	No.	Too much iron.	"	
Darien, Conn.	6	215	16,800	Granite.	42				
Fitch's Soldiers' Home.	8 8	251 80	8,000 to 12,000 12,000 to 20,000	Conglomerate schist.	20 20	Flows few gals. per hour.	....	.. ....	Shooting did no good.
Meriden, Conn. ...	8 8 8	208 205 256	Using 57,600	Red sandstone.	15	Yes.	Hard, clear.	Good results.	
Britannia Works, Meriden, Conn....	12	530	100,000	Brown sandstone.	90	No.	"Hard as lightning."	No shot.	
Stamford, Conn..........	8	450	... ...	....	..	"	Brackish.	"	
Electric Light Co., Newport, R. I........	8	110	75,000	Dark slate.	11	"	Very hard.	"	

OBSERVATIONS AS TO CURRENTS IN LAKE ERIE.

Walter P. Rice, the City Civil Engineer of Cleveland, O., has been conducting some interesting experiments to determine the action of wind and currents on the sewage discharged at Cleveland, in Lake Erie, with a view of locating the outfall to prevent possible contamination of the lake at the water-works intake. His preliminary report is as follows:

Currents and Location of Outfall.—A knowledge of the currents in the lake is necessary in determining the proper location for the outfall. For this purpose, careful observations were made, spar buoys were established at one, two, three, five and ten thousand feet distances from the shore in prolongation of Muirson and Marquette Streets. As a general rule, two floats were released at each buoy, one for surface, and the other mid-depth currents. The movements and positions of floats were noted from time to time, by means of triangulations from a shore base line. The observations on each float from ends of line were practically rendered simultaneous, by means of telegraphic communication. A few observations were also taken at the mouth of the river in the vicinity of the breakwater.

The surface float consisted of a cedar post, carrying a small flag, and weighted with stone at the submerged end. The mid-depth float finally adopted consisted of a combination of a pole float, with submerged oil barrel, having the heads knocked out and sunk by means of weights attached to a couple of cross rods. One float, having more surface exposed to the wind than the other, experiments were made to ascertain what the amount of error would be due to this cause, under similar conditions. Very little difference was noted in the results, however. It is safe to assume that there is some error due to this cause, the effect of which would be to give current velocities somewhat in excess of the true ones.

Bottle Floats.—In addition to the regular observations, bottle floats, with inclosed postal cards, were released at the different spar buoys, ranging from 1,000 to 10,000 feet lakeward. About 21 were heard from. Of a lot released on November 4, six were heard from, as having been found November 18, in the neighborhood of Presque Isle, within a radius of 2 miles. The distance is about 90 miles. A lot released November 1, were found scattered along the coast from Chagrin River, to a point east of Ashtabula, distance 22 to 60 miles from Cleveland; the 60-mile float having been found November 18. A lot released October 28, were found scattered from Willson Avenue to Fairport, the latter being found November 11, distance 28 miles.

Current Observations.—In taking observations it was soon discovered that the currents were controlled by the winds. All current velocities are, therefore, given in terms of the wind velocity—*i. e.*, as a percentage of the latter. The following are the results:

Surface currents from 1,000 feet station to the 10,000 feet station, run from 7 to 5 per cent. up stream, $3\frac{1}{3}$ to $3\frac{1}{10}$ down stream.

The 5,000 feet station shows an excess of per cent. both up and down; $5\frac{7}{10}$ per cent. up, $4\frac{1}{10}$ down.

Mid-depth currents run from $2\frac{56}{100}$ per cent. to $5\frac{8}{10}$ per cent. up, $2\frac{33}{100}$ per cent. to 2 per cent. down.

Five thousand feet no exception

Off piers—Ran $\frac{18}{10}$ per cent. up, $2\frac{4}{10}$ per cent. down.

Surface—Average per cent. up stream 6.03 per cent.; down, 3.54 per cent.

Mid-depth—Average per cent. up stream, 3.893 per cent.; down, 2.071 per cent.

Relation between up and down stream velocities is practically the same in both surface and mid-depth observations, the effect up stream being about double that of down stream. The mid-depth currents increase in power as you go seaward and the under currents are of course less than the surface. While the unfortunate fact is developed that the up stream currents are of greater strength than the down steam currents, it will be shown further on that the prevailing winds are from the west to southeast, thus diminishing the frequency of dangerous currents.

The heaping of the water on lee shores of the lake, due to long continued winds, prove that the water has a movement of translation due to wind. The disturbance of level can only be accomplished by currents, as likewise its readjustment and the head of water produced is a direct measure of the current intensities; the return or readjusting currents taking the path of least resistance in the effort to establish an equilibrium. In deep water the return currents might be along the bottom.

The topography of the south shore of Lake Erie shows a straight coast line, broken by one indentation or pocket, the most southerly point of which marks the location of the city of Cleveland. The general coast line prolonged would pass seven miles out to sea. The city is so situated as to have two-thirds of the lake to the east, and one-third to the west, thus affording double the length of sea for winds blowing from the easterly half of the compass. To my mind this fact principally accounts for the increased strength of currents up the lake, without having recourse to eddy effects which would perhaps exist under favorable conditions.

The different horizontal strata of water from surface to bottom respond to a continued wind in the order of their distance from the surface, so while there may be difference of direction in the upper and lower currents at any given moment, it only depends upon the duration of the wind to have all the currents wheel into line with the wind.

On the assumption that the float velocities are identical with the current velocities, a wind movement (velocity by time) of 80 miles would carry surface currents from Wilson Avenue to the water-works crib, and the mid-depth currents would require a movement of about 123 miles to traverse the same distance. The directions of the wind necessary to produce this movement are N. and N. E., and the frequency of its occurrence in the different months for both surface and mid-depth currents as deduced from the average for three years is as follows:

	S.	M-D.		S.	M-D.
January	4	2	July	13	5
February	3	2	August	9	4
March	6	4	September	5	2
April	8	4	October	3	2
May	8	4	November	3	2
June	7	4	December	2	1

Seventy-three times surface, 36 times mid-depth.

The cross-sections of Lake Erie, at Cleveland, is about 19,985,000 square feet. Taking the mean discharge of the Niagara, at 265,000 cubic feet per second, on the assumption that the lake can be treated as a river, the mean velocity of flow of the section would be about eight-tenths of a foot per minute, and as the average of the mid depth velocities during the present period of observations was 19 feet per minute, it clearly demonstrates that the currents due to flow are modified in direction day by day by the stronger currents due to the winds. In other words, there is no fixed line of current due to natural flow and the lake cannot be considered as a river, but rather as a basin with erratic currents, under control of the winds, and overflowing at the lowest point of the rim.

Corroborative Testimony.—Captains of fish tugs at this port unite in the declaration, that during a northeast wind there is a decided current of water from surface to bottom, up stream, or to the westward, the indications of which are the sagging of gill nets up stream and clogging of down stream side of nets with garbage, leaves, etc. These nets are set at various distances from the water-works crib outward as far as 20 miles; they are 6 feet deep and rest on the bottom. During the last winter, nets set between the crib and Axworthy Point, and for several weeks under the ice, were filled with a thick yellowish fungus growth and were also clogged on the lower side with some of the refuse, apparently dumped from scows. Fish entrails have been taken from the lower side of nets three miles out.

Strongly marked east and west currents have been observed on Lake Huron, due to winds. It is a known fact, and recorded in the pamphlet issued by the Lighthouse Board that changes in wind produce large variations in the discharge through the St. Clair and Niagara Rivers. In my opinion the strongest currents would be produced by the following conditions: A gale or blow of long duration lengthwise of the lake followed by a sudden cessation of wind In other words, the head of water produced at either end of the lake is a direct measure of the currents, and the time occupied in creating the head being greater than the time occupied by its dispersion, the return currents would be of maximum strength.

Movement of the Winds.—In attempting to draw proper conclusions as to the location of the outfall for a sewerage system, the observations on currents proving beyond all question that they are to all practical purposes dependent upon the winds, it becomes necessary to investigate the wind movements. I submit a graphical representation of the wind movements (time by velocity) compiled from the records of the Signal Service from 1883 to 1887 inclusive. January, February and March were omitted, as the lake is generally covered with ice during these months. The experiments of Mr. Whitelaw, however, show the existence of shore currents, even under these conditions, although probably not of great strength. On the diagrams the wind movement is plotted to scale working from circumference to center, so that the shaded portion represents the quantity of wind from all points of the compass. An inspection of the diagram reveals the following:

A great preponderance of wind movement from the west and southeast occurs during the months of October, November and December. The least movement is from the east in every month but August, which is the most evenly balanced month of all as regards the winds. The diagram showing the mean movements for five years during the nine months from March to January shows the following:

The minimum wind movement is from the east, the maximum wind movement is from the west to southeast.

The movement from the northwest, north and northeast being equally distributed and between the two, consequently the prevailing winds are favorable to any outlet east of the water-works crib. With a discharge of the sewage into comparatively deep water and near the bottom the sludge and heavier ingredients will soon settle, as the current movement is very slight. The lighter particles of the sewage ascending within reach of the surface, where the currents meet their maximum intensities, constitute their principal element of danger, and we must look for protection to the laws of diffusion and oxidization.

Unfortunately, circumstances did not permit of an investigation as to the law of diffusion, but in the report of Rudolph Hering and Samuel Gray on the "Disposal of the Sewage of the City of Toronto," the following conclusions are arrived at: That from observations of the flood discharges of the rivers entering the lake at Chicago, Cleveland and Milwaukee, in the case of the former (amounting to several thousand cubic feet per second) the dispersion is such as to render them unobservable at a distance of five miles; therefore that the average discharge is less than 100 cubic feet per second, which would represent the sewage from half a million people, would at that distance be even more thoroughly dispersed and in fact entirely lost.

This conclusion is corroborated by the investigation of John Whitelaw, Superintendent and Engineer of the Cleveland Water-Works, recorded in his report of January 31, 1869, where he makes the following statement: "During the months of January and February of last year, experiments were made and observations taken on the ice with a view of ascertaining if possible how far north the water in the lake was impregnated with the petroleum taste which has been such a source of annoyance for three winters past. For this purpose measurements were taken at right angles from the shore line at the inlet, and east and west of the same. Holes were cut in the ice at short intervals and the water tasted, at the same time the line running out from the inlet was measured and soundings were taken for the purpose of making a profile of the bottom."

After repeated observations it was found that the whole body of water, bottom as well as surface, for a distance of 4,300 feet, north from the shore line and parallel thereto, and for a distance of two miles west and one mile east of the river, was tainted with the taste of petroleum during the whole time the ice covered it. "The last trace of impure water was found at a distance of 3,800 feet north from the inlet, and in thirty feet of water." The distance from Willson Avenue to the water-works crib is about $4\frac{6}{10}$ miles, therefore sewage under infrequent conditions of the wind and current should be so thoroughly diffused as to be lost at that distance.

Final Conclusions.—The outlet should be, as far as possible, removed from the water-works crib, within practical limits, sewage under control of the currents may find its way to the crib from Willson Avenue, under proper conditions.

The outlet should be submerged as near the bottom as possible.

Some expedient might be adopted to prevent the sewage under infrequent conditions from being carried up the lake, if found necessary.

The sewage should be screened before entering the lake.

I would suggest that if the outfall was carried out into the lake at Willson Avenue, a distance of about 1,000 feet, in the shape of an embankment, with properly protected slopes or pile crib work, the same to be furnished with two discharge gates, one at the extremity and the other about half way out on the easterly side, that the conditions would be fairly well satisfied, the outer discharge being used in all cases, but the infrequent ones when the winds and currents are in the direction of the water-works crib, when the inner gate could be opened and the embankment would, with the shore line, form a vast reservoir to retain the diluted sewage during the brief time prior to the change of current to other directions, when it would naturally flow out into the lake and disperse. The expedient of using an inner gate can, if necessity ever demands it, be modified by a spur running from the main embankment parallel to the shore, thus preventing trouble along the beach.

CEMENT PAVEMENT IN ENGLAND.

John Parker, City Surveyor of Hereford, England, recently gave a description of some cement pavement being laid in the town named, which is published in the London *Building News*. The bottom bed, 3 inches thick, consists of clean gravel and cement, in the proportion of six to one, on a solid foundation, the surface or top coat being floated in $1\frac{1}{4}$ inches thick, consisting of 1 inch of clean washed sand, Dalbeattie (or Clee Hill), crushed $1\frac{1}{4}$-inch granite, and cement in equal proportions. Mr. Parker's specifications for the cement used are as follows:

"The cement is to be Portland, of the best quality, ground so fine that the residue on a sieve of 5,800 meshes to the square inch shall not exceed 10 per cent. by weight. A striked bushel shall weigh not less than 109 pounds, nor more than 116 pounds, the cement to be run through a hopper with spout 6 inches above top of measure. When tested, should the proportion which will not pass through the sieve be greater than 10 per cent., a quantity of cement proportionate to such excess must be added. When delivered, it is to be put into a dry shed at Corporation yard, and will not be accepted or paid for until it is tested by samples taken from different sacks or casks. About ten per cent. of its weight of water shall be added and briquettes formed into moulds of 1-inch sectional area at the weakest point. The briquettes, having in the mean time been kept in a damp atmosphere, are to be put into water 24 hours after being made, and remain in water until tested. It must not, at any time of the year, set in less than one hour, and must bear, without breaking, a weight of 350 pounds to the square inch 14 days after the briquettes have been made. If it does not, it will be rejected, and must forthwith be removed from the stores by the contractor."

Some wooden water pipe was recently dug up in Belfast, Ireland, says the London *Builder*, which is supposed to have been laid in 1678. The pipes were square, with a round hole, and occasionally a hole for the joining of smaller or service pipes. The wood was much decayed.

THE ELEVATED CABLE ROAD AT LOS ANGELES.

THE Los Angeles Cable Railway Company has recently built an elevated road on San Fernando Street, Los Angeles, Cal., which presents some unusual features in this class of work. The structure is 1,435 feet long and is parallel to and partly over the tracks of the Southern Pacific Railroad. By agreement between the two companies one row of columns of specified dimensions was to carry the two tracks of the cable company. The accompanying illustrations show how this was done by spreading the top and bottom of each column to a width of 12 feet. The base is imbedded in and anchored to a mass of concrete 15 feet long, 6 feet wide, and 7 feet deep, to insure stability. Upon the column is fixed a cross girder 16 feet long, on top of which the 50-foot longitudinals are placed. The rails are placed directly on the top flanges of these girders, with the cable and carrying pulleys between and below.

The structure was opened for traffic November 2, 1889, and has proved to be very firm and free from vibration with trains at 5-minute intervals, running 12 miles an hour. It was designed for a moving load of 1,000 pounds per lineal foot of track, and a wind pressure of 20 pounds per square foot of surface exposed, which is assumed, so far as the column is concerned, to be concentrated at the track level. The total weight of the structure is 518 tons, or 722 pounds per lineal foot. The contractor for the work was A. Gottlieb & Co., and the engineer was Samuel G. Artingstall, both of Chicago.

TESTING AUTOMATIC SPRINKLER HEADS.

IN discussing a paper on "The Determination of Sensitiveness of Automatic Sprinklers," read by A. F. Nagle at the recent Cincinnati meeting of the American Society of Mechanical Engineers, D. S. Jacobus gave particulars of tests of automatic sprinkler heads made by him, under the direction of Prof. Henry Morton, of Stevens Institute, for the New York Board of Fire Underwriters.

The sensitiveness of a sprinkler head, according to Mr. Jacobus, is only one of the elements that must be considered in determining whether it is perfect enough to be adopted. The capacity of the gas burner used by Mr. Jacobus to heat the oven in which the sprinkler head is tested is such that the temperature is raised to 200° Fahr. in about three minutes, and after this time the radiation of the sides of the oven is so great that the heat increases very slowly, rising to 230 degrees in about five minutes from the start. The average sprinkler operates in about five and a half minutes at 235° Fahr., so that by the time the head opens the temperature of the oven is increasing very slowly, and the error due to the difference of the actual temperature of the air and the reading of the thermometer is not a great one. On account of the existence of this small error, it was proposed to preserve the oven at a constant temperature, say 250 degrees, introduce the sprinkler head without sensibly altering this temperature, and note the time that was required to set off the head by means of a stop-watch. It was, however, decided that the test for sensitiveness as now conducted, was accurate enough, and the above refinement was not adopted.

The following tests are gone through at Stevens Institute on each set of sprinkler heads.

1 Tests in the oven to determine sensitiveness and reliability of action.

2. Tests by applying direct flame at intervals, to the head, to determine reliability of action.

3. Tests of distribution and rate of flow of water through the heads.

The most prevalent and dangerous defect usually found in sprinkler heads is the sticking of the valve to its seat after the releasing device has operated. To test the heads thoroughly in this respect the first and second tests, in addition to being made on the new heads, are repeated on heads that have been connected to piping and subjected to the action of water and of brine for about three months. The action of the water and brine for three months has caused the valves of many heads to stick so that they would not open under ordinary pressure.

The oven used for the sensitive tests is 2 feet in height and of 5 cubic feet capacity. At two of its sides pieces of glass are inserted about one foot long by 6 inches wide. A thermometer hangs at such a height that its bulb is about midway between the top and bottom of the oven. An arrangement of swing joints allows the pipe to be drawn outside of the oven, so that the sprinkler head may be readily screwed to its place. Before pushing the pipe back to its position in the oven a water pressure is made to act on the sprinkler, and any air that may be in the pipe is removed by means of a vent. The sprinkler is allowed to stand about two minutes in order to test for leakage, and then is pushed to its position in the oven. The bulb of the thermometer is placed near the solder joint and at the same height as the latter. The thermometer employed has a translucent scale, which is illuminated by a gas flame placed opposite the window at the back of the oven. A system of plates is used at the bottom of the oven to distribute the heat throughout the same. A gas burner is employed for heating.

A tank is mounted above the oven at such a height that 10 feet head of water is obtained. The sprinklers are usually tested under this small head of water. If the valve sticks to its seat after the releasing device has operated a valve leading to the tank is closed and the pressure gradually increased to that in the city mains, in order to determine if this will open the sprinklers. If the sprinkler opens the exact pressure at which it does so is recorded.

The advantage of employing water in the pipes instead of compressed air, and connecting the sprinklers in the same way that is done in practice, arises from the fact that their reliability of action and their sensitiveness can be tested at the same time. Sometimes sprinkler heads will fail on account of a slight leak starting at the valve, which allows a small amount of water to run over the partly melted solder joint of the releasing device, thus chilling it and preventing the complete opening of the head. This action would not occur if compressed air were used in the pipes, or if the sprinkler were connected in such a way that the water that escaped by leakage would not run over the solder joint and chill it. Various other defects are sometimes found in the releasing devices.

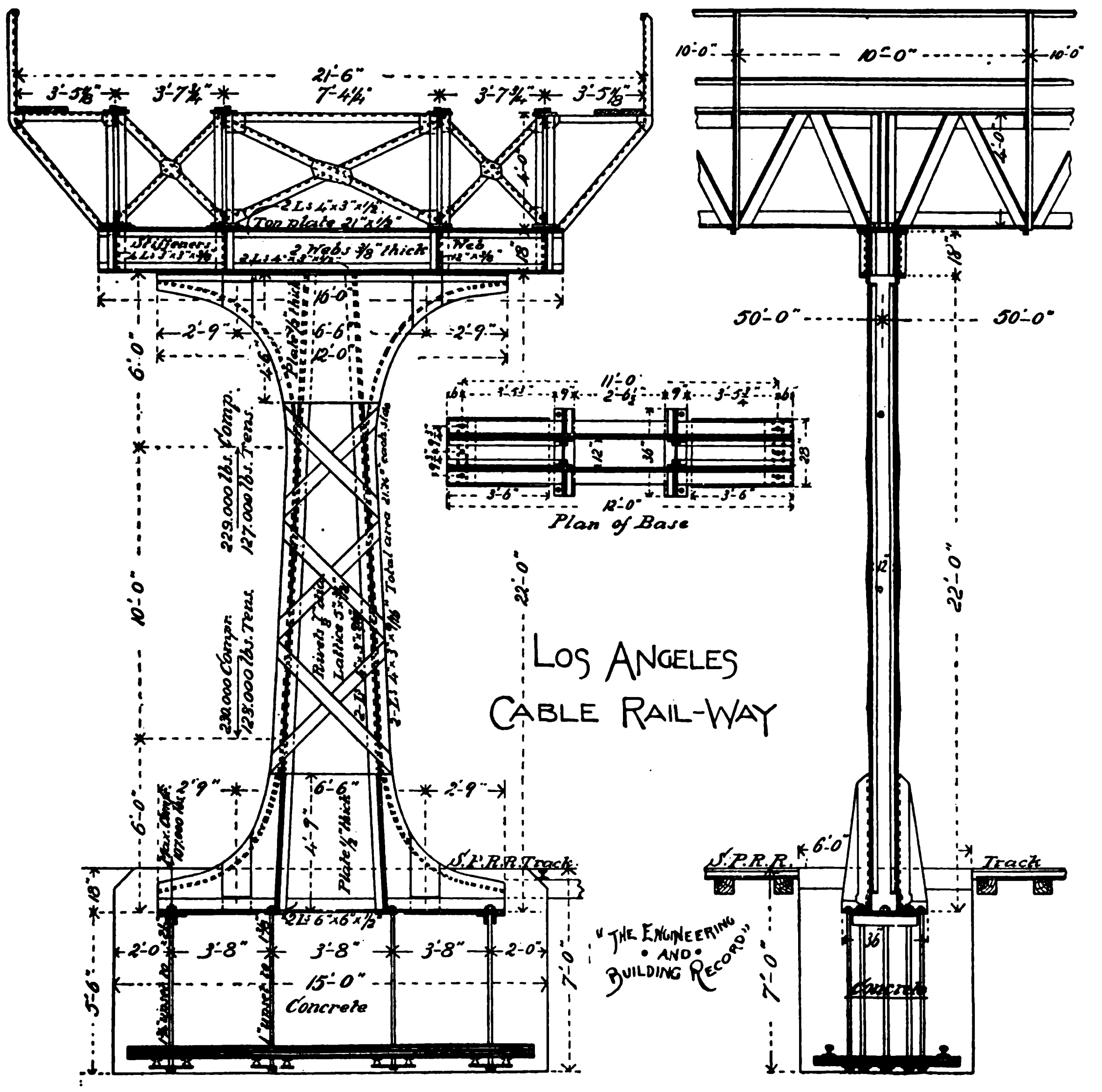
The tests of distribution and rate of flow are made under a head of ten feet, as well as under high pressure. A barrel is mounted so that the level of water in it is 10 feet above the center of the connection into which the sprinkler is secured. A large valve is placed directly under this barrel, by means of which the water may be admitted to the sprinkler without producing a throttling action. A 1-inch ordinary steam pipe screws into a bushing fitted in this valve. At a distance of 10 feet below the surface of the water a horizontal length of ¾-inch pipe, 10 feet long, is connected by means of an elbow. The reason for employing the lengths of pipe given above was to connect the head so that the water furnished it should have to travel through about the same length of pipe of a small diameter as it would in the case of a sprinkler connected to system in a building. The sprinkler head connected to the testing apparatus is 8 feet above the floor.

The New York Board of Fire Underwriters requires that the distribution 8 feet below the sprinkler head shall be over a circle whose diameter is 10 feet; that the diameter 6 inches above the head shall be 8 feet, and that the rate of flow shall be greater than one cubic foot per minute.

To measure the diameter 6 inches above the head a graduated straight edge is employed. The observer, standing on the same level as this straight edge, can readily observe the diameter spread over.

In some tests a flat surface has been placed 6 inches above the head to show how the water will be distributed when the head is used under a ceiling. If the water is thrown upward at too great an angle it will not distribute properly if used under a ceiling. All the heads are tested under 20 pounds pressure, as well as that due to 10-foot head.

An additional test that requires much time to arrive at satisfactory conclusions is one for liability to loss by water damage. Many heads are arranged so that they may be tightened up if leakage occurs. This tightening up is liable to bring an excessive strain on the solder joint, which may yield, not immediately, but perhaps one, two or three weeks afterward. It appears that the strain produced a slow, weakening action. This action has often been observed in the heads that were connected to open end pipes filled with water and brine and set aside for three months for the first and second tests, as already explained. Many of the so-called instances in which sprinklers have been opened by the water hammer may have been simply caused by excessive strain on the solder joint.



THE FREEZING PROCESS OF EXCAVATING.

THERE are given below some details of work at Iron Mountain, Mich., referred to in an article on excavating by the freezing process published in this journal May 7. Both description and illustrations are from an interesting article contributed by Daniel E. Moran, C. E., to a recent number of the *Railroad Gazette*. The 27 8-inch freezing pipes used were of ⅜-inch wrought iron, in sections, connected by taper screw joints cut in the thickness of the pipe itself and making flush joints inside and out. Each joint was tested by water pressure as lowered, and when the pipes reached the bottom the 10-inch casing pipes through which they had been sunk were removed by a water jet and the work, conducted up to this point by the Chapin Mining Company, was turned over to the Poetsch-Sooysmith Freezing Company, contractor for sinking the shaft.

A Linde ice machine (ammonia compression type), of 50 tons refrigerating capacity, built by F. W. Wolf, of Chicago, was used, driven by an Allis-Corliss engine, to which it was connected by a shaft carrying a heavy fly-wheel. The engine was 18 by 42 inches, used compressed air at 60 pounds pressure, and developed 55 horse power at 60 R. P. M.

No trouble was experienced from freezing of the brine used (60 per cent. Ca Cb$_2$), except when its specific gravity was below 1.200.

The cold brine was pumped through a set of distributing pipes and regulating valves to the ground pipes. After traversing the ground pipes it returned through a set of collecting pipes, similar in arrangement to the distributing pipes, to the refrigerating machine.

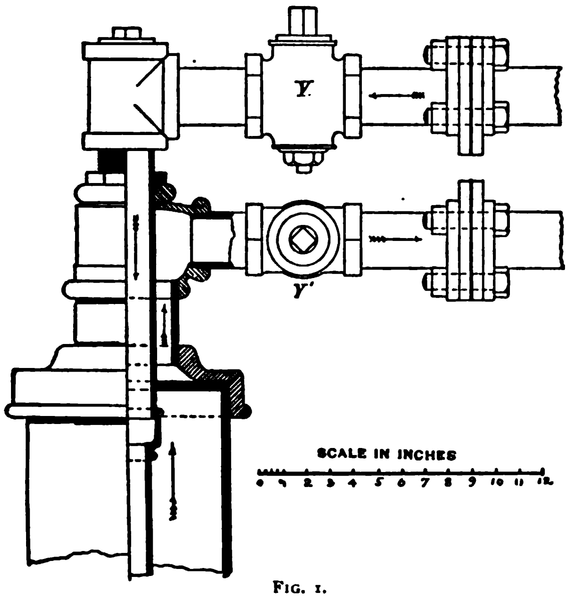


FIG. 1.

The connection of the ground pipe to the delivery and return pump pipes is shown in Fig. 1, where the circulation is indicated by arrows, and a portion of the 8-inch ground pipe and the inside 1½-inch pipe through which the brine is forced to the bottom is shown in section.

The circulation of the brine through each pipe was adjusted by means of regulating valves V and V$_2$ so as to bring the temperature of the return streams as nearly equal as possible. This method of regulation was designed to render the effect of each pipe equal in the event of the conditions affecting the pipes being different. The velocity of the brine in the inner down-flow pipes was 2 feet per second, the brine changing every 25 minutes in the ground pipes.

The connecting pipes above ground were not protected in any way, so that immediately after starting the condensation of moisture from the atmosphere coated the pipes and connections with a snow-like ice, which increased in thickness until some very picturesque effects were produced. The coating, moreover, served as a cheap and effective lagging.

The brine reached the bottom at nearly its initial temperature, so that the lowest temperature, and consequently the greatest freezing effect, was at the bottom of the shaft. With a nearly constant difference of only 1° Cent. between the top and bottom of the pipes there was a marked difference in the distance frozen, as determined at the completion of the work by means of a small trial shaft sunk on the outside of the wall, which showed a nearly uniform batter of about 1 in 15.

The rate of freezing varied in different materials according to the amount of water contained. Several careful experiments gave 17 per cent. of water in the fine sand. Where gravel or boulders were imbedded in the sand this percentage was largely decreased and the distance frozen was correspondingly greater.

It was calculated that the water in the sand consume nearly 80 per cent. of the refrigerating effect. If, then, the sand were replaced in part by material not containing water, the work of freezing would be proportionately reduced.

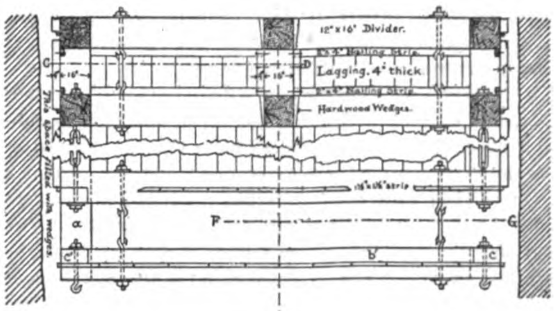


FIG. 3. Elevation and Section.

Losses of the total refrigeration are due to radiation above ground, conduction from subterranean sources of heat, conduction from surface, flow of subsoil water and the cooling of a quantity of material beyond the limits of the frozen wall.

The Iron Mountain sand had a slight tendency to cake and the grains were not clean. Nearly 70 per cent. of a 100-gramme sample (from the center of a lump) passed a 190-mesh screen.

Tests were made during the progress of the work to determine the strength of this material when frozen. Briquette molds were filled with saturated sand and frozen, the resulting briquette being kept at a low temperature until tested. An ordinary Fairbanks cement tester was used for both tensile and compressive tests. The compressive tests were limited by the size of the machine to 1-inch cubes, which were formed roughly by the same method used for the tensile strength briquettes. The tests were made in a cold room, but the temperature of the test pieces was not determined, nor is it known what effect, if any, cooling below 0° Cent. has on the strength of the material. The results were as follows:

	Tensile Strength.
Average of 4 tests	431 lbs. per sq. inch.
Maximum result	491 " "
	Compressive Strength.
Average of 8 tests	575 lbs. per sq. inch.
Maximum	880 " "

When unmixed with gravel frozen quicksand looks like a fine-grained sandstone; it is perfectly homogeneous, breaks with a tendency to conchoidal fracture and is as hard to work as a stone of similar character. When the sand contains gravel or boulders the difficulty of working is more than doubled. There seems to be no tendency of the rounded boulders to pull out of the quicksand, but rather for the break to follow.

Figure 2 is a section of the shaft showing the stratification of the soil and the arrangement of timbering and pipes.

Figures 3 and 4 show the details of the timbering, which was all framed at the surface.

The first and uppermost set of timbers was hung from heavy sticks which extended along two opposite sides of the shaft and were sufficiently long to get a solid bearing at each end 6 feet back from the edge of the excavation.

As the timbering progressed each set was hung by links and screw bolts from the one immediately over it. Only the main timbers and the 4-inch lagging were put in position at first, the cross timbers (or "dividers") not being put in until the timbering was nearly completed, and then in reversed order, beginning at the bottom and working up. The operation of putting in a set was as follows: The set having been framed, assembled and marked above ground, the first pieces sent down were the two opposite ones, *b* and *b'*, Figs. 3 and 4, which were to be hung from the set above, and support in turn the other two pieces, *c* and *c'*, by their halved ends. Pieces *b* and *b'* being in position, hanging loosely by the links and screw bolts, pieces *c* and *c'* were put in place without special care as to exact position. The four corner pieces ("studdles") came next, and then wedging, bolting, spiking, and putting on the lagging.

Between the sides of the excavation and the lagging heavy wooden wedges were driven, and where the material was especially fine hay was also packed in with the idea that it would, when wet, swell and fill the cracks between the 4-inch lagging pieces, and prevent any sand from entering. The only difficulty was to get the last piece in position, and careful fitting was necessary to have it go in tight.

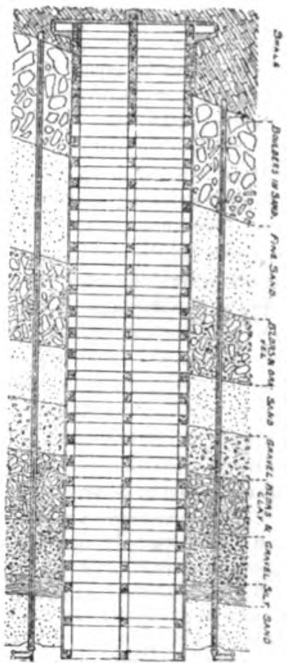


FIG. 2.

The joints between the pieces of lagging were waterproofed by strips of tar paper dipped in hot pitch and held in place by battens.

The timbering followed the excavation closely, chiefly to save the trouble of scaffolding.

The finished shaft was nowhere more than a quarter of an inch out of truth or plumb.

The completed excavation carried the shaft into the ledge from 4 to 10 feet. It was necessary to make a tight connection between the ledge and the lining, and to arrange for the support of the timbering from the ledge. This latter was accomplished in the usual manner by running short drifts into the ledge at the center of each side and putting in extra long and heavy cross timbers. The joint was made by trenching in the bottom of the shaft for the bottom set of timbers and carefully grouting the space between the timbers and the trench. To this bottom course of timbers the next course was fitted and spiked and the space between it and the ledge filled with cement mortar. The gap between the lowest set of open timbers and the bottom of the shaft was in this way filled in with solid timbering.

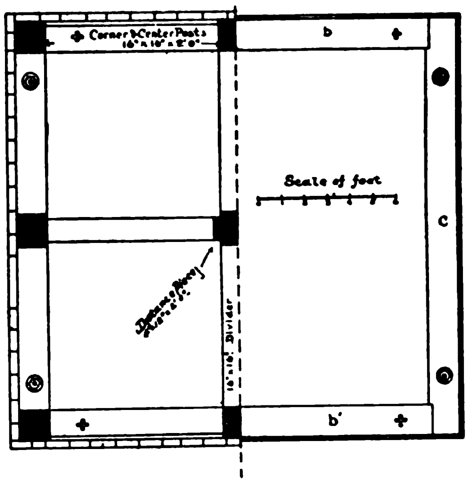


FIG. 4.

Sectional Plan on Line C. D. Plan on Line F. G.

When the timbering was completed steam was turned into the shaft to thaw all ice on the timber, so as to permit the joints in the lining to be made tight with tarred paper, as before described. Finally, water was pumped in up to the level of the water in the soil, and the shaft left to thaw out. The purpose of filling the shaft with water was to equalize the pressure on the timbering during the thawing, which, it was thought, might bring sudden or unequal strains on the shaft.

From trial borings made after the completion of the work it was believed that the quantity of material frozen at that time was bounded by a cylindrical surface, 54 feet in diameter and about 100 feet in depth. This mass of frozen material took a long time to melt, notwithstanding efforts of the mining company to hasten the result. It was not until 50 days after shutting down ice machine, that the ice wall gave way sufficiently to permit water to come into the shaft.

COMPRESSED AIR FOR WORKING ELEVATORS.

THE Popp system of compressed air power transmission at Paris is being steadily extended. According to a recent report the Parisian Compressed Air Company has just introduced an elevator having this motive power, and it is being tried at the Bourse du Commerce and at one or two of the principal hotels. Its main recommendation is said to be that the cost is about one-half that of hydraulic elevators, and that the expense of working is proportionate to the weight of material raised. The principle of the elevator is very simple. The elevator is worked by compressed air, which operates upon water. When the compressed air is admitted it enters a water chamber. The water in the chamber is forced out under the elevator ram or piston, which is driven upwards. On the descent of the elevator the water flows back again into the chamber, so that the action is easy and gradual. By this method the power exerted can, it is claimed, be regulated at will, and the elevators now in use in Paris are employed both for lifting persons and for raising machinery and similar heavy goods. The same company has also laid down an installation in the Bourse du Commerce for refrigerating purposes, the air being maintained at a low temperature by expansion of compressed air.

VALVES FOR WATER AT HIGH PRESSURES.

IN discussing a question as to the best form of valve for water at high pressures, presented at the recent Cincinnati meeting of the American Society of Mechanical Engineers, G. C. Henning referred to the valves used in the emery testing machines in which there was no leakage at pressures as high as 4,500 pounds per square inch. Hammered emery bronze is used for the seats of these valves, the valves proper being steel plugs carefully turned and ground. Both valve and seat are conical, and, according to Mr. Henning, this form of construction has been satisfactorily used under pressures ranging up to 10,000 pounds per square inch. A leather ring is used for packing the valve stem, and the largest size of valve of this kind used had a 1-inch opening.

HOW TO KEEP FROST OUT OF WATER PIPES AND HYDRANTS.*

OUR pipes at Leadville, Col., are laid 6 feet deep, and the frost goes 7 to 10 feet deep. After laying the pipes, and before filling in with dirt, we pack around them with good stable manure, which makes a good warm dirt even after the life is out of the manure. All large rocks and boulders should be removed and not put back in the ditch.

Hydrants should be inclosed around the bottom with a box of 2-inch lumber 2x2½ feet, and 2 feet high without a bottom. A 1½ inch pipe should lead from the box up by the side of the hydrant to blow steam in.

All services are laid in double boxes, the double boxing makes an air-chamber preventing frost from catching the pipes so quickly. One box is 8 inches in the clear and the other 4 inches, and the service pipe is laid in that with a ½-inch pipe running up by the side of the curb-box, and also extending some distance each way in the pipe-box so as to blow steam in.

We have a steam boiler, about four horse-power, mounted on a wagon, which we hitch horses to. We open the hydrants almost every day after the frost gets down, and if they are beginning to catch or freeze, which, with a little experience almost any one can tell, we blow steam down the ½-inch pipe to warm up the bottom of the hydrant. If the 4-inch pipe leading to the hydrant is frozen we take the top off and take the inside barrel out, then we have a heavy ½-inch steam hose which we feed through a 2-inch pipe bent a little at the lower end, and it is very easy to feed it through to the main pipe, cutting out all the ice in a few minutes.

If the main pipe freezes we dig down as soon as possible, drill a 1¼-inch hole in the main and feed in the steam hose either way. Of course it is necessary to shut off the water, and therefore there should be plenty of valves. If taken in time we seldom have a pipe burst. And for service pipes, if we are notified as soon as they freeze, we attach our steam hose to the ½-inch pipe or stop-box and blow steam for a few minutes into the double boxing and it thaws them out. We seldom have a bursted pipe if taken in time. We do not agree to keep service pipes open, but, as a rule, when we have steam up and have the time we make no charge for thawing them out. Our plumbers have similar steamers, only on a smaller scale, to pull by hand, which they use quite extensively, and for which they charge the consumer.

We also have a system of opening and closing valves and opening hydrants to test the different cross streets, by which we can tell if the main pipes are freezing. If so we let the hydrant run for a few minutes and the water will cut the ice out. The temperature of our water is from 33 to 35 degrees, and where it is possible when pumping we turn the exhaust into the sump so as to raise the temperature, which is quite a benefit.

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* Paper read by C. N. Priddy, Superintendent of Water-Works at Leadville, Col , before the annual meeting of the American Water-Works Association at Chicago, May, 1800.

RECENT WATER-WORKS CONSTRUCTION.

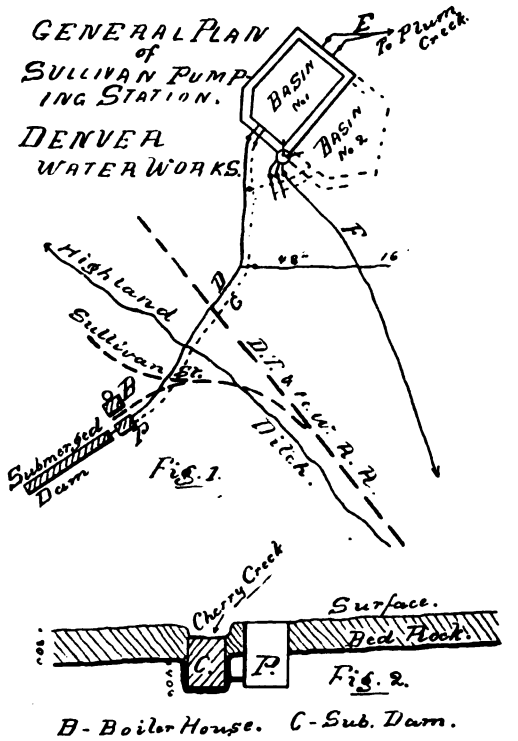
No. XXII.

(Continued from page 360, Vol. XXI.)

NEW WORKS FOR DENVER, COL.

THE general plan of the water-works now being built at Denver, Col., by the Denver Water Company, will be understood from the annexed sketches, which roughtly outline the locations of the reservoirs and pumping-station, the lay out of the delivery mains, and a vertical section at the primary source of water supply.

The works will embrace a submerged dam, or rather caisson, built of timber and designed to intercept the subterranean flow of water under Cherry Creek. The latter is dry except during periods of flood, and the bed rock immediately underneath it forms a depression about 40 feet deep, making the depth below the surface of the ground about 70 feet. The section (Fig. 2) explains the formation There is a steady slope up to the mountains at the right, and the subterranean flow of water after having reached the depression under Cherry Creek, will be caught by the caisson and delivered into the pump shaft at the right. The length of the caisson will correspond with the width of the depression, measuring 700 feet, and will be about 16 feet wide. Its height from bed rock to the surface of the bed of the creek will be from 60 to 70 feet, which will allow an ordinary flow or freshets to pass over its top without damming up the creek. The pump shaft will, for the present, contain two sets of triple expansion pumping-engines, built by E. P. Allis & Co., of Milwaukee, Wis., each having a daily pumping capacity of 15,000,000 gallons against a head of 200 feet. A third set will be added in the near future. The pumping station will be at Sullivan Station, about seven miles from the city of Denver.


GENERAL PLAN of SULLIVAN PUMPING STATION.
DENVER WATER WORKS.
BASIN No. 1
BASIN No. 2
E
To Plum Creek.
F
48"
16
D
G
Highland
Sullivan St.
D. T. & G. R. R.
Ditch.
B
P
Submerged Dam
Fig. 1.
Cherry Creek
Surface.
Bed Rock.
C
P
Fig. 2.
B - Boiler House. C - Sub. Dam.
D - 48" Delivery Main.
E - Future 48" Delivery Mains from Platte R. & Plum Creek Basins to Cherry Creek Basins
F - 48" Main to Denver. P - Pump Shaft.
G - Duplicate Future 48" Line.

The work of excavation for the pumping station is now progressing. It will be 150x70 feet, and its foundation will be in bed rock. The walls will vary from seven feet at foundation to two feet at line of water table. The pump house surmounting these foundations will be a stone building, the design selected being that submitted by Albert Kahn, of Detroit, Mich., in the pumping station competition of THE ENGINEERING AND BUILDING RECORD, published in the issue of March 29, 1890.

The construction work is now in progress with a force of 50 men and 25 2-horse teams, which will be increased to 500 men within 30 days, and whose work will be supplemented by improved dredging machinery. The present steam dredge is mounted on a scow and will be used to a depth of 30 feet, after which the timber dam will be put together and sunk, when the dredging will be done from the interior of the caisson by means of a vertical dredge operated by an electric motor.

The pumping engines will have a guaranteed duty of 130,000,000 foot-pounds, and the first set is to be ready for operation on April 1, 1891. The second set is to be complete by October 1, 1891. The water ends of the engines, as will be understood, will be at the bottom of the pump shaft, on a level with the bottom of the submerged caisson, and will thus be submerged, while the steam ends will be above on the pump-house floor.

The reservoir will be at an elevation of 398 feet above the City of Denver and that to be first completed, marked Basin No. 1, in Fig. 1, will have a capacity of 70,000,000 gallons. The available water pressure, it is understood, will be sufficient to reach the highest buildings of Denver. The quality of the water is said to be excellent and its temperature exceedingly low. The cleaning of the reservoirs, when necessary, will be effected by special blow-off valves and outlets in the bottoms, the latter being arranged to form a number of large pockets intended to serve as collecting basins for the mechanically suspended impurities. The blow-off valves will be located at the lowest points.

The accommodation for the working force at present comprises a boarding house 200 feet long, two stories high with a dining room 100 feet by 30. Contracts have also been let for three brick dwelling houses and a brick storehouse, which will be permanent structures.

There are now being made two switches from the Denver, Texas & Gulf Railroad at Oakesdale, ten miles from Denver.

Capt. Edward Ruger, chief engineer, is in general charge of the work ; W. F. Hawes is assistant engineer ; Capt. H. N. King, superintendent of construction; T. A. Taylor, general foreman.

The estimates for the work call for an expenditure of about $500,000.

For the above particulars THE ENGINEERING AND BUILDING RECORD is indebted to Mr. W. A. Underwood, of The American Water-Works Company, New York.

THE CONTAMINATION OF STORAGE WATER.

IN discussing a paper entitled, "Contamination of Storage Water on the Pacific Coast, and the Palliatives Resorted To," presented by L. J. LeConte at the recent Chicago meeting of the American Water-Works Association, Professor Albert R. Leeds, among other things, said :

Mr. LeConte brings into prominence the unusual physical conditions prevailing upon the Pacific Coast; and, more particularly, the climate. He thinks that we on this side have no adequate comprehension of the difficulties growing out of these conditions. Mr. LeConte says that they are compelled to rely for their water supply upon the rain which falls in their winter season between the months of November and May. After this period for a period of six months they have no rain, and their storage system must be regulated accordingly. It is very usual for a whole winter to pass, and sometimes more than one, without any rain. The period of drought may extend to 600 days, and they must have reservoirs to give them a water supply reaching over 900 days, or more than two years' supply. The city of San Francisco has three reservoirs on a scale of which we have little experience on the Atlantic Coast. One of these reservoirs has a capacity of 10,080,000,000 gallons; the second 6,690,000,000 ; and the third 3,830,000,000. The amount of water supplied to the city from the first two reservoirs is 9,000,000 gallons a day, or only a little more than 1-1,000 part of their united capacity.

The city of Oakland, he further says, has a reservoir of 4,300,000,000 gallons, supplying 22,000,000 gallons per diem, or about 1-200th of its capacity.

In a very lucid manner he describes the life history, if I may so call it, of the water as it falls from the clouds, is impounded in the reservoirs, flows down from the aqueduct, and finallly reaches the consumers. He divides this life history into three stages: First, the period of collection extending through the winter season up to the end of May. During this time the water is good, notwithstanding some light silt or mud is carried into it by 48 winter floods. He makes the important observation that up to the end of this period of collection the temperature of the surface water is 48° Fahr., and that of the bottom water 50, and since the warmer water is below and the colder at the top, there goes on during this first phase of the life history a constant circulation.

The second phase, he calls the period of fermentation. This sets in about the end of May. The surface of the water now acquires a temperature of 62 degrees, while the bottom retains its temperature of about 50. As a physical consequence the circulation ceases, and this period of fermentation is also a period of stagnation. This second phase of the life history is attended with a growth of phenogamous plants; that is to say, ordinary fresh water plants, plants capable of giving up oxygen, assimilating carbonic acid, supporting fish life, etc. Later, the era of fermentation is marked by the rising of bubbles all through the water, which consist of carbonic acid gas and carburetted hydrogens. As these gases increase in quantity, the dissolved oxygen diminishes and the vegetation changes its character. It is no longer phenogamous, it becomes cryptogamous: the familar plants which flourish in lively water disappearing, and the more obscure forms of vegetable life, the algæ, making their appearance.

Now comes another and more tragic phase of the life history: First, the youthful life with its beauty, then its development, then approaching decay. Now, there has arrived the last phase, which is that preceding death, and this last phase is one of putrefaction. When this has arrived the gases have changed their character. The oxygen has largely disappeared and carbonic acid gas, carburetted hydrogen and sulphuretted hydrogen have taken its place. In the phase of putrefaction, decay is going on, and whenever decay occurs in the absence of oxygen it is dangerous and means death; it means the formation of septic poisons, fatal to both vegetable and animal life.

This period of decay ends with the close of October. In November the life history enters again upon a new cycle. The frosty nights set in as soon as the water becomes chilled. The chilled water sinks to the bottom, and once more circulation of the water in the storage reservoirs takes place with consequent alterations and changes. Curiously enough, at this point, the water as shown by analysis is at its worst. This is due to the circulation having been established once more. The warmer water rising from the bottom, along with the gases, brings mud and organic impurities to the surface. Mr. LeConte emphasizes the fact, that while the water in the storage reservoirs is very bad, yet as it passes down the open flumes and aqueducts leading from the reservoirs, being in contact with the air in these open conduits, its quality continues to improve progressively until by the time it reaches the surface reservoirs it is at all times much better than the water in the impounding reservoirs. He further discriminates in this connection between the changes taking place and the resulting quality of the San Francisco water and the city of Oakland water. Both are provided with enormous impounding reservoirs, but the San Francisco water comes down through open conduits and passes through screens placed at the service reservoirs within the city limits. The city of Oakland water, on the other hand, passes through screens placed near the storage reservoirs, and then flows many miles out of contact with air before it is delivered to the consumers. It results from these differences that the quality of the water in San Francisco is far better than the city of Oakland water. Furthermore, in regard to the city of Oakland, an additional source of the offensive taste is in the pipe system. During the entire putrefactive stage in the storage reservoir the water in the pipes supplying the consumer is always bad. Mr. LeConte attributes this offensiveness to the mud in the surface pipes and finds it to be so much the worse as this mud is excluded from the air.

In concluding this resumé of the paper, I will bring to your attention the palliatives proposed by Mr. LeConte. His first palliative consists in the removal of the mud from the reservoirs. He proposes to effect this removal by means of a pipe let down to the bottom through which the mud should be pumped.

Secondly, the accumulation of the mud in the service pipes should be remedied by previous subsidence and sand filtration.

I have now given you as fair an idea of the contents of this valuable paper as I could from my recollection of it as read.

I am sorry that I have no personal knowledge of the climatic conditions prevailing on the Pacific coast. But the troubles which Mr. LeConte speaks of are similar to those which baffle and perplex all of us, perhaps more than anything else in connection with the palatability of particular water supplies. To show that these troubles are very common in the Middle and New England States, I would mention that in the summer of 1874, the state of affairs Mr. LeConte speaks of as chronic in these Californian storage reservoirs, occurred over the whole of the northern part of New Jersey. Mr. Owen, our fellow member, said to-day, that, in accordance with the recommendations of the Water Commission of New Jersey, the whole of the water supply which falls upon the Passaic water-shed of northern New Jersey, and which is 900 square miles in area, is to be parcelled out, and so many million gallons are to go to the city of Newark, so many to Jersey City, and so on. But, while the remark made by Mayor Haynes, of Newark, that this water is of great purity, is true of the water in its ordinary condition, yet, in the natural impounding reservoirs, which are the lakes all through this water-shed, the same trouble that Mr. LeConte speaks of frequently occurs. In the summer of the year 1874, if I recall the date correctly, there was not a lake in this water-shed which did not present the same phenomena, and went through the same changes of fermentation. The fish were affected by it, a vast number dying and rising to the surface, being killed by the poisons generated in this process of putrefaction. The country people recognize the recurrent character of this aquatic disorder, and denominate it the "purging of the water."

I spoke of New England. At Athol, Mass., for instance, the water is taken from a natural impounding reservoir, and every season it goes through the same cycle. Not only the period of fermentation and of algæ, but of putrefaction attended by an intolerable stench. At Springfield, Mass., the Ludlow reservoir covers 550 acres, and they have tried a number of palliatives, especially gravel and charcoal screens, but without success. The water supplies of Newburg, on the Hudson, and of very many other towns in the Middle States have their like periods of fermentation and putrefaction.

It is a mistake to suppose that troubles from aquatic vegetation take place only in the warm season. Our friend, Mr. Tubbs, will sustain me in the statement that in connection with the water supply taken from Hemlock Lake at Rochester, they have had trouble in winter quite as bad as in summer, due to the development of certain forms of algæ. There are certain kinds of algæ that will grow on the ice, and they have suffered on this account at Rochester in the month of February. The same thing is true of the water supply of Philadelphia in the winter of 1882. The water supply at Philadelphia comes mainly from the Schuylkill River, which has a daily flow of 300,000,000 gallons. At that particular season, the river was coated with ice from Pottsville and the mining district down to the Fairmount Pumping Station. Many of you who visited the Centennial in 1876 will probably recall that there were a great many cases of typhoid fever among the visitors at Philadelphia at that time. The origin of the typhoid fever prevalent among the Centennial visitors was attributed to the polluted water of the river Schuylkill. The examination of the water at Philadelphia in 1882 showed that it was very impure, but the cause of the offensive taste and odor was not revealed until the analysis was extended to the examination of the gases dissolved in the water. This examination showed that the oxygen had disappeared, and its place had been taken by carbonic acid and carburetted hydrogen. These changes had come from the putrefaction of the sewage contained in the Schuylkill water, beneath the ice, and consequently out of contact with the air.

I shall have a few words to say with regard to the nature of the remedies that appear to be indicated. Mr. LeConte dwells upon the importance of the removal of the mud from the bottom of the reservoirs, and on keeping it out of the pipes by subsidence and filtration. In reference to the former recommendation, I would add the importance of preventing the process of fermentation and putrefaction in the reservoirs, by eliminating the dissolved carbonic acid and carburetted and sulphuretted hydrogen by means of excess of oxygen. These two objects are being carried out in a number of places by artificial aeration. Water, after this treatment, does not require preliminary subsidence. Its suspended mineral matters can be completely removed by precipitation and filtration, which at the same time remove all other particles however minute, including the spores of bacterial and cryptogamic life.

Questions and Answers.

All questions relating to building construction, paving, sewerage, water supply, or kindred subjects, will be welcomed in this column provided they relate to matters of general interest and are not such as should properly be referred to a consulting engineer. Answers will be carefully prepared and a proof of both question and answer mailed to the inquirer as early as proper consideration will permit. They will be published for the benefit of other readers as soon as convenient. The full name and address should be given, not necessarily for publication, but as a guarantee of good faith, and to facilitate further correspondence in case the question is not sufficiently explicit.

Inquiries of the Editor, in order to secure prompt attention, should *not be written on the same piece of paper as a communication* to the *Publishing Department.* Letters renewing subscriptions are sent to a clerk in the publishing office, and matter for the Editor, if in the same enclosure, is likely to be overlooked unless it is on a separate piece of paper, so that it may be promptly sent to the Editor.

HOW TO PROPORTION VAULT WALLS AND ROOF.

"ARCHITECT" writes: "I am somewhat puzzled over the following problem, and venture to ask your assistance in its solution.

An underground vault in a public road is 25 feet wide, 300 feet long and 10 feet deep, and will have a covering of 7 feet of earth. Supposing the roof to be of I-beams with flat 8-inch brick arches and sidewalls of brick, for what strains should the roof and sidewalls be proportioned?

It is assumed that 15-inch I-beams, 4-foot centers will be sufficient, supposing the load to be 250 pounds per square foot. It seems to me that this is incorrect, as the filling may weigh 100 to 110 pounds per cubic foot, giving for 7 feet in depth 700 to 800 pounds per square foot which, with the weight of brickwork 125 pounds $\times .7' = 90$ pounds per square foot, and 1-foot length of I-beams $\frac{200 \text{ pounds}}{3} = 70$ pounds, making in all about 1,000 pounds per square foot. There is also no allowance for live load.

The side walls sustain a load per lineal foot of ½-span × weight per square foot on roof $= 13 \times 1{,}000 = 13{,}000$ pounds, and I suppose should be treated as a surcharged retaining wall, because the banks are very likely to crack when the sheeting is drawn, and in accompanying diagram, in which I attempt to treat the solution graphically. I assume that the slope must be considered as about 1 to 1. After applying forces, surcharge, etc., I find resultant pressure lies just inside foot of wall; also the triangle above the surcharge appears to act on the roof. Have I properly indicated the amount and point of application of this force? It is not included in the roof load or any other. What is effect of roof to prevent overturning of wall? [See Fig. 1.]"

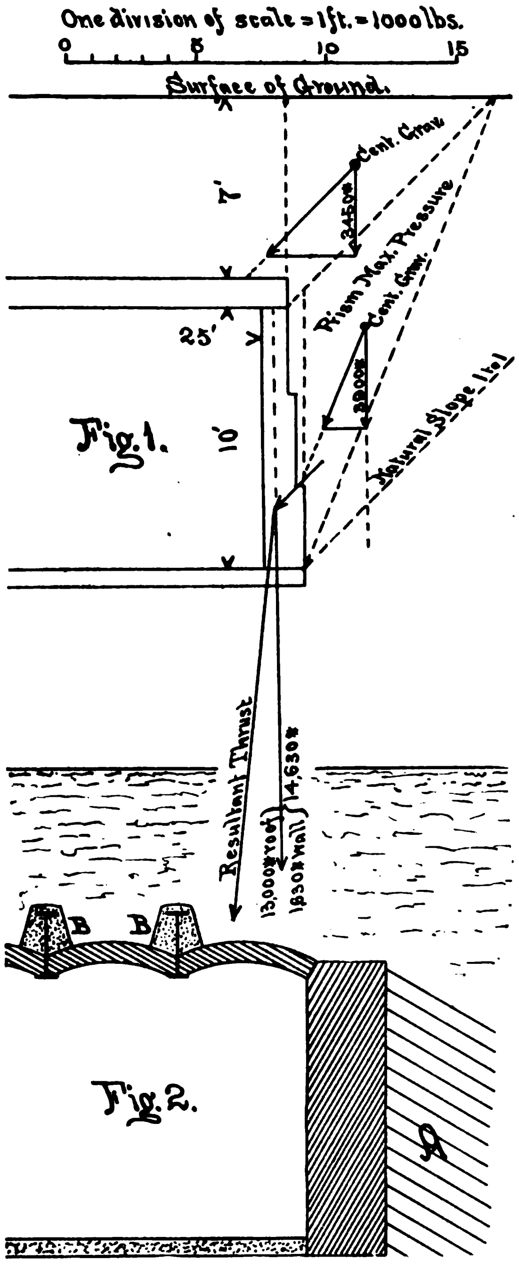
[The assumed load of 250 pounds per square foot on the roof of the vault is, as our correspondent has pointed out, altogether too small, and 1,000 pounds per square foot, as he suggests, is probably pretty near the truth for the dead load, although he has neglected to divide his weight of I beams by four as would be necessary with beams spaced 4 feet to centers. To carry this load with rolled beams would require 20-inch heavy I-beams about two feet apart and weighing about 45 pounds per square foot of roof. Riveted girders would be stiffer and weigh less per square foot and cost less per pound, and could be put enough further apart to considerably reduce the labor of turning the arches. Let us see how large they would have to be if spaced five feet to centers. The dead load above assumed of 1,000 pounds per square foot would give a maximum shearing strain of $\frac{1}{2} \times 1{,}000 \times 5 \times 25 = 62{,}500$ pounds and a maximum bending moment of $\frac{1}{8} \times 1{,}000 \times 5 \times 25 \times 25 = 390{,}625$ foot-pounds. The heaviest live load would probably be a 15-ton road-roller, and of this not more than one-half could very well get on one girder at a time, though it might rest on it near one end, and so give a maximum shearing strain of, say, 12,500 pounds. The maximum bending moment from this load at the center would be $\frac{1}{4} \times 15{,}000 \times 25 = 93{,}750$ foot-pounds.

From live and dead loads combined the maximum shear would therefore be $62{,}500 + 12{,}500 = 75{,}000$ pounds, requiring, at 6,000 pounds per square inch, 12½ square inches in the web plate, which, if 24 inches deep, would give a thickness of, say, 0.5 inch, or if 30 inches, 0.4 inch.

The total bending moment would be $390{,}625 + 93{,}750 = 484{,}375$ foot-pounds, giving a chord stress for a girder 24 inches deep of, say, $480{,}000 + 2 = 240{,}000$ pounds, and requiring chord sections, at 12,000 pounds per square inch, of 20 square inches, or, if 30 deep, of 16 square inches. The total section of the 30-inch girder would, therefore, be $12 \times 16 \times 16 = 44$ square inches, and its weight per square foot of roof supported $\frac{1}{5} \times 44 \times 3.33 = 29$ pounds, which would be increased somewhat by rivets and stiffeners, but would not much exceed two-thirds the weight of the rolled beams per square foot, especially as something could be saved by reducing the chord section toward the ends. These girders would weigh about two tons apiece. In view of the fact that a central support would reduce the shearing stress by about 50 and the bending moment by about 75 per cent., with a corresponding reduction of metal in the girders, it would evidently be well to provide such a support if possible. Light 15-inch beams about four feet apart would then answer the purpose, and would weigh about 12½ pounds per square foot of roof.

In calculating the pressure on the side walls our correspondent has not hit the mark so closely. In the first place, no ordinary material can be depended on to stand continuously at a slope of 1 to 1, certainly not if it has to be sheet piled when excavated, as he intimates. A slope of 1½ to 1, or 33⅔ degrees, is as much as it is safe to calculate upon. A glance at the diagram is sufficient to show that merely as a retaining wall the structure would not support the pressure of the earth, but, fortunately, it does not have to act in that way. The wall, or rather, for convenience, we will say, any portion of it a foot long, is in the condition of a loaded column subjected to a lateral pressure, or, perhaps, it may be more conveniently treated as a weightless beam supported at both ends and subjected simultaneously to end pressure and to the action of a distributed load. This load is the pressure of the earth, which varies directly as the depth, and inversely with the angle of repose of the material. With 33⅔ degrees, as the assumed angle of repose, the horizontal pressure at any point on a vertical plane will, according to Rankine, be equal to 0.29, say 0.3, of the vertical pressure of the earth at the same depth. If the top of the wall is 8 feet below the surface, and we take the material to weigh 110 pounds per cubic foot, then the horizontal pressure at that point will be $8 \times 110 \times 0.3 = 264$ pounds per square foot; at the bottom of the wall, which is 10 feet lower, it will be 594 pounds per square foot, and will vary uniformly between giving an average pressure of 429 pounds, or a total pressure per lineal foot of wall of $10 \times 429 = 4{,}290$ pounds. The variation in the pressure will slightly increase its bending effect, but it will also slightly lower the point of greatest bending moment, and without going into any exact calculation, its effect will, perhaps, be fully allowed for by calling the pressure 4,300 pounds, and uniformly distributed. This, on a beam supported at two points 10 feet apart, would give a maximum bending moment of $\frac{1}{8} \times 4{,}300 \times 10 \times 12 = 64{,}500$ inch-pounds.

It now remains to find how thick the wall must be in order that the tensile stress at its inner face may be reduced to safe limits or altogether eliminated. In this case the tensile stress will be reduced and the compressive stress increased by the load on the top of the wall as well as by the weight of that part of the wall itself which is above the point of maximum bending moment. The weight of the earth and masonry above the spring of the arches has been taken at 1,000 pounds per square foot, and if we take the masonry to weigh 120 pounds per cubic foot and the point of maximum bending moment to be at half the height of the vault, or five feet below the spring, the weight of wall to be added will be 600 pounds per square foot, or a total of 1,600 pounds per square foot, or 11 pounds per square inch.



· VAULT WALLS & ROOF.

On the side walls the load per lineal foot from the roof and earth would be $12\frac{1}{2} \times 1{,}000 = 12{,}500$ pounds. This would give a load per square inch on a 24-inch wall of 43 pounds, to which should be added the 11 pounds already allowed for the weight of the upper part of the wall and of the earth above it, making 54 pounds in all. The bending moment of 64,500 inch pounds per lineal foot would give in a 24-inch wall a maximum stress of 56 pounds per square inch, which, combined with the longitudinal stress just found, would give at the face of the wall a tensile stress of $56 - 54 = 2$ pounds per square inch, and at the back a compressive stress of $56 + 54 = 110$ pounds per square inch. The material can easily bear twice this compressive stress, and the tensile stress is so small that it may be safely neglected, especially as it is likely to be still further reduced by the bearing of the beams not being over the middle of the wall either originally or in consequence of their spring when loaded, which would bring it nearer the inner face.

The end walls do not carry so much of the roof load, having only one-half of one arch to carry, or $2\frac{1}{2} \times 1{,}000 = 2{,}500$ pounds per lineal foot, but as this is all carried at the spring of the arch it will produce at least twice as much compression at the face of the wall as if uniformly distributed. On a 36-inch wall, therefore, this would produce a compressive stress at the face of $2 \times 2{,}500 \div 432 = 12$ pounds per square inch, to which must be added the 11 pounds as before, giving 23 pounds of compression. The bending moment will produce in a 36 inch wall a maximum stress of 25 pounds per square inch, so that at the face of the wall there will be a tensile stress of $25 - 23 = 2$ pounds per square inch, and at its back only the 11 pounds per square inch due to the superincumbent earth and the upper half of the wall.

The thicknesses of 24 and 36 inches thus found are probably quite ample, as walls of such dimensions could hardly fail by bulging, after the mortar had hardened, without exerting a positive arch action that would oblige them to lift the entire roof before they could give way. It is, therefore, probable that a thickness of 32 inches would prove sufficient for the end walls, and in fact the whole problem is one involving so many considerations that while it is well to figure out the pressures and thicknesses as a guide in forming a conclusion, the trained eye and judgment of the engineer will in the end be found to be a better dependence than calculation alone.

It is obvious, that as these walls depend mainly for their stability on their superincumbent load and the support they receive at the top, that the roof should be finished and loaded and the mortar allowed some time to harden before any lateral pressure from the filling is permitted to come upon them, and to further this object it may be better not to draw the sheeting but to let it support the bank as long as it will.

If there is room to do it the horizontal pressure of the back-filling may be materially reduced by compacting it in layers inclined from the wall as shown at A, Fig. 2. The upper flanges of the girders or beams should be covered with concrete, as shown at B, Fig. 2, so as to prevent corrosion in the damp earth, and if absolute water tightness is desired it would be well to cover the whole roof with several alternate layers of roofing felt and asphalt.

If the side walls could be lowered a couple of feet or so, and made thick enough to act as abutments, the vault could be conveniently spanned with a 24-inch arch of say 5-foot rise. This would avoid all iron work and be more easily made tight, and by smoothing off the earth in the middle to act as a center while turning the arch, and removing it at the ends after the arch was completed the expense of wooden centering would be saved, and the cost of the entire work would be probably much reduced. It would be well to make a careful estimate of the comparative cost of these plans before proceeding with the construction.

If our correspondent prefers to proportion his work according to the ordinary rules of retaining walls he should look up the subject a little more carefully and need give himself no anxiety about the triangle of earth above the surcharge. The wall can only act as a retaining wall before the roof is on, and in that case the triangle will quickly slide off, or if the earth is so compact that it will preserve its position there will be no lateral pressure on the wall.

We have answered this question at some length as containing some points of general interest, and the thickness of vault walls, though something which has often to be determined, we do not remember to have seen discussed before. As a rule, however, such questions should be referred to a competent consulting engineer, and our correspondent will find the professional cards of several of these gentlemen on the last cover page of this journal. It will probably be wiser for him to get one of them to apply the principles above stated to his particular case than to attempt to do it himself.]

AT a recent meeting of the Montreal City Council, it was stated that there were only four water main manufactories in Canada, that in some recent purchases for the city only two of them were asked to bid, and of the two one was unable to supply the pipe, and so the contract was let practically without competition. Importing pipes was suggested, but there was no action in regard to it.

THE AVON, MASS., WATER-WORKS.

IN the recently issued report of the Board of Water Commissioners of the town of Avon, Mass., the Engineer, Louis E. Hawes, describes the main features of the system of water supply, on which work was commenced August 15, 1889.

The system is what is known as a pumping system, with a compensating reservoir or stand-pipe for storing water between periods of pumping, which, in consequence of the small amount of water that will be used in the town for some time, will occur daily in small quantities, or at longer intervals as the desirability becomes apparent. The system comprises a source or supply well, pumping plant, reservoir and distribution piping with its stop-gates, fire hydrants and service connections. The supply well is circular in form, has an average diameter of 20 feet, is made of heavy rubble masonry laid dry, and lined with a 12-inch brick wall, laid in hydraulic cement. The brickwork starts at a point 6 feet from the bottom, leaving the stonework to that height open for the free percolation of water. The whole rises several feet above the surrounding meadow, the surface above the well being graded to meet it, and is surmounted by a conical roof, with a suitable entrance to the interior. The well is 22 feet deep, with an overflow 4 inches from the top, to which point the water rises and escapes, although 3 feet above the elevation of the original spring, thus storing the water higher. A 10-inch suction pipe connects the well with the pumping machinery.

The pumping plant comprises a horizontal tubular boiler, a duplex compound condensing pumping engine, an air pump and condenser, a boiler-feed pump, and the necessary piping, fixtures, gauges, etc. The boiler is 13 feet long and 54 inches in diameter. The pumping engine has steam cylinders 9 and 16 inches in diameter, water cylinders 9½ inches in diameter, with a 12-inch stroke for all. It is provided with ample air chambers and an air-charging device, has a counter to record the revolutions of the engine, and is so arranged in its connection with the condensing apparatus that it can be run non-condensing, exhausting into the atmosphere. The engine is capable of pumping 36,000 gallons per hour, at a piston speed not exceeding 95 feet per minute, the lift from engine room to high water in the reservoir being 167 feet, or a total average lift from the well of 177 feet, exclusive of friction. The boiler feed pump is so arranged that cold water can be pumped from the well, taken directly from the street main, or hot water pumped from the hot well, always, however, passing through the heater before going into the boiler.

The force main from the pumping station is 8 inches in diameter part of the way, and is then enlarged to 10 inches, continuing this size to the reservoir which it enters at the bottom, rising to a height of 84½ feet, so that water is admitted to the top of the reservoir, and by an automatic arrangement drawn from the bottom, thus insuring complete circulation.

The foundation of the reservoir is 22 feet in diameter and 6½ feet deep, built of rubble stone and cement laid solid, with six anchor plates imbedded below, and six hammered bracket stones set in the top for the anchor bolts to pass through. A tunnel lined with brick extends from the outside to the middle allowing the passage and inspection of the leading main. The reservoir upon this foundation is made of wrought-iron, and is 20 feet in diameter by 90 feet high, made up in sheets thoroughly riveted together. There is a ladder inside and out and a manhole near the bottom. The iron of the bottom and lower 20 feet is half an inch in thickness, the next 20 feet seven-sixteenths, the next 20 feet three-eighths, the next 15 feet five-sixteenths, and the upper 15 feet quarter of an inch thick, which gives a factor of safety of 4.15 at the bottom, four being considered ample. For every foot in height the reservoir contains 2,356 gallons, and when full to high-water mark, which is within 3 feet of the top, holds 205,000 gallons.

The distribution piping is cast iron. The 10 inch pipe weighs 60 pounds per foot, the 8-inch 45 pounds, and the 6-inch 30 pounds per foot, every length being certified to have received a pressure test of 300 pounds to the square inch before leaving the foundry.

IN Toronto, Ont., local improvements paid from special assessments instead of the general city fund—pavements, sidewalks, etc.—will have 10 per cent. added to their cost to cover engineering and clerical expenses connected with them. This will relieve the general taxpayer from all burden of improvements of the kind.

DOMESTIC PLUMBING & HEATING LIGHTING & VENTILATION ENGINEERING

PLUMBING IN THE HUDSON RIVER STATE HOSPITAL

A GENERAL description of the plumbing system in the New York State Hospital at Poughkeepsie was published in this journal December 25, 1886, accompanied by details of traps, etc., of the pipe fittings in one shaft, and of a brick and stone receptacle in the foot of the shaft which received the discharge from the soil and waste pipes, and emptied into the sewer. Since that article was published other buildings have been added to the institution, and some changes developed in the plumbing, as will be seen in the accompanying illustrations of pipes in the new Surgeons' House.

Figure 2 is a section through the toilet room, and Fig. 1 is a section and elevation at Z Z in Fig. 2. Each trap has the usual back-air vent pipe A that connects with the upper part of the soil pipe, and another independent pipe B extending above the roof, connected to the house side of the trap and serving as a local vent. H H, etc., are handholes with screw caps. C C is a section of the 6-inch pipe and fittings that receives the discharge from the waste and soil pipes and empties into the sewer. It replaces the brick receptacle A B, shown on page 91, Vol. XV, and is not trapped, it and the connected sewer being considered thoroughly aired by the pipes D D, etc. E is a water pipe, which is carried through the same shaft, but is not directly connected with the drainage system. In this case but one set of fixtures is connected to the stack of pipes, but in other new buildings at the Hospital there are two or three sets of fixtures, at different stories, on the same vertical pipes, although the arrangement is substantially the same as shown here.

The plumbing in the Surgeons' House was arranged by Dr. J. M. Cleveland, Superintendent of the Hospital.

NATIONAL PLUMBERS' ASSOCIATION MEETING.

THE eighth annual convention of the National Master Plumbers' Association will be held at Denver, Col., June 17, 18 and 19.

PLUMBING • IN THE • HUDSON RIVER HOSPITAL

FIG. 1

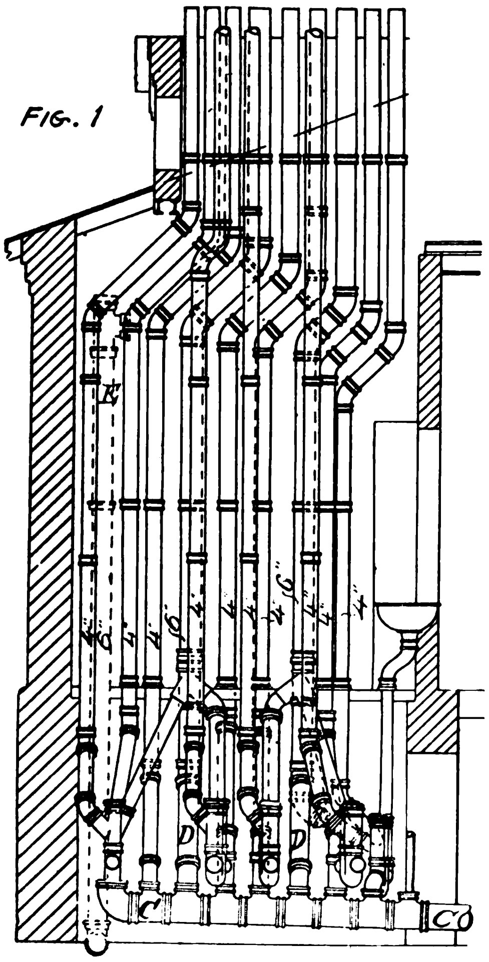
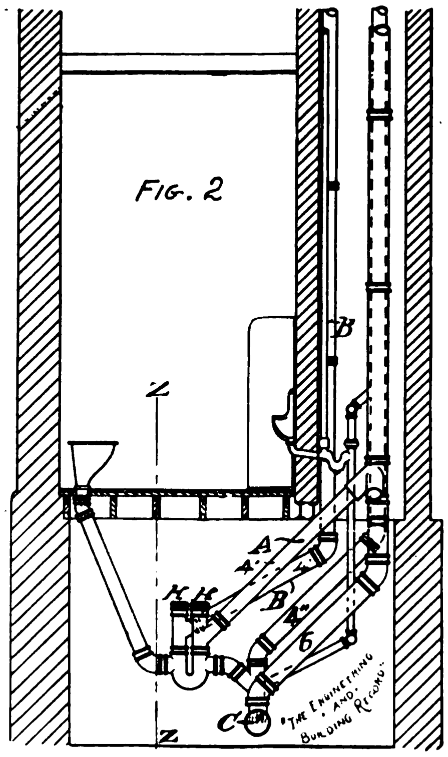


FIG. 2



NEED OF OFFICIAL INSPECTION OF HEATING APPARATUS IN BUILDINGS.

BEARING further on the above subject, referred to in THE ENGINEERING AND BUILDING RECORD of May 3, 1890, the following extracts from the "Ordinances of the Building and Health Departments of the City of Chicago" are given:

1070. Hot air, hot water, steam or other furnace, whether brick or metal, shall be kept at least 10 inches and the smoke flue at least 20 inches, off from any unprotected woodwork. All furnaces shall be placed on foundations of brick or stone, with proper hearths, of incombustible material, at least 24 inches wide in front of the ash pit. All hot air conductors that are placed within 10 inches of any woodwork shall be made double, one within another, with at least ½-inch space between the two. All hot air registers shall be set in incombustible borders not less than 2 inches in width; all such borders shall be firmly set in plaster of paris; openings in floors for registers shall be lined with bright tin to receive the register boxes, the lining to be kept at least 1 inch distant from such register box. I. C. or I. X. bright tin shall be used in the construction of all hot air flues and their appendages.

1079. Floors under all stoves shall be protected by a covering of incombustible material. Stoves shall be kept at least 20 inches, and their smoke pipes 12 inches from any unprotected woodwork.

1080. The woodwork of all boiler houses and boiler rooms shall be kept at least 6 feet from the boiler, and 4 feet from the breeching or smoke conductor, and 1 foot from the dome of the boiler, unless such woodwork is properly protected with incombustible material, and then there shall be at least 2 feet space from the boiler or smoke pipe and the protection.

1081. The floors of all rooms, when containing stationary boilers, shall be made of incombustible materials, 5 feet on all sides, and at least 8 feet in front of any boiler.

1082. When portable boilers are used on wood floors of any building, such wood shall have a close protection of incombustible material, not less than 6 inches thick, covering all the space under the boiler and projecting not less than 2 feet on the sides and rear, and 6 feet in front, with an air chamber of not less than 2 inches formed in such protections. Hollow tiles, properly laid, may be used for such protection.

1086. No unprotected heater or movable light shall be kept within any room or building wherein hay or straw, or any highly inflammable articles are kept or stored, the least protection in such cases shall be a permanent surrounding wire screen with meshes less than ¼ of an inch.

1087. Steam pipes shall be kept at least 2 inches from all woodwork, otherwise they shall be protected by a soapstone or earthen ring or tube, or rest on iron supports.

1088. No pipes shall be let into the joists or beams of any floor to a greater depth than 2 inches, and not more than 3 feet from the ends of the joists or beams.

1096. Any chimney not forming a part of a wall shall rest upon the ground with proper foundation, and in no case shall any chimney rest on or be supported by framework, beams or posts of woodwork of any description.

The ordinances of the city of Boston contain the following specifications:

72. The shell of all flues for brick ranges, boilers, furnaces and ovens shall hereafter be of brickwork, 8 inches thick, or its equivalent, to a height of 25 feet above such ranges, boilers, furnaces, or ovens.

73. Ranges or boilers shall have the outside of the flue to the same exposed without covering, or, if plastered, shall be plastered on the outside, directly upon the bricks, up to the ceiling of the room, and no woodwork shall be placed on the outside of the same.

74. All floor timbers, headers and trimmers of every brick building hereafter erected or altered, in which a chimney is to be built in a brick wall, shall be placed distant at least 2 inches from the outside of every chimney flue, and the space between such timbers and the brickwork of chimney shall be closed by a proper fire stop of incombustible material.

75. All hearths shall be supported by trimmer arches of brick or stone, or be of single stones, at least 6 inches thick, and supported entirely by iron beams, one end of which shall be securely built into masonry of chimney or adjoining wall. The brick jambs of every fireplace, range or grate opening must be at least 8 inches wide, each, and the backs of such openings must be at least 8 inches thick, to at least 2 feet above such openings. All such hearths and supports shall be at least 12 inches longer than the width of such openings, and at least 18 inches wide in front of the chimney breast. The brickwork over all fireplaces and grate openings shall be supported by proper iron bars, or brick or stone arches.

76. If any chimney, flue, or heating apparatus on any premises shall, in the opinion of the inspector, endanger the premises, the inspector shall at once notify, in writing, the owner or agent of said premises. If such owner or agent fails for a period of 48 hours after the service of said notice upon him to make such chimney, flue, or heating apparatus safe, he shall be liable to a fine of not less than $20 nor more than $50 for every day's continuance thereof, to be paid into the treasury of said city.

77. Every smoke pipe in a building entering a chimney flue shall be at least 12 inches from every wooden floor, ceiling, or partition; shall be guarded by a soapstone ring not less than 4 inches in thickness, extending through the partition, or by a double metal collar, with an air space of not less than 4 inches around the same when running through any stud or wooden partition; and no smoke pipe shall project through any external wall or window.

78. The smoke pipe of every furnace shall be kept at least one foot distant from all beams and ceilings not protected by a shield of tin plate at least two inches distant from said beams or ceiling; and no smoke pipe shall be placed nearer than 12 inches to any beam or ceiling, unless the beam and ceiling are plastered, in which case the pipe may be kept within 6 inches of the plastering, if protected by the above described shield; and the top of all heating furnaces set in brick shall be covered with brick, supported by iron bars, and so constructed as to be perfectly tight; said covering to be in addition to and not less than 6 inches from the ordinary covering of the hot air chamber.

79. No furnace and no range set in masonry shall hereafter be placed or its location changed in any building, except as the inspector shall approve.

80. The top of every heating furnace not set in brick shall be kept at least 6 inches below the beams or ceiling, with a shield of tin plate made tight, suspended not less than 2 inches below the said beams or ceiling, and extending one foot beyond the top of the furnace on all sides. If the ceiling over a furnace is plastered, the top of the brickwork may be kept within 6 inches of the ceiling.

81. All hot air register boxes hereafter placed in the floors or partitions of buildings shall be set in soapstone borders not less than 2 inches wide, firmly set in plaster of paris or gauged mortar, or such other protection as shall, in the judgment of the inspector, be equivalent to soapstone; shall be made of tin plate, with a flange on the top to fit the groove in the soapstone, and shall have an open space of one inch on all sides, extending from the under side of the ceiling, below the register, to the soapstone in the floor or partition; the outside of said space covered with a casing of tin plate, tight on all sides, and extending from the under side of the aforesaid ceiling up to and turn under the said soapstone; register boxes of 15 by 25 inches or more shall have a space of 2 inches.

82. No woodwork shall hereafter be placed nearer than one inch to any tin or other metal pipe, to be used to convey heated air or steam in any building, unless protected in a manner satisfactory to the inspector, and such woodwork shall be protected by a soapstone or earthen ring or tube, or a metal casing.

83. Every building in which a steam boiler of ten or more horse-power is placed, shall have the space on the floor allotted for said boiler inclosed in incombustible material satisfactory to the inspector, and shall be so arranged that all openings between the said boiler-room and the other parts of the building in which it is placed shall be protected by iron or metal covered doors, which shall be securely closed at the close of each day.

As AN illustration of the growing substitution of iron and steel for wood, it is stated that in France there have recently come into use hollow iron window frames and doors. It is claimed that they combine the advantages of lightness and strength with great durability.

A NOVEL HOT-WATER HEATING SYSTEM.

THE accompanying illustration shows the general arrangement of a novel hot-water heating plant, designed by W. F. Porter & Co., of Minneapolis, Minn., and installed at the residence of F. L. Brooks, of that city. It need be explained only that a closed tank is used in this system. The main supply pipe, marked M, leads up from the boiler directly to the expansion tank E, and from this the supply pipes to the various parts of the house branch out, descending to the radiators on the different floors. Each radiator has only one valve, placed on the inlet, and when these valves are closed circulation of the water goes on uninterrupted through the pipe system alone. When the valves on any of the radiators are opened, however, circulation through the radiators is established. In the illustration, S represents the safety valve, F a float in the expansion tank to work the water-supply valve, and R an indirect radiator.

The apparatus, as put into Mr. Brooks' residence, is said to perform satisfactorily in all respects. The expansion tank is made of 12-inch pipe, capped, and all the piping measures 1 or 1¼ inch, except the main supply pipe M, which is 3 inches in diameter. All the pipes in the attic are covered with hair felt; the remainder are exposed. The fittings are common cast-iron tees and ells, the valves used being angle valves laid horizontally. For the direct radiation, "Union" radiators, made by the H. B. Smith Company, of New York, are used. About 468 square feet of radiating surface are used, and are divided up as follows: for the first floor in the proportion of 1 to 30, and in the second, in the proportion of 1 to 40. The indirect radiator R is a "Climax" radiator, made by the A. A. Griffing Iron Company, of Jersey City.

A Page steam boiler is used, having a 21-inch fire pot, and a steam dome, though Messrs. Porter & Co. state that in their later practice they substitute for the dome a number of sections. The reason for leaving the dome on was that the plant was put in to be run as a steam job, while the house finish was being placed in position. The advantages claimed for the system are that no air valves are necessary, and no openings are required to be left open to waste water. Messrs. Porter & Co. further claim a positive circulation with an even dirtribution; absence of opportunity for air pockets to form and impede circulation, and ease of filling and emptying the apparatus.

THE ROSE POLYTECHNIC INSTITUTE.

THE eighth annual catalogue of the Rose Polytechnic Institute, of Terre Haute, Ind., has just been issued Like all other publications of this class it gives brief reviews of the courses of study in the different departments, and sets forth the facilities which the institution possesses for instruction in its lines. The course of instruction includes the principles and practice of engineering with special reference to the branches of mechanical and civil engineering, chemistry, physics, electricity and drawing.

Novelties.

Devices are described under this head purely and strictly as news; because believed to be new and calculated to interest readers.

In no case is pay accepted, directly or indirectly, for publishing a novelty notice.

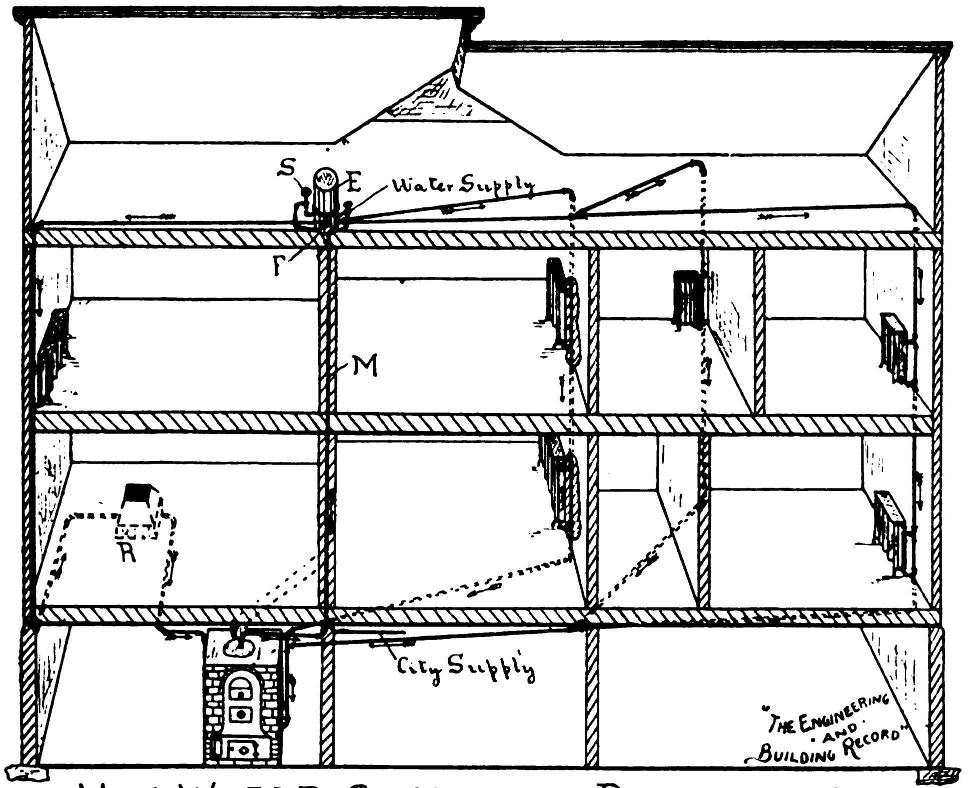
As the subjects are selected for their supposed novelty and interest merely, it will, of course, be understood that the selection does not imply endorsement.

ELECTRICAL SIGNALING APPARATUS FOR GAS EXHAUSTERS AND GOVERNORS.

IT is a matter of frequent observation in gas-works that the governing arrangements of the exhausters are liable at times to be neglected unless under constant supervision; and as a result considerable loss and inconvenience are caused. To obviate this, an apparatus, embodying an ingenious application of electricity to checking the governing and exhausting arrangements of gas-works, has been devised and put in operation at the works of R. Dempster, at Penmaenmawr, North Wales. The *Journal of Gas Lighting* refers to it as follows: It is fixed in such a manner that, when the pressure or vacuum varies from the regulation standard, a bell is set ringing; thus bringing the matter directly before the notice of the engineer or manager.

The apparatus may be described as follows: A small boxwood case, with glass front, is fitted against the wall of the exhauster house. In this box are placed two gauge tubes of about 2 inches in diameter. These are connected at the bottom like an ordinary pressure gauge. A glass bell is made to float in the tube exposed to the atmosphere; the other tube being connected with the gas. The float rises or falls in proportion to the change in pressure or vacuum, and is suspended to the end of a balance lever, the other end having an adjustable screw weight for regulating its position. This lever is pointed with platinum, and is connected to three cells, between which a switch turns the current on or off at pleasure. When the instrument is brought into action, the lever moves in position, and the platinum-pointed end is brought into contact with a platinum-pointed adjustable screw at either side—one representing pressure and the other vacuum. These screws can be adjusted to give warning of alterations of pressure varying from $\frac{1}{10}$ of an inch to any degree required. It will be at once seen that immediately the end of the lever is brought into contact with either of these screws, an electrical circuit is formed, causing one or more bells to be rung. These bells may be placed in a convenient position in the works or offices, and will continue ringing until the pressure or vacuum is adjusted.

It is suggested that there are many other purposes on gas-works to which the invention could be applied with advantage; such, for instance, as giving notice of undue pressure on the station governors, etc.



HOT WATER SYSTEM IN RESIDENCE AT MINNEAPOLIS, MINN.

RUBBER PACKING RINGS FOR GAS-PIPE JOINTS.

AT a recent meeting of the *Mittelrheinischer Gasindustrieverein*, in Germany, particulars were given by Mr. Kugler, of Offenbach, of the substitution of rubber packing rings for the commonly used lead filling in making gas-pipe joints, with pipes ranging from about 3 to 4 inches in diameter. According to Mr. Kugler, the rubber packing had at first been used in connection with pipes having the ordinary bells as employed for lead joints, but more recently pipes with special bells had been tried, the bells having grooves into which the rubber rings fitted accurately. With these modified bells even better results were obtained than in the earlier experiments, entire absence of leakage and eminent durability being claimed for the packing. To protect the rubber rings from destructive external influences a coat of cement is plastered over the outside of the joints.

It was noted that rubber packing for gas pipe joints was used in some localities a number of years ago, but experience with them was not encouraging, possibly on account of a poor quality of rubber being used, and insufficient protection against external corroding agents.

THE LIGHTING OF PARIS.

AT a recent meeting of the International Society of Electricians at Paris M. Fontaine, the President, read an interesting paper on the "Lighting of Paris." He made a comparison of the amount of light used in the years 1855, 1872, 1877, 1883, and 1889 and gave the approximate figures for each source of light, such as candles, paraffin lamps, gas, compressed oil gas, and electricity. On the whole, paraffin oil is the most used at present, gas remains stationary, and electricity is rapidly growing in favor.

Compressed gas has only recently been adopted. Electric lighting commenced in 1877, during which year 230 horse-power was in use; the horse-power in 1883 was 900, and in 1889, 17,400. During 1889 there were 322 installations driven by steam engines, 97 by gas engines, 77 by compressed air, and 22 by vacuum. In addition to the 17,400 horse-power actually in work there are installations representing 10,500 horse-power in course of construction.

COST OF ELECTRIC LIGHT FROM GAS ENGINES.

EXPERIMENTS made by O. Tirrill, 39 Dey Street, New York City, in using a gas engine for electric lighting purposes are said to have shown economical working, notwithstanding the double transformation of energy gone through. The gasoline gas, or rather vapor, was produced by Mr. Tirrill, according to the available data, at $1 per 1,000 cubic feet. The engine was found to consume about 4 cubic feet of this gas per 16 candle-power lamp per hour when driving the dynamo under full load, making the cost per light two-fifths of a cent per hour.

ANNUAL REPORTS.

REPORT ON THE WORKS EXECUTED BY THE COMMISSIONERS OF SEWERS OF THE CITY OF LONDON, during the year 1889.

This report, prepared by William Haywood, engineer and surveyor to the Commission, was issued a short time ago. While embracing only 51 pages it treats of a variety of subjects of interest to municipal engineers, and is, on the whole, more comprehensive than its title would seem to indicate. Besides sewers and house drainage, carriage and footway pavements street lighting, by both gas and electricity, street cleaning and water supply, are among the subjects considered.

SELECTIONS FROM NATIONAL EXHIBITION OF ARCHITECTURAL DRAWINGS AND SKETCHES.

THIS is the title of a handsomely printed quarto publication which contains, as its title implies, a selection of the exhibits at the architectural exhibition held in Cincinnati in November, 1889, under the auspices of the Cincinnati Architectural Club at the time of the annual convention of the American Institute of Architects.

It is a creditable collection and well worth the price charged. It can be obtained of A. O. Elznar, 220 Main Street, Cincinnati, O., for $1, postage paid.

CONTRACTING NEWS DEPARTMENT.

A WEEKLY RECORD

OF SPECIAL INTEREST TO CONTRACTORS, BUILDERS AND MANUFACTURERS OF ENGINEERING AND BUILDING SUPPLIES.

TRADE PUBLICATIONS.

James Brand, importer of English and German Portland cements, 81 and 83 Fulton Street, New York, has just issued in pamphlet form a paper on "Portland Cement for Engineering Works," prepared by Captain W. W. Maclay, C. E. The paper gives, as Mr. Brand explains, the latest facts on and experiments with Portland cement, designed for the benefit of architects and engineers. In an appendix to the paper are given abstracts of the new German rules for testing cements, and of the system of testing recommended by the Cement Testing Committee of the American Society of Civil Engineers. Directions also are given for using Portland cement and mixing Portland cement mortar and concrete. Mr. Brand will send the pamphlet gratuitously on application.

We have received from the New York Central Iron Works, of Geneva, N. Y., a little pamphlet illustrating and describing the various types of the Duning boiler manufactured by them.

CONTRACTING INTELLIGENCE.

For works for which proposals are requested see also the "Proposal Columns," pages i-31.

PUBLIC IMPROVEMENTS IN NOVA SCOTIA.

Town Office,
New Glasgow, N. S., June 11, 1890.

The Engineering and Building Record:

This town is putting down about 2,000 feet extension to their water system, which, when completed, will make a total mileage of seven miles.

Proposals are about being asked for a system of sewerage and an additional pump.

Blast furnaces are about being erected, and they ask for a supply of 26,000,000 gallons of water annually to supply their works.

This will increase the duty of the engines 50 per cent. over last year. At present we have one of "Blake's Duplex Pumps," capable of delivering 700,000 gallons daily, and they are now working to their fullest capacity supplying the town, the Nova Scotia Steel Works, and the Intercolonial Railway. The town of Stellarton, two miles distant, is negotiating for a supply from our works.

Our system is pumping through system, overflow going to reservoir.

Yours truly, A. M. Fraser,
Town Clerk.

WATER.

For Additional Water Items see Proposal Columns.

Homestead, Pa.—The officials of this place have issued the following circular for the information of water-works construction companies, engineers, water-works supply companies and others interested: "The Borough of Homestead on the 18th day of February, 1890, voted an increase of $70,000 indebtedness for the purpose of building and operating a water-works system, said plant to be owned and operated by the Borough. The needs of Homestead in the way of a water-works plant are from six to eight miles of pipeage, engine, pumps and reservoir, sufficient to supply the present and probable population with water for private consumption and fire protection. The water supply must be drawn either from the Monongahela River, or from artesian wells. The construction of the works will be begun in the spring of 1891 and completed by the fall of the same year. The construction of the plant is in the hands of a committee of five, appointed by the Borough Council, to which committee the Burgess, Solicitor and Clerk have been added as ex-officio members. Preliminary steps are now being taken, and parties interested may address the undersigned, M. P. Schooley, Secretary Water-Works Committee."

Macon, Ga.—Considerable apprehension is felt by some of the city officials regarding the scarcity of water, and active efforts are being made to prevent waste. Mr. Cox, Chairman of the City Council, is in favor of establishing a new system of water-works, to be owned by the city, and suggests issuing bonds in the sum of $100,000 for that purpose. Other officials think that when the waste is stopped the supply will be sufficient. The question is to be considered at an early date.

Calgary, Can.—The people of this place have decided to expend the sum of $60,000 in establishing a system of water-works.

Carthage, O.—The Water-Works Trustees have contracted with the Bradford Well Company to dig a test well.

Lebanon, O,—The citizens of this village want water-works, but as yet no decided action has been taken.

Pottstown, Pa.—It is understood that the contract awarded to Max Tyson, of Reading, for the new water basin, has been declared off and is therefore open again.

Gainesville, Ga.—This place has voted the sum of $40,000 in bonds for the purpose of establishing a system of water-works. The work is to proceed at once.

New Utrecht, N. Y.—The New Utrecht Water Company has been incorporated at this place. Its objects are to accommodate, store, conduit, sell, furnish and supply water for mining, domestic, manufacturing, municipal and agricultural purposes. For particulars, address James A. Townsend, of Bay Ridge, N. Y.

Livermore, Cal.—John Aylward, Superintendent of the Livermore Spring Water Company, writes: "The proposed water-works extension is 2½ miles of 6-inch pipe from the Livermore Springs to reservoirs close to the town, with a pumping station at those springs, and the completion of a large reservoir."

Goffston, N. H.—Regarding the project of water-works at this place, the City Clerk writes: "Surveys have been made and the water analyzed. There will probably be nothing more done this season. Kendrick Kendall, Chairman of the Board of Fire Wards, can furnish particulars."

Statesville, N. C.—Mayor D. A. Miller, writes: "We have submitted the matter of water-works to the people and voters of the town, which will take place on July 7. We have submitted matter on the rental system with the option to buy in five or ten years. We will need five to six miles of mains and pipe, from 45 to 50 hydrants. If ratified by the voters will be ready immediately for contracts."

Blacksburg, S. C.—City Clerk W. B. Anthony, writes: "The City Council has granted the Blacksburg Land and Improvement Company the privilege of establishing water-works, electric lights and a street railway in this city, and they will be the proper parties to contract with for the work, as the Council has given that company the privilege. Work will be commenced at an early date."

East Chattanooga, Tenn.—This place is to have a system of water-works. Address S. Thompson for details.

Florence, S. C.—Information regarding water-works construction is wanted at this place by J. P. Chase.

Boulder, Col.—A new water-works system is to be established at this place.

Tallapoosa, Ga.—The Tallapoosa Water Company will establish a plant at this place. Address for particulars J. M. Crane.

Ashland, Ky.—A water-works system is to be established at this place by the Ashland Water Supply Company,

Monrovia, Cal.—City Clerk O. E. Slosson writes: "The sum of $40,000 bonds have been voted to purchase water, water-bearing lands and develop and conduct same."

Cattaraugus, N. Y.—A water-works system is to be established at this place by the Cattaraugus Water Company. Estimated cost, $25,000. Address, for details, Jessie B. Conway, Secretary.

Spring Valley, Cal.—The Spring Valley Water Company intends constructing immediately a large reservoir. The establishment of several pumping stations, to supply the reservoir, is also to begin soon.

Philadelphia, Pa.—The movement to supply Germantown and other suburbs is about to be realized, and work will be commenced at an early day. Chief Engineer Ogden can furnish particulars.

Ellicottville, N. Y.—A water-works plant is to be established at this place by the Ellicottville Water Company, at an estimated cost of $10,000. Address for details C. P. Vedder, as above.

Hermosa, S. Dak.—City Clerk W. C. Ritchie writes regarding the water-works project as follows: "The City Council had a conference with George W. Chadwick about six weeks ago and they had about come to a satisfactory conclusion to grant a franchise for 20 years, when shortly after Mr. Chadwick died in Rapid City, S. Dak. This put a quietus on the proceedings and nothing has since been done in the matter."

Laurens, N. Y.—The Town Clerk at this place writes: "W. L. Hopkins, W. H. Widger, and Dr. P. K. Strong of this place are interested in forming a water-works here and are meeting with fair success."

Woodstown, N. J.—W. D. Clayton, Borough Clerk, writes: "As yet no definite steps have been taken about water-works plant. Two or three parties have given estimates for supplying the borough with fire hydrants by the year. If suitable terms can be made this most likely will be the plan adopted by our Council. Our townspeople are in favor of having a water supply."

Carthage, Ill.—About 4,000 additional feet of water mains will be laid at this place, and proposals will soon be wanted. Address George W. Payne, City Engineer, as above.

Nicholasville, Ky.—Town Clerk E. R. Sparks, writes: "We are now building a reservoir, and if we are able to get water supply we will build water-works here. Will be glad to have any information on the subject."

Marysville, O.—Town Clerk L. G. English writes: "Ordinance has been passed, contracting with Messrs. Fullington, Zwerner, Davis & McPeck, a home company, to put in a water-works system of a 7-mile plant. Election will be held on Monday, June 23, for the purpose of ratifying contract by the electors. It will, undoubtedly, be adopted, and work will begin immediately upon construction of works."

Oceanside, Cal.—The Oceanside Water Company is being formed at this place, to develop a supply of water for irrigation purposes. The reservoir site of the company is located about five miles from Oceanside, and is of sufficient capacity to store water to irrigate about 10,000 acres of land, and elevation sufficient to reach the highest mesas. The capital stock has not yet been fixed, but it is estimated that $200,000 will be abundant funds to complete the system, which will be about $20 per acre for the lands irrigated. They also contemplate putting water in Oceanside and Carlsbad.

Los Angeles, Cal.—Reports say that efforts are being made to consolidate all the water companies in this city, and that several purchases have already been made with this end in view. J. F. Crank, it is said, has bought the East Side Water Company's plant and also a controlling interest in the plant of the Citizens' Water Company. It is asserted that the City Company will buy out all the companies in the city and consolidate into one system, and that Mr. Crank is now East, floating bonds to raise money to extend and improve the consolidated system as soon as the combine is made.

Long Island City, N. Y.—The Board of Aldermen of this city proposes to appropriate the sum of $6,000 to sinking additional wells for the purpose of increasing the water supply, which is said to have become inadequate. Alderman Desmond can furnish particulars.

Water-Works.—See our Proposal Columns for information regarding water-works and water-works furnishings at the following places: Denver, Col.; Binghamton, N. Y.; Cedar Rapids, Iowa; Jersey City, N. J.; Trenton, N. J.; Rochester, N. Y.; Columbus, O.; East Liverpool, O.; Providence, R. I.; Ottawa, Ont.; Brooklyn Village, O.; Fargo, Dak.; Toronto, Ont.; Geneseo, N. Y.; Providence, R. I.; St. Paul, Minn.; Montreal, Can.

Medina, N. Y.—Bassett Brothers, of Buffalo, N. Y., will construct a complete system of water-works at this place in a short time.

SEWERAGE.

For Additional Sewerage Items see Proposal Columns

Scranton, Pa.—Additional sewers have been authorized by the City Council. The City Engineer can furnish particulars.

Cincinnati, O.—Clifton, a suburb of Cincinnati, wants sewerage connection with the latter city. Isaac M. Jordan and Mayor Bowler, of Clifton, are interested in the matter.

Akron, O.—Sewer extensions are to be established at this place. Address the City Engineer.

Middlesborough, Ky.—Colonel Waring is making plans for the sewerage of Middlesborough, which presents features of peculiar difficulty. The town is about 3½ miles long, is practically level, with no point of outlet sufficiently low to obviate the necessity for pumping, and with quicksand of bad character about ten feet below the surface. Contracts have not yet been let.

Mobile, Ala.—Colonel Waring has been engaged by the City Council to visit this city and advise as to the arrangement of a plan of sewerage.

Boston, Mass.—At a recent meeting of the City Council the City Engineer was authorized to at once begin the construction of a brick conduit from Squantum to Moon Island, in place of the present wooden flume connected with the main drainage system, and authorized to spend the sum of $100,000 for the purpose.

Flushing, N. Y.—The officials have authorized the construction of numerous new sewers. Address Judge Clinton B. Smith, Village Clerk.

Ishpeming, Mich.—This town has voted to bond itself to build new sewers.

Ashtabula, O.—Colonel Waring has been employed by this city to advise concerning a system of sewerage.

Marion, O.—It is reported that the people of this place have decided to establish a system of sewers. The City Clerk is B. F. Davis.

Crookston, Minn.—A complete system of sewers is to be established at this place. Address A. R. Starkey, civil engineer, St. Paul, Minn.

Butler, Penn.—A plan for the sewerage of this place has just been completed by Col. George E. Waring, Jr., of Newport, R. I.

Chicopee Falls, Mass.—The contract for the construction of the new sewers at this place has been awarded to C. B. Cadwell, of New Britain, Conn., at 90 cents per linear foot, and $48 each for manholes.

Menominee, Mich., and Iron Mountain, Mich., have employed Mr. Rudolph Hering, C. E., of New York, to report upon sewerage plans now being prepared. It is proposed to build a number of sewers this season. City Clerks for each town can give particulars.

Beverly, Mass.—E. W. Bowditch, C. E., of Boston, has been employed to prepare plans for a sewerage system.

Lakeside, Minn.—The contract for the sewer system at this place and Lester Park has been awarded to H. E. Stevens, of Duluth, for $26,500.

Albany, Ore.—City Recorder N. J. Henton writes: "The city contemplates putting in a complete system of sewerage in 1891. Nothing will be done in the matter until after the Legislature meets, which will be in January, 1891, at which session the right will be granted the city to issue bonds."

Hornellsville, N. Y.—City Clerk H. C. Sawyer writes: "The bill authorizing the construction of sewers in our city has been signed by the Governor. It is necessary that the question now be submitted to the taxpayers as to whether we have them or not. We will have a special election early in July to decide the matter. If decided in the affirmative, the city will issue bonds to the amount of $100,000."

La Salle, Ills.—About $15,000 will be spent on sewer construction this summer—as voted on by Council. Wm. P. Rounds is the engineer.

Piqua, O.—H. C. Babbit, civil and sanitary engineer, of Columbus, O., has been invited to consult with the officials of this place as to a proposed plan for sewerage of the latter city.

Detroit, Mich.—Several miles of main sewers will be built in Detroit after July 1, some of which may be advertised between now and July 1. Apply to Board of Public Works.

Union, N. J.—The following bids for the construction of about 8,400 feet of main sewers were received by Louis Formon, Town Clerk, June 7: Everson & Liddle, Yonkers, N. Y., $142,521; Holmes & Coogan, 316 York Street, Jersey City, $157,217.50; Henry & McGivney, 360 Webster Avenue, Jersey City, $127,906; Deehan Bros. & Co., 1911 Hamilton Street, Philadelphia, Pa., $188,076.25; M. Brennan, 88 Bright Street, Jersey City, $153,283.30; D. R. Paige & Co., 45 Broadway, New York, $159,395; B. Feeney, Bullsferry Avenue, Union Township, $167,745; Myles Tierney, 271 W 73d Street, New York, $142,775.

Southampton, N. Y.—The *Seaside Times*, of this place, suggests that the citizens take some steps towards establishing a sewerage system. Address Walter R. Burling, the editor, for details.

Knoxville, Tenn.—The surveys for the sewerage system are being made by Messrs. Wright & Wood, of this city. The system will be designed by R. Frank Hartford, C. E., of Chattanooga, Tenn.

New Glasgow, N. S.—This place is to have a system of sewers. For details address A. M. Fraser, Town Clerk.

Brooklyn, N. Y.—Proposals were opened June 1, at the City Works Department, for the construction of the main relief sewer, known as Section 1, from Gowanus Canal, through Butler Street to Fourth Avenue, and through Fourth Avenue to Dean Street; also, for a continuation of the same work, known as Section 2, from Dean Street through Fourth Avenue to Hanson Place, through Hanson Place to Greene Avenue, and through Greene Avenue to Marcy Avenue. The bids were received on the following subdivision. For Section 1. (*a*) 2,000 lineal feet of 180-inch diameter main brick sewer; (*b*) 1,000 lineal feet of iron beam covered main brick sewer; (*c*) 1,000 cubic yards of brickwork for the silt and trap basin; (*d*) 46 tons of wrought-iron beams, straps and bolts for silt and trap basin; (*e*) 35 tons of cast-iron plates and columns for silt and trap basin; (*f*) 435 piles for foundation of silt and trap basin; (*g*) 90,000 feet B. M. for lumber used in and about silt and trap basin; (*h*) 90,000 feet B. M. for lumber used in coffer dam about silt and trap basin; (*i*) 6,500 cubic yards of earth excavation, including removal and replacing of crib work at silt and trap basin; (*j*) 3,000 running feet of 12-inch cement pipe drain under main sewer; (*k*) six manholes complete, inclusive of iron head; (*l*) two street basins complete, inclusive of iron pans. For Section 2: (*a*) 800 lineal feet of 180-inch main sewer tunnel; (*b*) 4,400 lineal feet of 168-inch main sewer tunnel; (*c*) 3,200 lineal feet of 144-inch main sewer tunnel; (*d*) 1,000 lineal feet of 120-inch main sewer tunnel; (*e*) 5,000 lineal feet of 12-inch cement pipe (for drain); (*f*) 18 manholes; (*g*) two street basins.

The bidders on Section 1 were as follows:

John McNamee, (subdivision *a*) $43.50, (*b*) $47.50, (*c*) $10, (*d*) $80, (*e*) $60, (*f*) $5, (*g*) $38, (*h*) $50, (*i*) 70 cents, (*j*) 50 cents, (*k*) $100, (*l*) $100.

Daniel J. Crean, (*a*) $28, (*b*) $34, (*c*) $6, (*d*) $70, (*e*) $60, (*f*) $3, (*g*) $38, (*h*) $38, (*i*) $1, (*j*) $1, (*k*) $55, (*l*) $100.

John H. O'Rourke, (*a*) $67, (*b*) $55, (*c*) $12.50, (*d*) $80, (*e*) $70, (*f*) $10, (*g*) $70, (*h*) $70, (*i*) $1, (*j*) $2, (*k*) $150, (*l*) $200.

Charles Hart, (*a*) $55, (*b*) $50, (*c*) $13, (*d*) $82, (*e*) $70, (*f*) $6, (*g*) $40, (*h*) $47, (*i*) $2, (*j*) $1.10, (*k*) $55, (*l*) $120.

Edward Freel, (*a*) $52.50, (*b*) $49.50 (*c*) $12.50, (*d*) $90, (*e*) $65, (*f*) $75, (*g*) $43, (*h*) $60, (*i*) 95 cents, (*j*) $1, (*k*) $65, (*l*) $150.

The bidders on Section 2 were as follows:

Charles Hart, (*a*) $69, (*b*) $65, (*c*) $50, (*d*) $35, (*e*) $1, (*f*) $800, (*g*) $1.

John H. O'Rourke, (*a*) $69, (*b*) $62, (*c*) $58, (*d*) $54, (*e*) $2.50, (*f*) $1,500, (*g*) $500.

The maximum cost of the entire work is $1,000,000.

BRIDGES AND IRON STRUCTURES.

For Additional Bridge Items see Proposal Columns.

Baltimore, Md.—The County Commissioners on June 4 opened the proposals for the building of the following bridges in Baltimore County as follows:

No. 1, over Gwynn's Falls; span 51 feet between walls, and width between iron 13 feet; the bridge will be at right angles with masonry. No. 2, over Herring Run; span 66 feet between walls, and width between iron 16 feet; angle with masonry, 72 degrees. No. 3, over Stemmer's Run; span 60 feet between walls, and width between iron 13 feet; the angle with abutments is 66 degrees. No. 4, over a stream about 1½ miles east of Phœnix Station; span 50 feet between walls, and width between iron 15 feet; the angle with abutments is 49½ degrees. No. 5, at Mt. Washington, N. C. R. R.; span 35 feet between walls, and width between iron 20 feet, with a sidewalk on one side of six feet clear width; the bridge will be at right angles to the masonry. The bids are given by the numbers below as follows:

Penn Bridge Company, Pittsburg, Pa.—No. 1, per lineal foot, $17.20; No. 2, per lineal foot, $20.10; No. 3, per lineal foot, $18,20; No. 4, per lineal foot, $18.90; No. 5, per lineal foot, $22.24. To deduct 50 cents per foot if they receive the contract for the five bridges.

Pittsburg, Pa., Bridge Company.—No. 1, $852; No. 2, $1,337; No. 3, $1,087; No. 4, $960; No. 5, $701.

Wrought Iron Bridge Company, Canton, O.—No. 1, $731; No. 2, $1,115; No. 3, $810; No. 4, $945; No. 5, $795.

Indiana Bridge Company.—No. 1, per lineal foot, $18.85; No. 2, per lineal foot, $20; No. 3, per lineal foot, $19; No. 4, per lineal foot, $19; No. 5, per lineal foot, $26.

King Iron Bridge Company, Cleveland, Ohio.—No. 1, $909; No. 2, $1,449; No. 3, $1,140; No. 4, $998; No. 5, $879.

Youngstown, O., Bridge Company.—No. 1, per lineal foot, $10.12; No. 2, per lineal foot, $10.12; No. 3, per lineal foot, $10 55; No. 4, per lineal foot, $10.76; No. 5, per lineal foot, $11.36. This bid without lumber.

Mt. Vernon Bridge Company, Ohio.—No. 1, per lineal foot, $17; No. 2, per lineal foot, $21; No. 3, per lineal foot, $20.50; No. 4, per lineal foot, $17; No. 5, per lineal foot, $26.75.

Wallace Iron Works, New Jersey.—No. 1, $853.48; No. 2, $1,271.98; No. 3, $1,157.31; No. 4, $850. No. 5, $882.52.

Berlin Bridge Company, E. Berlin, Connecticut.—No. 1, $1,123; No. 2, $1,410; No. 3, $1,178; No. 4, $1,133; No. 5, $1,014.

Dean & Westbrook, New York.—No. 1, $1,015; No. 2, $1,329; No. 3, $1,240; No. 4, $1,090; No. 5, $1,120.

Columbus, O., Bridge Company.—No. 1, $755.46; No. 2, $959.36, No. 3, $807.30; No. 4, $1,147.30; No. 5, $618.26.

The papers were all referred to Mr. Wm. H. Shipley, the Superintendent of Bridges, to report on the same. The Berlin Bridge Company and the Indiana Bridge Company afterwards withdrew their bids.

Wheeling, W. Va.—Plans are being prepared by the City Engineer for the construction of the bridge at Main Street, this city. The estimated cost is $92,000.

Shelburne, Mass.—Plans and specifications have been completed for an iron bridge to span the Deerfield River, at this place, to be erected at a cost of $18,000.

Rochester, N. Y.—City Surveyor Peacock has completed plans for a bridge to be erected over the river, at Court Street. The structure is to be erected at an estimated cost of $175,000.

Tonawanda, N. Y.—The bill re-appropriating $20,000, and making a further appropriation of $12,000 for an iron bridge over the Tonawanda Creek and Erie Canal at this place, has become a law.

Rochester, N. Y.—City Surveyor O. H. Peacock writes: "The matter of establishing a bridge over the river at Court Street has been referred to the City Surveyors for an ordinance authorizing its construction."

Albany, N. Y.—The Canal Board met June 10, and adopted plans and estimates for lengthening Locks 40, 42, 43 and 46 on the Erie Canal, Locks 8 and 12 on the Oswego Canal, and for partially rebuilding Lock 1 on the Black River Canal. The Board also adopted plans and estimates for placing machinery in the locks to be lengthened on the Erie Canal, for rebuilding a bridge over the Erie Canal, required by the lengthening of Lock 42, and for building a stone culvert at James Street, Rome. The original contract for lengthening Lock 42, Erie Canal, was abandoned.

New Haven, Conn.—Civil Engineer J. E. Budington has submitted plans for a stone bridge at Springside Farm, New Haven, to connect Wintergreen and Springside Avs.

Shrpherdstown, W. Va.—Reports say that a steel bridge is to replace the wooden structure over the Potomac River, which has been damaged by recent floods.

Evansville, Ind.—An iron bridge is to be erected over Pigeon Creek, at Ohio Street, by the County Commissioners.

Huntington, Conn.—It is reported that New Haven and Fairfield Counties will, jointly, build an iron bridge over the Housatonic River, at this place.

Grand Rapids, Mich.—Reports say that a bridge is to be erected over the river at Lyons Street, this city.

Lancaster, Pa.—A bridge is to be erected over the Octoraro River, at Little Britain Township by the Commissioners of Lancaster and Chester Counties.

Logan, Iowa.—Reports say that two iron bridges will be erected over the Snake River, at this place.

Hackensack, N. J.—Iron bridges are to be erected over the Saddle River, at Garfield.

Middletown, N. Y.—The City Engineer has been instructed to prepare specifications for two bridges, to be built here.

Pikeville, Ky.—Regarding the projected bridge over the Big Sandy River, at this place, Town Clerk C. M. Parsons writes: "We have our charter from the Legislature of Kentucky and books open for stock. We hope to be able to begin work soon, yet the work is not yet let to contract. Would be glad to receive bids at any time before letting from contractors."

Cincinnati, O.—East Cumminsville citizens have petitioned the Board of Public Works to build a bridge over Mill Creek for vehicles and pedestrians.

Grand Rapids, Mich.—Our correspondent writes: "The G. R. & I. R. R. Co. has secured plans for a new double-track iron railroad bridge which they will build shortly to replace an old wooden one now in use in this city, spanning Grand River at a point where it is about 500 or 600 feet wide No further particulars are known, except that no estimates have been made as yet."

Minneapolis, Minn.—Bids have been received for the bridge over the railroad tracks at Second Avenue, as follows on the iron superstructure: Milwaukee Bridge Company, $35,370; Canton Wrought Iron Bridge Company, $38,900; Shiffler Bridge Company, Pittsburg, $40,600; Chicago Bridge and Iron Company, $35,518; Keystone Bridge Company, Pittsburg, $43,600; King Bridge Company, Cleveland, $43,000; Wisconsin Bridge Company, Wauwautosa, $39,257; South Bridge Company, Toledo, O., $42,489; Fair, William & Co., Ottumwa, Iowa, $33,900, informal.

There were four bidders on the substructure, as follows: Granite, per cubic yard, $35; Mankato stone, per cubic yard, $11; piling, per lineal foot, $0.26; lumber, per thousand, $20; excavation, per yard, $1.

The bridge will be of iron, will include four spans 506 feet in length, with a roadway of 18 feet, and walks 6 feet wide on either side.

Bids were also opened for the substructure of the new bridge on Fifteenth Avenue southeast, and Ring & Tobin were awarded the contract, their bid of $8 per cubic yard for the masonry, or a total of $8,080. The grading for this bridge, 15,000 cubic yards, was awarded to E. F. Comstock & Co., at 16 cents per cubic yard, or a total of $2,400.

Guttenberg, N. J.—A number of surveyors have been engaged in surveying the bluffs of the Palisades at Guttenberg to secure a landing for the western end of the proposed North River Bridge. The plans are nearly completed.

Paterson, N. J.—Town Clerk William Nelson writes: "A committee has been appointed to confer with a similar committee of the Bergen County board regarding the projected bridge over the Passaic at Thirty-third Street; the latter board has just appointed a committee. The Passaic board has authorized a committee to solicit bids for a new iron bridge across the Passaic River at Little Falls, to take the place of the old covered wooden bridge at that place. It is to be in one span, about 140 feet long."

McKeesport, Pa.—It is probable that the Port View Bridge Company's foot and wagon bridge to span the Youghiogheny River at the foot of Thirteenth Avenue will be built soon. Frederick Wilson, the Secretary of the company, states that the directors will at once arrange to have plans and specifications for the structure prepared.

Duluth, Minn.—Engineer A. P. Boller writes that the plans and specifications for the foundation and masonry for the new bridge across the canal will soon be ready, and that he will arrange for plans to be seen either at his office in New York or at the office of the Board in this city. Plans will be ready and advertised so that bidders will be able to make tenders by the first of July.

Leavenworth, Kan.—There is a project on foot in this city favoring the erection of a viaduct over the Missouri Pacific tracks, the estimated cost of which is $30,000.

Brooklyn, N. Y.—The Park Commissioners opened proposals June 11 and made awards for the erection of a bridge over an arm of the lake in Prospect Park. The foundation is to be of granite and concrete and the superstructure of iron work. The bidders for all the work are as follows: The King Iron Bridge and Manufacturing Company, $53,758; Harris & McGuire, $54,797; L. E. Brown, agent, $55,700; Poulson & Eger, $60,693; John J. Hopper, $52,925. For the iron work separately there were bids as follows: Wallis Iron Works, $15,542; Poulson & Eger, $18,100; Post & McCord, $18,580. There were separate bids for the stone work as follows: The King Iron Bridge and Manufacturing Company, $36,758; L. E. Brown, $37,100. The Commissioners awarded the contract for the iron work to the Wallis Iron Company, of Jersey City, at $15,542, and the contract for the stone work to L. E. Brown, builder, Brooklyn, N. Y., at $37,100.

Sioux City, Iowa.—Reports say that a pontoon bridge is to be erected over the Missouri River at this place, by the Pacific Short Line.

Augusta, Ga.—A bridge is proposed over the canal at Broad Street.

Front Royal, Va.—Reports say that the Front Royal and Riverton Improvement Company will build one or more iron bridges.

Houston, Tex.—It is proposed to connect the Second and Fifth Wards by a bridge.

Buncombe County, N. C.—It is said that two bridges are to be placed over the French Broad River and one over Cave Creek in this county. The Board of Magistrates can furnish details.

Bridges.—See our Proposal Columns for information regarding bridge construction at the following places: Pembina, N. Dak.; Eureka, Cal., Alder Point, Cal.; Mitchell, Dak.; Lynchburg, Va.; Boston, Mass.; Duluth, Minn; Evansville, Ind.

NEW DEPOTS.

Pittsburg, Pa.—New freight depots and round houses will be erected and other improvements, to cost $400,000, will be made in this city by the Baltimore and Ohio Railroad Company.

STREET-WORK AND PAVING.

Akron, O.—Considerable brick paving will be done this summer. For further information address City Engineer, Akron, O.

Grand Rapids, Mich.—Our correspondent writes: "Grand Rapids is likely to profit in the near future from the present agitation concerning new paving. Some action affecting several thousand feet of streets will very likely be taken shortly."

Montreal, Can.—Reports say that the City Council has decided to borrow $10,000,000, to be devoted to harbor improvements and permanent road works.

St. Paul, Minn.—The Arlington Hills Citizens' Union will petition the Council to open Payne Avenue for travel from Joy Street to White Bear road, and to pave and curb Bradley Street from Seventh to Decatur, out Decatur to Payne and along the latter street to Jessamine.

Scranton, Pa.—Numerous streets are to be paved. Address the City Engineer for details.

Amsterdam, N. Y.—All the proposals for the paving of Market Street, recently opened, have been rejected as being excessive. New bids will soon be wanted. Address Clerk of the Common Council for particulars.

PHILADELPHIA, PA.—The Sub-Committee on Improved Pavements, of Councils' Highway Committee, has decided upon the distribution of the $180,000 appropriated out of the permanent loan for repaving with improved pavements streets not occupied by passenger railways.

BIRMINGHAM, ALA.—The contract for paving Main Street, this place, has been awarded to C. W. Blakeslee & Sons, of New Haven. The figure was not made public.

LEAVENWORTH, KAN. — A boulevard is proposed for this city. Address Col. C. S. Chase, as above for particulars.

RAILROADS, CANALS, ETC.

NEW PHILADELPHIA, O.—The Pennsylvania Railroad Company has decided to extend the Tuscarawas branch, beginning at Bayard, on to Dennison.

GAS AND ELECTRIC-LIGHTING.

PITTSFIELD, MASS.—Reports say that the directors of the Pittsfield Gas Company have contracted with the United States Gas Improvement Company, of Philadelphia, Pa., for a water-gas plant, to cost $30,000.

MEMPHIS, TENN.—The Voltaic Electric Manufacturing and Supply Company has been incorporated here, with a capital stock of $1,000,000. Incorporators: J. W. Allison, R. M. Stratton and others.

JOHNSTOWN, N. Y.—The Board of Trustees has closed a contract with the Johnstown Power Company to light this village for a term of two years with 2,000 candle-power arc lights at $75 per light per year, the company to furnish 50 lamps or more if needed.

ELSWORTH, ME.—The electric light plant at this place has changed hands, and is to undergo extensive improvements.

PENN YAN, N. Y.—The contract for public lighting has been awarded by the Board of Trustees to Messrs. C. and H. Russell, at $3.300 per annum for 45 arc lights to burn all night.

FAIRMONT, W. VA.—This place is to have electric lights.

CHICAGO, ILL.—The Worrall Electric Construction Company has been incorporated here with a capital stock of $500,000, to construct and maintain electric plants. Incorporators, C. E. Gaylord, M. J. Frost and others.

KITTANNING, PA.—This place is to have electric lights.

TOLEDO, O.—The Toledo Electric Light Company is to enlarge its plant.

OMAHA, NEB.—An electric lighting plant is to be established at this place.

ELIZABETH, PA.—A plant is to be established at this place by the Elizabeth Electric Light, Heat and Power Company. Proposed outlay, $10,000.

SCRANTON, PA.—The South Side Electric Light, Heat and Power Company has been incorporated at this place, with a cash capital of $12,000.

PASO ROBLES, CAL.—The Central Milling Company, of this place, will put in an electric light plant in connection with its new flouring mill, and will light the city.

DAYTON, ORE.—The electric light plant at this place, which was recently destroyed by fire, is to be re-established.

TECUMSEH, MICH.—The Tecumseh Electric Light Company has been incorporated at this place. Capital, $30,000.

LOUISVILLE, KY.—Efforts are being made to establish an electric light plant at this place.

GARDEN CITY, ILL.—An electric lighting plant is to be established at this place by the Garden City Electric Lighting and Power Company. Estimated cost, $25,000. Address Charles A. Buell, as above.

DETROIT, MICH. — The United Electric Company has been incorporated at this place with a cash capital of $50,000.

KALAMAZOO, MICH.—This city will have 4,000 more incandescent lights.

IRON MOUNTAIN, MICH.—The Iron Mountain Electric Light and Power Company has been incorporated at this place, with a capital stock of $25,000.

CEDARTOWN, GA.—This place is to have electric lights.

ST. PAUL, MINN.—Additional gas mains will be laid here.

BAR HARBOR, ME.—Improvements and extensions are to be made to the plant of the Bar Harbor Illuminating Company.

MORRISTOWN, N. J.—The plant of the local electric light company is to be improved.

SACRAMENTO, CAL.—The Sacramento Electric Construction Company has been incorporated at this place, with a cash capital of $1,000,000. W. Gambs can furnish information.

COPENHAGEN, CAN.—An electric lighting plant, to have a capacity of 10,000 incandescent lamps, is to be established at this place.

LOS ANGELES, CAL.—An electric lighting plant is to be established at this place by the Rhodes & Keese Electric Company. The proposed expenditure is $25,000. For particulars, address Col. G. Wiley Wells, as above.

CINCINNATI, O.—The directors of the Zoological Garden have decided to put in an electric light plant of 500 incandescent lamps.

ELECTRIC RAILWAYS.—New electric railways will be established, and improvements will be made to those already built. at the following places: Boston, Mass.; Quincy. Mass.; Cincinnati, O.; Sioux City, Iowa.

BIDS OPENED.

MINNEAPOLIS, MINN.—Court House.—The Board of Commissioners of Morrison County has let the contract for the erection of a court house at Little Falls to Foster & Smith, of Minneapolis, at $43,974. There were fourteen bidders, ranging from $42,588 to $59,300.

GOVERNMENT WORK.

WASHINGTON, D. C.—The following proposals for the construction, etc., of new naval vessels were opened June 10 by the Secretary of the Navy: For the 8,100-ton ship, the Union Iron Works of San Francisco, $3,100,000 on the plans of the department, or $3,000,000 on the bidders' plans; the William Cramps & Sons' Shipbuilding Company of Philadelphia, $3,150,000 on department's plans, $2,985,000 on the bidder's plans; the Risdon Iron and Locomotive Works of San Francisco, $3,450,000 on the department's plans.

One bidder put in an estimate on the 5,500-ton vessel, the Union Iron Works of San Francisco, whose bid was $1,796,000 on the plans of the department, or $1,760,000 on their own plans.

For the practice vessel two bids were received: F. W. Wheeler & Co., West Bay City, Mich., $245,000; the Samuel L. Moore and Sons Company of Elizabethport, N. J., $250,000. No awards were made.

PITTSBURG, PA.—Synopsis of bids for iron furring, lathing and plastering the U. S. Court House, etc., at this place, opened by the Supervising Architect of the Treasury Department:

BIDDERS.	For plaster throughout, with wire cloth expanded, metal or corrugated iron lathing.	Adamant throughout, with finish coat, using metal lathing.	Adamant throughout, without finish coat, using metal lathing.	Adamantine, with finish coat, first story; plaster throughout all other stories.	Adamantine, without finish coat, first story; plaster throughout all other stories.
H. & I. Mellon New York......	$38,621.00	$58,943.00	$47,500.00	$45,752.00	$40,572.00
David B. Morris, New York....	85,000.00	91,000.00	88,000.00	86,000.00	85,000.00
F. Lingenfelser, Pittsburg, Pa..	71 000 00	78 000.00	74,798.00	72,698.00	71,873.00
R. S. Halderman, Chicago, Ill...	35,917.00	40,900.00	36,825.00	36,560.00	36 025.00
M. P. Scully, Cincinnati, O......	37,800.00	41,600.00	39,000.00	38,200.00	37,900.00

PORT TOWNSEND, WASH.—Synopsis of bids for stone and brick masonry for the superstructure of the United States Custom House, etc., at this place, opened by the Supervising Architect of the Treasury Department: C. P. Wakeman & Co., $93,754.62; Jos. Summers, $99,720; Ritter, Harlin & Mattill, $72,500.

INDUSTRIAL.

CUMBERLAND GAP, TENN.—The East Cumberland Gap Land Company is reported to have employed Col. George E. Waring, Jr., Newport, R. I., and Messrs. Wright & Wood, of Knoxville, Tenn., to plan and lay out a new town near this place.

Mr. William B. Bigelow, architect, No. 52 Broadway, is making plans for a hotel to accommodate 500 guests.

Mr. John Dufais, No. 337 Fourth Avenue, is making plans for a casino, to cost $5,000, and a sanitarium, with a capacity for 100 patients. A topographical survey of the ground is now being made by Waring, Chapman & Farquhar, under whose direction the work of construction will be prosecuted. No bids have yet been let.

MIDDLESBOROUGH, KY.—The Harrogate Land Company, owning about 700 acres, is laying out, under the direction of Colonel Waring, an ornamental village, as a residence for the business men and manufacturers of Middlesborough. The work of laying out and grading streets, water supply, sewerage, etc., will be under the direction of Waring, Chapman & Farquhar.

GREENSBOROUGH, N. C.—The North Carolina Steel and Iron Company of this place are laying out a manufacturing town with an area of 2,000 acres, with streets, walks, business, manufacturing and residence sites. George E. Waring, Jr., has been employed as consulting engineer.

WANTED.

TOO LATE FOR CLASSIFICATION.

WANTED—AN ARCHITECTURAL Draughtsman, competent to take charge of office work. Only those wishing to make long engagement need apply. If contract is made, traveling expenses will be paid. J. W. STEVENS, Architect, St. Paul, Minn.

PROPOSALS.

(Continued from page i.)

Notice to Water-Works Tunnel Contractors.

SEALED PROPOSALS WILL BE RECEIVED at this office until FRIDAY, June 20, 1890, at 10:30 o'clock A. M., for furnishing all materials and doing all the work necessary and required to construct a **WATER-WORKS TUNNEL** seven and one-half (7½) feet in diameter out three thousand (3,000) feet under Lake Michigan, including two (2) shafts, wells and crib, according to plans and specifications on file in this office.

Bidders will submit their bids in accordance with the terms of the specifications.

Work to be completed on or before the 1st day of June, 1891, failing in which the contractor shall pay to the city of Milwaukee, as liquidated damages, the sum of $700 per day for each and every day's delay in completing the contract.

Bonds to accompany bids required in the penal sum of $40,000, signed by two sureties, or in lieu thereof the bidder may deposit with the Board of Public Works the sum of $20,000 in money or certified check.

Sureties must be residents of this city.

All bids must be stated in writing and figures.

All moneys deposited will be returned to unsuccessful bidders on award of contract, and to successful bidders when contract is entered into.

Before the award of the contract the Board of Public Works must be satisfied of the ability and facilities of the successful bidders to perform the work according to the terms of the specifications and this advertisement.

The Board of Public Works reserves the right to reject any or all bids.

Dated MILWAUKEE, June 3, 1890.

G. H. BENZENBERG,
G. DUNCK.
W P. O'CONNOR,
G. P. TRAEUMES,
Commissioners of Public Works.

Countersigned:
FRED. F. WILDE,
Deputy Comptroller.
2

To Contractors.

SEALED PROPOSALS WILL BE RECEIVED by the Board of Public Works in and for the corporation of the CITY OF DULUTH, MINNESOTA, at their office in said city up to July 1st, 1890, for constructing the **PIERS AND FOUNDATIONS** of a draw bridge over the Ship Canal across Minnesota Point, Duluth. Plans and specifications may be seen at the office of said Board, on and after June 15, where form of contract and of tender may also be obtained.

Plans, specifications, and forms may also be seen at the office of Alfred P. Boller, Consulting Engineer, 71 Broadway, New York.

Bids will be received only from contractors who are experienced in the class of work called for, and the Board reserves the right to reject any or all proposals.

MYRON BUNNELL,
Pres. Board of Public Works.
Official: GEO. T. HUGHES, Clerk.
3

PROPOSALS.

PROPOSALS FOR WATER-WORKS.

SEALED PROPOSALS ADDRESSED TO the City Clerk will be received by the city of GALESBURG, ILL., until 5 o'clock P. M., July 1, 1890, for furnishing materials and labor, and doing the work required to build a system of **WATER-WORKS** in and for said city. Proposals will be received for the whole or the separate portions of the work, and the plans and specifications may be seen at the office of the City Clerk or at the office of the Engineer in Chicago after June 24th.

Accompanying each proposal must be a certified check payable to the city of Galesberg, Ill., or its equivalent, for $500.00, as a guarantee that the bidder will enter into and execute the contract awarded him and which deposit will be forfeited if he fails so to do.

The right is reserved to reject any or all bids.
By order of the City Council.

JOHN. C. STEVENS,
City Clerk.

CHESTER B. DAVIS, Engineer,
549 Rookery Building, Chicago, Ill.

Notice to Contractors.

SEALED PROPOSALS WILL BE RECEIVED by the Board of Directors of the North Hudson Driving Park Association, at their office, No. 113 Hudson Street, HOBOKEN, N. J., until 7.30 P. M., June 19, for **GRADING** the infield of the Guttenberg Race Track at North Bergen, N J. Plans and specifications can be seen, and all information obtained at the office of Messrs. BEYER & McCANN, Civil Engineers and Architects, Hudson Place, Hoboken.

JUNE 10, 18 0.

SEALED PROPOSALS WILL BE RECEIVED at the office of the Supervising Architect, Treasury Department, Washington, D. C., until 2 o'clock P. M., on the 21st day of June, 1890, for furnishing and delivering at freight depot, in city where required, **FIRE-PROOF SAFES, ETC.**, required for the U. S. Government Buildings at the following cities: Atlanta, Ga., Augusta, Me., Cleveland, O., Columbus, O., Concord, N. H., Des Moines, Iowa, Jackson, Tenn., Knoxville, Tenn., Kansas City, Mo., Lincoln, Neb., Lexington, Ky., Minneapolis, Minn., Newark, N. J., New Haven, Conn, Oshkosh, Wis., Omaha, Neb., Reading, Pa., St. Paul, Minn., Shreveport, La., Toledo, O., and Utica, N. Y., in accordance with the specification, copies of which may be had on application at this office. Bids for one or all the safes required must be accompanied by a certified check for $100. The Department will reject all bids received after the time fixed for opening the same; also, bids which do not comply strictly with all the requirements of this invitation. Proposals must be sealed and indorsed "Proposal for Safes for Government Buildings," and addressed to JAS. H. WINDRIM, Supervising Architect.
3

JUNE 7, 1890.

SEALED PROPOSALS WILL BE RECEIVED at the office of the Supervising Architect, Treasury Department, Washington. D. C., until 2 o'clock P. M., on the 27th day of June, 1890, for furnishing and putting in place complete the iron floor, ceiling and roof construction, iron columns with terra-cotta covering, brick and terra-cotta floor and ceiling arches, sky-lights, constructive iron work of stairs, wood sheathing, terra-cotta tiles, slate and copper work of roofs, down pipes, etc., required for the U. S. Court House and Post Office Building at BIRMINGHAM, ALABAMA, in accordance with the drawings and specification, copies of which may be had on application at this office and the office of the superintendent. Each bid must be accompanied by a certified check for $100. The Department will reject all bids received after the time fixed for opening the same; also bids which do not comply strictly with all the requirements of this invitation. Proposals must be sealed and indorsed "Proposal for Iron Floors, Ceiling and Roof Construction, Iron Work of Stairs, Etc., of the U. S. Court House and Post Office Building at Birmingham, Ala.," and addressed to JAS. H. WINDRIM, Supervising Architect.
3

MAY 28, 1890.

SEALED PROPOSALS WILL BE RECEIVED at the office of the Supervising Architect, Treasury Department, Washington, D. C., until 2 o'clock P. M. on the 21st day of June, 1890, for the erection and completion (except approaches and heating apparatus), of the U. S. Court-House and Post-Office building at STATESVILLE, N. C., in accordance with drawings and specification, copies of which may be had on application at this office or the office of the Superintendent. Each bid must be accompanied by a certified check for $500. The Department will reject all bids received after the time fixed for opening the same; also, bids which do not comply strictly with all the requirements of this invitation. Bids must be inclosed in an envelope, sealed and indorsed, "Proposal for the erection and completion (except approaches and heating apparatus) of the U. S. Court-House and Post-Office building at Statesville, N. C.," and addressed to JAS. H. WINDRIM, Supervising Architect.
2

JUNE 4, 1890.

SEALED PROPOSALS WILL BE RECEIVED at the office of the Supervising Architect, Treasury Department, Washington, D. C., until 2 o'clock P. M. on the 28th day of June, 1890, for all the **LABOR AND MATERIALS** required in the erection and completion of the U. S. Court-House and Post-Office building at TEXARKANA, ARK.-TEX. (heating apparatus and approaches not included), in accordance with the drawings and specification, copies of which may be had on application at this office or the office of the Superintendent. Each bid must be accompanied by a certified check for $500. The Department will reject all bids received after the time fixed for opening the same; also, bids which do not comply strictly with all the requirements of this invitation. Proposals must be sealed and indorsed "Proposal for the erection and completion (except heating apparatus and approaches) of the U. S. Court-House and Post-Office building at Texarkana, Ark.-Tex.," and addressed to JAS. H. WINDRIM, Supervising Architect.
2

PROPOSALS.

BRIDGE, Evansville, Ind.—Proposals are wanted until July 18, for the construction of a wrought-iron bridge over Pigeon Creek. Address James D. Prrvin Auditor, as above.

BUILDING, West Cleveland, O.—Proposals are wanted until July 3, for the erection of a school building at this place. Address G. T. Brooks, Clerk Board of Education, as above.

WATER-WORKS, Vermillion, S. Dak.—Proposals are wanted, no date specified, for constructing a system of water-works at this place. Address F. N. Burdick, Mayor, as above.

SEWERS, Trenton, N. J.—Proposals are wanted until June 17, for constructing an intercepting sewer at this place. Address J. C. Owens, City Clerk, as above.

SEWERS, Brooklyn Village, O.—Proposals are wanted until June 30, for constructing sewers in certain streets. Address C. N. Collins, Village Clerk, as above.

SEWERS, Columbus, O.—Proposals are wanted until June 20, for constructing sewers in certain streets. Address F. M. Senter, Board of Public Works, as above.

BUILDING, Alpena, Mich.—Proposals are wanted until June 25, for the erection of a brick and stone school building at this place, Address Secretary Board of Education, as above.

SEWERS, Syracuse, N. Y.—Proposals are wanted until June 16, for the construction of certain sewers. Address H. F. Stephens, City Clerk, as above

PAVING, Syracuse, N. Y.—Proposals are wanted until June 23, for paving numerous streets. Address H. F. Stephens, City Clerk, as above.

SEWERS, St. Paul, Minn.—Proposals are wanted until June 23, for the construction of certain sewers. Address J. T. Kerker, Clerk Board of Public Works, as above.

STREET WORK, Dennison, O.—Proposals are wanted until June 30, for the improvement of numerous streets. Addrees James Spruceband, Council Clerk, as above.

SEWERS, Jersey City, N. J.—Proposals are wanted until June 16, for the construction of certain sewers. Address George T. Bouton, City Clerk, as above.

PAVING, Martin's Ferry, O.—Proposals are wanted until July 3, for paving certain streets here. Address R. F. Allenda, City Clerk, as above.

PAVING, Clinton, Iowa.—Proposals are wanted until July 1, for paving numerous streets of this place. Address Peter Matzen, City Auditor, as above.

WATER PIPE, Rochester, N. Y.—Proposals are wanted until June 20, for furnishing a quantity of water-pipe, special castings, etc. Address Thomas J. Neville, City Clerk, as above.

PAVING, Jersey City, N. J.—Proposals are wanted until June 16, for doing certain paving. Address George T. Bouton, City Clerk, as above.

SPECIAL CASTINGS, Montreal, Can.—Proposals are wanted until June 24, for furnishing a quantity of special castings. Address B. D. McConnell, Water-Works Superintendent.

DRAINS, ETC., New York City.—Proposals are wanted until June 18, for the excavation and removal of rock and earth, furnishing materials and constructing the drains and receiving-basins, furnishing the materials and laying the drain pipe, in connection with the Metropolitan Museum of Art in the Central Park; the whole in accordance with the plans, specifications and architect's directions therefor. Address the Department of Public Parks, 49 Chambers Street, as above.

SEWERS, Rochester, N. Y.—Proposals are wanted until June 20, for the construction of certain sewers. Address Thomas J. Neville, City Clerk, as above.

PAVING, Rochester, N. Y.—Proposals are wanted until June 20, for paving numerous streets. Address Thomas J. Neville, City Clerk, as above.

REMOVAL OF WRECK, Philadelphia, Pa.—Proposals are wanted until July 10, for the removal of the wreck of the schooner "General W T. Sherman," lying in Delaware Bay. Address Major C. W Raymond, U. S. A., as above.

PAVING, Quebec, Can.—Proposals are wanted until June 18, for paving certain streets at this place. Address W. D. Baillairge, Assistant City Engineer, as above.

WATER-WORKS, Hughesville, Pa.— Proposals are wanted, no date specified, for constructing a complete system of water-works. Address J. K. Reshel, President Hughesville Water Company, as above.

PIERS, Duluth, Minn.— Proposals are wanted until July 1, for constructing the piers and foundations of a drawbridge over the Ship Canal, across Minnesota Point, at this place. Address Myron Bunnell, President Board of Public Works, as above.

STREET WORK, Brooklyn, N. Y.—Proposals are wanted until June 19, for flagging, etc., certain streets at this place. Address John P. Adams, Commissioner of City Works, as above.

SCHOOL BUILDING, Harshman, O.—Proposals are wanted until June 30, for the erection of a school house. Address Otto Gemin, Clerk of the Board of Education, as above.

Building Intelligence.

NEW YORK.

178 Essex st, br flat; cost, $16,000; o, G W Folsom; a, J M Farnsworth.

56 Prince st, br and s warehouse; cost, $20,000; o, Chesebro & Whitman; a, M Heusel.

BUILDING INTELLIGENCE.
NEW YORK.—Continued.

47–49 Morton st, br flat; cost, $100,000; o, Mary E McLaughlin; a, F Ebeling.

118 Ridge st, rear, br workshop; cost, $7,000; o, H W Frankel; a, Horenburger.

86 E 9th st, br workshop and store; cost, $16,000; lessee, m and c, Hattie K Hilton; a, F G de Lachan.

412–14 W 49th st, 2 br and s flats; cost, $20,000 each; o, m and c, Dick & McKelvey; a, M V B Ferdon.

215 W 31st st, br and s flat; cost, $18,000; o, Mary Wilson; a, J W Cole; b, J Sheridan.

264–66 W 39th st, 2 s flats; cost, $23,000 each; o and b, J Devlin; a, J W Cole.

9th av, 25 n 48th st, 2 br flats; cost, $25,000 each; o, Mary J Walsh; a, J H Valentine; m and c, J Walsh.

77th st, n s, 70 w Madison av, 4 br and s dwells; cost, $12,000 each; o, Trustee J L Kipp; a, Hubert, Pirsson & Hoddick; m, Deeves & Bro; c, Mandeville & Son.

105th st, s s, 180 w 4th av, 3 s flats; cost, $18,000 each; o, F Moran; a, A Spence.

120th st, s s, 125 e 5th av, br and s flat; cost, $30,000; o, Mary McManus; a, J H Valentine; c, P H McManus.

436–38 E 121st st, 2 br flats; cost, $22,000 each; o, C Biersack; a, H Horenburger.

Park av, s w cor 93d st, 5 br and s flats; total cost, about $110,000; o, Downey & Curry; a, A I Finkle.

2d av, e s, 75 n 80th st, 2 br and s flats; cost, $20,000 each; o, M Solomon; a, A Spence.

77th st, s s, 115 w 10th av, br stable; cost, $10,000; o, W D Ellis; a, R S Townsend.

124th st, s s, 75 w Lenox av, 3 s flats; total cost, $42,000; o, Flood & Van Note; a, F S Barus.

8th av, e s, 50 s 126th st, br club house, etc; cost, $14,500; o, P Byrne and ano; a, J C Burne.

137th st, s s, 125 e Lincoln av, 2 br flats; cost, $16,000 each; o, Mary E Yost; a, A Spence.

Cauldwell av, e s, 147.8 s Boston av, 2 fr dwells; cost, $5,200 each; o, Beckley & Hargreaves; a, C C Churchill.

Southern Boulevard, n e s, 50 s e Decatur av, fr dwell; cost, $7,000; o, Welthea C Smith; a, E K Bourne; m, W Hargrave; c, G W Tompkins.

S s 95th st, 100 w 9th av, 2 br flats; cost, $32,000 all; o and a, F G Butcher.

S s 99th st, 225 w 8th av, 2 br flats; cost, $44,000 all; o, E B Chace; a, J C Burne.

S e cor Willis av and 138th st, br flat; cost, $18,000; o, P H McManus; a, J A Webster.

E s Willis av, 25 s 130th st, 3 br flats; cost, $42,000 all; o and a, as above.

N w cor 150th st and Edgecourt av, br dwell; cost, $25,000; o, N C Bensinger; a, W Schickel & Co.

59 Madison st, br club house; cost, $15,000; o, P Divver Asso.; a, J S O'Meara.

27–29 Pike st, 2 br flats; cost, $50,000 all; o, J L Butteweiser; a, G A Schillinger.

N s 70th st, 125 w av, br stable; cost, $11,000; o, W B Baldwin; a, G F Pelham.

412–414 W 29th st, 2 br flats; cost, $38,000 all; o, J Weil, B Mayer; a, as above.

N e cor Madison av and 23d st, br office bldg; cost, $750,000; o, Metropolitan Life Ins. Co; a, N Le Brun & Son.

194 Chrystie st, br store; cost, $14,000; o, Weil & Mayer; a, Schneider & Herter.

S s 133d st, 335 w 8th av, 6 br flats; cost, $114,000 all; o, J Wicks; a, E Wenz.

Bainbridge st, 240 w Southern boul, br convent; cost, $70,000; o, Ursuline Convent, a, T H Poole.

88 Cortlandt st, br hotel; cost, $18,000; o, P Wilkins; a, J Kastner.

173 Madison st, br flat; cost, $17,000; o, J L Butteweiser; a, R S Pollock.

Waverly pl, n e cor Green st, br store; cost, $285,000; o, J C Lyons; a, Buchman & Disler.

N s 85th st, 90 w West End av, 3 br dwells; cost, $45,000 all; o, G J Cohen; a, R S Townsend.

N s 160th st, 100 e Morris av, fr dwell; cost, $7,500. o, J L Cavanaugh; a, G E Harding Co.

125th st, s s 250th e 7th av, br store; cost, $200,000; o, H C F Koch; a, W H Heume.

BUILDING INTELLIGENCE.
NEW YORK.—Continued.

N s 43d st, bet 5th and 6th avs, br club house; cost, $250,000; o, Racquet and Tennis Club; a, C L W Eidletz.

Broad st, n e cor Pearl st, br office bldg; cost, $250,000; o, Metropolitan Telegraph and Telephone Co; a, same as above.

27th and 28th sts and 11th and 13th avs, br storage bldg; cost, $650,000; o, W W Rossiter; a, G B Malory.

161 w 19th st, br stable; cost, $20,000; o, M Straus; a, H J Hardenburg.

N s Vyse st, bet Boston & Newark avs, fr school; cost, $7,723; o, Grace Church; a, S G Slocum.

N s 82d st, 325 e 10th av, 6 br dwells; cost, $75,000 all; o, McDowell & Henry; a, same as above.

ALTERATIONS—NEW YORK.

116 st, s w cor Park av, br flats; cost, $125,000; o, C Daly; a, W H C Hornum.

291–93 Bowery, cellar and 3-story extension; cost, $10,000; o, J Stimmel; a, L F Heinecke; m, J Schoffler.

1732 Madison av, repair damage by fire; cost, $7,000; o, R Maywald; a, F Ebeling; c, R Hacket.

762–66 Broadway, raised two stories, seven-story extension; cost, $75,000; o, S Dessau; a, Schneider & Herter.

524–28 W 43d st, repair damage by fire; cost, $20,000; o, J A Weser; a, J J Smith.

66 W 72d st, extension, interior alterations, walls altered and new elevator; cost, $10,000; o, Charlotte H Dickinson; a, J M Lawlor; m, A C Brown; c, J J Brown.

BROOKLYN.

Cornelia st, n s, 200 w Bushwick av, 3 fr (br filled) dwells; total cost, $9,000; o, John H Garrison.

N s Cornelia st, 200 w Bushwick av, 3 fr dwells; cost, $9,000 all; o, J H Gaynor; a, not given.

E s Washington st, 100 n Riverdale av, 8 fr dwells; cost, $17,600 all; o, P J Callahan; a, P B Marryat.

N e cor n 9th and Roebling sts, fr dwell; cost, $7,000; o. P O'Hara; a, Thomas Engelhardt.

E s Patchen av, 40 n Decatur st, 3 fr dwells; cost, $12,000 all; o and a, G Evans.

S w cor Aberdeen st and Bushwick av, 5 fr dwells; cost, $18,500 all; o, J Reilly; a, F B Langston.

N s Myrtle av, 350 w Lewis av, 6 br dwells; cost, $40,000 all; o, M Hall Reimer; a, Thomas Engelhardt.

E s Stuyvesant av, 70 s Jefferson av, br church: cost, $12,000; o, Grace Presbyterian; a, not given.

N s Myrtle av, 100 e Sumner av, 6 br dwells; cost, $40,000 all; o, M Hallheimer; a, Thomas Engelhardt.

S w cor Butler and Nevans sts, br dwell; cost, $10,000; o, Department of Public Works; a, R L Davis.

E s Marcy av, 75 s of Green av, br dwell; cost, $12,000; o and a, H Fountain.

N s Union st, 100 w 8th av, 5 br dwells; cost, $70,000 all; o and a, E G Gollner.

N e cor Washington and Prospect sts, br dwell; cost, $12,000; o, E G Black; a, W M Coots.

N e cor 3d av and 51st st, fr dwells; cost, $7,000; o, J E Seeba; a, H L Spicer Sons.

Dean st, s s, 400 E Nostrand av, 5 br dwells; cost, 35,000 all; o, C J Hastings; a, W H Burhaus.

Central av, s s, 34 n Cornelia st, 8 br dwells; cost, $56,000 all; o, W Hopkins; a, F Holmberg.

N s Dean st, 150 w 6th av, br dwell; cost, $8,000; o, Julia A Feeny and others; a, T F Houghton.

S s VanBuren st, 214 e Lewis av, 3 br dwells; cost, $13,500 all; o, T F Bryant; a, I D Reynolds & Son.

S s President st, 216 e Henry st, br dwell; cost, $8,000; o, G B Dearing; a, F F Houghton.

S s Jefferson av, 225 w Ralph av, 3 b, dwells; cost, $12,000 all; o, S Ayers and C E Palmer; a, owners.

W s 6th av, 60 n 11th st, br dwell; cost, $10,000; o, J Heesch; a, W Wirth.

N s Macon st, 222 w Ralph av, 10 br dwells; cost, $45,000 all; o, R F Clayton; a, W F Clayton.

BUILDING INTELLIGENCE.
BROOKLYN—Continued

E s Bedford av, 75 n Rodney st, br dwell; cost, $8,200; o, C Engert; a, F J Bullenbach.

E s Humboldt st, 100 s Van Cott st, 6 br dwells; cost, $18,000 all; o and a, same as above.

N s Monroe st, 200 e Patchen av, 5 br dwells; cost, $55,000 all; o, R D Robbins; a, H Vollweiller.

E s Central av, 24 n Cornelia st, 8 br dwells; cost, $56,000 all; o, W Hopkins; a, F Holmberg.

N e cor Central av and Cornelia st, 12 br dwells; cost, $20,000 all; o and a, same as above.

N s Cooper st, 218 e B'way, 8 br dwells; cost, $36,000 all; o and a, W McClenahan.

N s St Marks av, 120 e Rogers av, 3 br dwells; cost, $19,500 all; o, H L Chappell and others; a, G P Chappell.

S s Jefferson av, 6 br dwells, cost, $24,000 all; o and a, S J Burrows.

E s B'way, 27 n Vanderveer st, 2 br dwells; cost, $30,000 all; o, W E Cozzens; a, W M Coots.

N e cor Vandeveer av and Broadway, br dwell; cost, $30,000; o, W E Cozzens; a, W M Coots.

N s Broadway, 22 e Cooper av, 2 br dwells; cost, $22,000 all; o, J A Soucks; a, W M Coots.

N e cor Broadway and Cooper av, br dwell; cost, $18,000; o and a, same as above.

S s Macon st, 22 w Ralph av, 10 br dwells; cost, $53,000 all; o, R F Clayton; a, W F Clayton.

S s First st, 100 w 7th av, 4 br dwells; cost, $20,000 all; o, J Kalle; a, R Dixon.

N s St Marks av, 100 e Nostrand av, br dwell; cost, $20,000; o, J Hills; a, G P Chappell.

S s Jefferson av, 95 e Stuyvesant, 4 br dwells; cost, $19,600 all; o, Lambert & Mason; a, I D Reynolds & Sons.

N s 50th st, 120 w 4th av, 3 fr dwells; cost, $7,200; o and a, A Svenlin.

N s Jefferson av, 95 w Stuyvesant, 4 br dwells; cost, $24,000 all; o, W C Bush; a, J E Dwyer.

MILWAUKEE, WIS.— Cor 1st av and Washington st, church; cost, $10,000; o, Southside Baptist Congregation; a, J Douglass; b, Geo Czaplewski.

Michigan and Milwaukee sts, alteration of theatre; cost, $14,000; o, George, Boyd & Lewis; a, W A Holbrook; b, Ellis & Coogan.

Bids will be advertised for in a few days for work on a new $400,000 hotel. H C Koch, architect.

The Hanover St Congregational Church will erect a new building. Address Rev Theo Clifton, as above.

MINNEAPOLIS, MINN.—738–48 E 18th st, 3-story br ten; cost $30,000; o, a and b, A Berg.

1113–15 Washington av, N, br store and ten; cost, $12,000; o, K Goldblum; a, F A Clarke; b, Carl Peterson.

700–04 Marshall st, N E, fr stores and flats; cost, $15,000; o, Frank Shepard; a, Mr Barber; b, Reau & Brude.

1412 Yale pl, fr dwell; cost, $10,000; o, James A Paige; a, Geo M Goodwin; b, A J Sampson.

SIOUX CITY, IOWA.—N w cor Douglas and 13th sts, row of br houses; cost, $45,000; o, Joseph Sampson; a, not let.

4th st, cor Jennings, 5-story office bldg; o, James Rockwell; a, G G Baldwin.

Pearl st, cor 9th st, St Mary's Catholic Church; cost, $40,000; b, Jas P Wall.

Pearl st, cor 16th st, fr res; cost, $18,000; o, R J Chase.

Douglas st, fr res; cost, $21,000; o, R C A Flournoy; a, C P Brown.

Central Park, summer house; cost, $7,000; o, John Pierce; a, same as above.

3-story livery stable; cost, $25,000; o, Geo Westcott; a, G G Baldwin; b, C K Poor.

Flouring mill; cost, $28,000; o, G Y Brown.

An English syndicate will build a beef and pork packing house on the Floyd, to cost $100,000. Walter Strange is their representative, a, Joseph Nicholson, Chicago.

The Union Stock Yards Company will build an exclusive beef packing house, to cost $75,000, to be operated by parties from Nebraska City; a, same as above.

THE ENGINEERING & BUILDING RECORD

AND

THE SANITARY ENGINEER.

A JOURNAL FOR THE ARCHITECT, ENGINEER, MECHANIC, AND MUNICIPAL OFFICER.

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THE SUBWAY PROBLEM IN NEW YORK.

THE serious gas-pipe explosion at the corner of Broadway and Fulton Street, New York, last week, followed within a few days by two underground steam pipe explosions near the same point, has evidently done much to re-awaken a lively public interest in the much-discussed subway question. These latest accidents, while perhaps not much more serious than a large number of others of the same class which have occurred within the past year, have been accompanied by a greater show of outward destruction, and have proved correspondingly more effective in rousing public indignation and clamor for relief.

The conclusion reached in some quarters several years ago, and staunchly upheld by THE ENGINEERING AND BUILDING RECORD, as reference to back volumes will show, that a system of substantial subways to accommodate steam, gas, and water pipes, pneumatic tubes, electric cables, etc., and to provide for sewage disposal, offers the only satisfactory solution of the problem of successfully managing so elaborate a network of underground conduits as is found in a great city like New York, would seem at last to have become generally established, and it ought now require but little additional agitation to have at least preliminary work commenced on a rational subway system. The necessarily heavy expense involved in the construction of one main subway or tunnel for all underground pipes and wires, and the temporary inconvenience which would be entailed by it, have always been more or less effectively urged against the prosecution of such an undertaking. The fact has, however, apparently been lost sight of that in the near future the city would actually be driven to it, and that the lapse of time would only add to the difficulties, dangers and expense of the work.

The present outrageous condition of New York streets and underground work is the natural result of short-sighted policy to which THE ENGINEERING AND BUILDING RECORD has again and again directed attention. Street upheavals menacing the safety of life and property, entailing traffic disturbances of the most serious kind, and an ever present promise that matters would constantly grow worse, have all been of little or no avail in shaping the course of the New York City government so far as this branch of the Public Works Department is concerned. As matters now stand, however, a climax seems near at hand. The latest accident has conclusively shown that the dangers of explosion from defective underground work have, in part, been transferred from the streets to the buildings bordering them, and it is a matter of unpleasant speculation how long it will be before a calamity of yet unrecorded proportions will be added to the already long list of minor street accidents.

The authorities of Paris long since appreciated the necessity of placing their gas and water pipes and electric wires in subways, and their method of utilizing sewers for such a purpose, as illustrated on another page in this issue, will be found suggestive, though for the conditions existing in New York the plan proposed in Col. Julius Adams' report, published in our issue of August 4, 1888, and commented on in the issue of October 6, 1888, is more in the line of what will ultimately have to be carried out in New York. As we have frequently stated no time should be lost in taking steps to restrict each industry to one set of pipes in the lower part of the city—and in the matter of gas insisting that they shall have thoroughly sound mains and services—which, under present conditions, it seems impossible to secure or at least maintain.

ABOLITION OF HORSE CARS IN NEW YORK.

THE Court of Appeals of New York State have rendered a decision that permits any street railway company in the State to change its motive power from horses to cables or electricity by obtaining consent of half the property owners along its route, and without the consent of the local authorities.

This confirms the constitutionality of the act of 1889, which provides that any street railway company which has obtained the consent of half the property owners may apply to the State Railroad Commissioners for permission to change its motive power The constitutionality of the act was questioned because it did not include consent of the local authorities as one of the requirements for the change, but the Court decides that such consent is necessary only in the granting of new franchises.

It is announced that the largest two corporations are ready to begin the change to cable traction at once—namely, the Third Avenue road and the Broadway line. The change from horses even to cable traction will, unquestionably, prove a great boon to the citizens of New York.

On the other hand, it is to be regretted that electric propulsion on the storage battery system has not received more favorable consideration. In the light of recent experience this system has shown itself to be, beyond all doubt, the ideal one for street car propulsion, and what has been accomplished with it on the Fourth Avenue line at New York has not unreasonably suggested the possibility of its general application in crowded cities. Underground work in the streets and the consequent tearing up of pavements would be entirely uncalled for by it, a point which alone should favorably commend it. The important matter of cost of operation and maintenance is the only one, we believe, which has been considered as likely to present difficulties, and even this would seem to have been satisfactorily disposed of in the practical tests at New York. It would seem, therefore, that the Railroad Commission should look carefully into this matter before consenting to cable roads in the lower part of the city.

STREET CLEANING IN THE CITY OF LONDON.

WILLIAM HAYWARD, engineer and surveyor to the Commissioners of Sewers of that portion of London, England, known as the "city," in his recently issued report for the year 1889, gives some interesting particulars on the cleaning of the streets within the jurisdiction of the Commissioners.

Briefly summed up, the system, as carried out, involves daily sweeping of the carriage ways, while the main thoroughfares in wet weather are frequently swept twice a day. Besides this, the street orderly system is carried out on all the main, as well as in some of the important secondary, thoroughfares. Altogether about 150 boys and young men are employed for this purpose during the working days of the week. The advantages of this street orderly system are, as might be expected, most apparent in wet weather. The work of cleaning the main thoroughfares often begins at 2 or 3 o'clock in the morning, and is, in nearly all cases, finished by 8 or 9 A. M. The street orderlies commence their work at 7.30 A. M., after the streets have been swept, and cease work at 4.30 P. M.

In addition to this almost continuous cleaning by hand some of the carriageway pavements, when the weather permits or necessity requires it, are washed with jet and hose. The courts and alleys inhabited by the poorer classes are not only cleaned daily, but are also usually washed with jet and hose twice a week between May and the end of October. A few places are, for special reasons, washed nightly throughout the year.

The sidewalks are swept by the Commission whenever it is found necessary, and in wet weather those in the main thoroughfares are cleaned with squillgees during the day.

With so comprehensive a system of street cleaning a good condition of the streets, as regards cleanliness, may reasonably be looked for, and is, no doubt, secured. The street orderly system, in many places, has much to commend it, and might, to great advantage, be given a wider range of application.

BENEVOLENT WORK BY THE INSTITUTION OF CIVIL ENGINEERS.

A NOTABLE instance of work of the incidental kind by an engineering association is given by the report cf Benevolent Fund of the Institution of Civil Engineers in England. The fund was established in 1864, and is managed by a committee of six elected for the purpose, with the President of the institution as chairman *ex officio*. The purpose of the fund is to give assistance to meritorious members of the institution and their families, to the families of deceased members, to persons who have been members five consecutive years and to their families.

The income is from investments of money belonging to the fund and from annual subscriptions. By the annual report for 1889, which has just come to hand, it appears that the amount set apart as permanent capital in 1865 was £22,833, which had increased at the end of 1887 to £25,659. Lord Armstrong proposed in 1888 to add £5,000 to the capital, on condition that other members of the institution contributed a like sum, and the £10,000 addition to the capital made in this way is to be known as the Lord Armstrong Fund. The receipts from annual subscriptions and dividends in 1889 amounted to £2,981, and the grants to £3,070. The capital is now put at £37,506. It would be a graceful act for some one of the pecuniarily successful members of the American Society of Civil Engineers to start a fund for a similar purpose in the United States.

THE BROADWAY CABLE ROAD.

THE Broadway and Seventh Avenue Railroad, of New York City, has applied to the State Railroad Commissioners for permission to substitute cables for horses as motive power. Their plan calls for a duplicate cable system from Central Park to South Ferry, by way of Seventh Avenue, Broadway, Battery Place, and Whitehall and State Streets. The conduit is to be a tube of steel with a ⅝-inch slot at the surface. It will be 2 feet 6 inches deep, and 1 foot 6 inches wide. The conduit will be surrounded by a bed of concrete 6 inches thick. Every 4½ feet there will be an iron frame, or yoke, further supporting the concrete and the rails. Side-bearing rails will be used, and the space between and outside of the rails will be paved with granite blocks resting upon the concrete and iron frames. Every 31½ feet there will be pulley pits, each containing two pulleys for the two cables. The conduits in the two tracks are connected with a manhole between the tracks. A sewer pipe will drain the conduit.

The shafts of the pulleys are to be suppored by bearings having self-oiling attachments, and the rims of the pulleys are to be lined with a composition metal, so as to diminish the noise of the cables. Both slot and track rails are to be of steel, the slot rails to weigh 65 pounds to the yard and the track rails 82 pounds to the yard.

The cable system is stated to be substantially the same as that now in use in Pittsburg and that now being put in in Baltimore and West Chicago, except that this system has two cables and is heavier and stronger in construction. Each cable and its supporting pulleys are entirely independent of the other and its supporting pulleys, so that both cables can be in operation or at rest at the same time, or one in operation and the other at rest. The machinery is so arranged that the cars can be easily and quickly transferred from one cable to the other, and the grips of the cars are made double, so as to take hold of either of the cables as occasion requires.

It is proposed to have an electric signal service for speedily stopping or starting the cables. An insulated wire will run either between the tracks or along the conduits, having signal boxes at short intervals under manhole covers.

ENGINEERING AND ARCHITECTURAL DEGREES CONFERRED.

AT the commencement of the Rensselaer Polytechnic Institute this week the degree of Civil Engineer was conferred upon the following named graduates:

Carl Frederick Adam, Buffalo; William Henry Arnold, Troy; Lawrence Parker Butler, Jefferson Barracks, Mo.; William Dinsmore Card, Pittsburg, Pa.; William Easby, Jr., Media, Pa.; Walter George Filer, Sharon, Pa.; Antonio de Barros Franco, S. Paulo, United States of Brazil; Richard David Gottlieb, Chicago; Bertrand Eugene Grant, Troy; Charles Kirschner, Troy; Antonio Llano, Medellin, Republic of Columbia; Arthur Bernard Mader, Cincinnati; Liberty Gilbert Montony, Troy; Winfield Scott Potter, Brooklyn, N. Y.; Willett George Ranney, Cleveland, O.; K. Oake P. Reinholdt, New Castle, Pa.; Percival Mosley Sax, Nashville, Tenn.; James Wilson Shields, Mt. Pleasant, Pa.; Ogle Tayloe, Warren, Troy.

Cornell University conferred degrees as follows:

Bachelor of Science in Architecture.—Charles Hay Bernheisel, Frank Horton Brown, Clement Benjamin Brun, George Willard Conable, Clarence Ephraim Dobbin, Alexander C. Eschweiler, Edward Thomas Fallows, Arthur Norman Gibb, William T. Sherman Hoyt, Edwin Henry Hulbert, Edwin Augustus May, Floyd Lucien Robinson, Charles Goodwin Sands, Frederick Farley Sewall, George Francis Seymour, William Adam Stevens, Herman Frederick Stuhr, Alexander B. Trowbridge, Henry Wilhelm Wilkinson.

Civil Engineer.—Nelson Seymour Crouch, Joseph Haines Dickinson, Franklin Marcus G. Dood, Albert Edward Duckham, William Jackson, B. S., Herbert Henry Landers, Gustav Frederick Roess, John Franklin Skinner, Clinton Brown Stewart, Bunzo Sugi, William Twining, Thomas McEldeny Vickers, Joel Edward Wadsworth, Robert Bruce Wilcox, Frederick Kelley Wing.

Mechanical Engineer.—Louis Lees Bentley, Ernest Spencer Bowen, P. M. Chamberlain, B. S., Fred Andrew Crossman, William Dalton, Francis Daniel Davis, John Jackson Ewing, Elbert Curtiss Fisher, Ferd Guy Gasche, Victor Ignatius Hahn, Benjamin Marvin Harris, Charles Louis Heisler, William R. Webster, Jr., George Cleveland Hicks, Jr., Wilson Freeman Higgins, Embury Asbury Hitchcock, Edwin Curtis Knapp, Charles Philip Miller, William Stanton Monroe, William Dye Mount, Harry Trevenen Shick, Louis Lincoln Smith, Henry King Spencer, Ernest August Stege, Guy Harold Thayer, Daniel Upton.

Master of Civil Engineering—Ernest Martin Holbrook, C. E.

Master of Mechanical Engineering.—George Ira Alden, B. S.; Arthur Bernard Levy, B. S.; William Wilb. Churchhill, M. E.; Louis Benedict Marks, B. S.; John Joseph Flather, P. B.; Arthur Tannatt Woods.

Mechanical Engineer in Electrical Engineering.—George Hall Ashley, Henry Primm Broughton, Percy Alfred Clisdell, Hayward Cochrane, Joseph Walker Cowles, Samuel B. Fortenbaugh, Frank Fairfield Goodwin, John Eckert Greenawalt, Louis Watres Healy, Arthur Hobart Herschel, Sherwood Johnson Larned, Max Levy, Julius Smith Loomis, Ph. Bell Woodworth, B. S., William Henry Powell, Joseph Cowan Ramage, Eugene Aertsin Rumsey, Harland Aaron Sawyer, Eugene Charles Sickles, William Nelson Smith, Olin Ames Stranahan, Milton E. Thompson, Howard Ford Thurber, William Boardman Tobey, George Hicks Walbridge, Edward H. Waldo, A. B., John Ackroyd West, Jr., Ed. Adam Wilheim.

The Stevens Institute of Technology conferred the degree of Mechanical Engineer upon graduates as follows:

Alberto Atristain, N. F. Lawrence, A. H. Hill, H. M. Brinckerhoff, J. F. Haworth, Shirk Boyer, William N. Carlton, John D. Dehart, Jr., Charles J. Everett, Jr., William Ebsen, E. W. Frazer, William M. Farrar, Eugene E. Hinkle, Sol Fechheimer, Carl Graf, A. R. Whitney, Jr., D. C. Harvey, Harry P. Jones, W. W. Kissam, S. F. Smith, Henry S. Loud, G. A. Trube, G. W. Merritt, Ernest H. Peabody, Louis R. Mendoza, J. T. Westcott, A. B. Moore, Frank Moynan, Alfred Nathan, Walter F. Phelps, Leonard D. Wildman, Francis B. Stevens, Jr., Hugh Wreaks, R. S. Twitchell, Frederick Thuman, George L. Todd, Henry Torrance, Jr., C. W. Trautvetter and E. H. Whitlock.

THE Bowen-Merrill Company, Indianapolis, will publish shortly a useful work for lawyers interested in highway and railroad cases, entitled, "The Law of Roads and Streets," by Byron K. and William F. Elliot. The book will treat of the general principles of the law of roads and streets. It does not deal with statutes, except in an incidental way, but discusses the general rules of law.

ANNUAL CONVENTION OF THE AMERICAN SOCIETY OF CIVIL ENGINEERS.

IT is announced that at the annual convention of the American Society of Civil Engineers, at Cresson, Pa., next week, the President's Address will probably be made Thursday evening. Thursday, Friday, Saturday and Monday will be occupied partly by meetings and partly by excursions by rail to points not far from Cresson, probably including Altoona, Johnstown (Cambria Iron Works) and Bell's Gap. The banquet will be, as now arranged, on Saturday evening. The convention will probably close Monday evening or some time Tuesday, but doubtless many will stay at Cresson several days longer.

The special train leaves Pennsylvania Railroad ferry, foot of Cortlandt or Desbrosses Street, New York City, Wednesday morning, June 25, at 10 o'clock.

A PRESS dispatch says that oil has been discovered along the banks of the Mercer County, O., reservoir, and that two syndicates have been formed to lease the entire tract and bore for oil under the water. The reservoir covers 16,000 acres, and one of the syndicates has offered an annual rent of $48,000 for a ten years' lease. The reservoir is the main feeder of the Miami and Erie Canal, and the only obstacle in the way of perfecting the lease is the fear that the water will become contaminated from the waste oil. It is claimed that a plan to prevent this has been devised, and the syndicate offers to enter into bonds to keep the waste oil out of the water. It is urged that the rent offered would put the entire canal in good condition and make it a strong competitor of the railroads in the carrying trade from Lake Erie to the Ohio River.

OBITUARY.

CAPT. C. M. CLARKE, C. E., of Washington, D. C., is reported to have committed suicide June 14, from mental aberration caused by overwork in the sun.

PERSONAL.

HARRY J. MARCH, of the class of 1887, has been given the honorary degree of Civil Engineer by Rutgers College.

EMORY C. DAVIS, of Northampton, Mass., has been appointed Engineer of the projected improvements in the water-works of Springfield, Mass.

E. L. ACTON, architect, Dayton, O., has moved his office from the Hollencamp Block to the new Newsalt Block, corner of Fourth and Jefferson Streets.

J. F. LEBARON, recently in charge of work on the Nicaragua Canal, has opened an office at 61 Broadway, New York City, as civil and consulting engineer.

THOMAS C. CLARKE has been appointed Chief Consulting Engineer, and William B. Brush Assistant Engineer of the "Greene" Hudson River Bridge Company.

J. J. DEKINDER, C. E., of Philadelphia, Pa., has been invited by the Board of Improvements of Cincinnati, O., to take charge of the city water-works for three months.

JAMES C. BAYLES, of East Orange, N. J., ex-President of the New York City Board of Health, has been given the honorary degree of Doctor of Philosophy by Rutgers College.

CARL W. BUCHOLZ, M. Am. Soc. C. E., has been appointed by President Howell, of the Brooklyn Bridge Company, one of the Board of Experts to examine and report in regard to terminal facilities for the bridge.

GEN. SAMUEL B. HOLABIRD, Quartermaster General U. S. Army, who has served with distinction since his graduation at West Point in that important branch of the service, has been retired, having reached the age of 64. His successor has not yet been appointed.

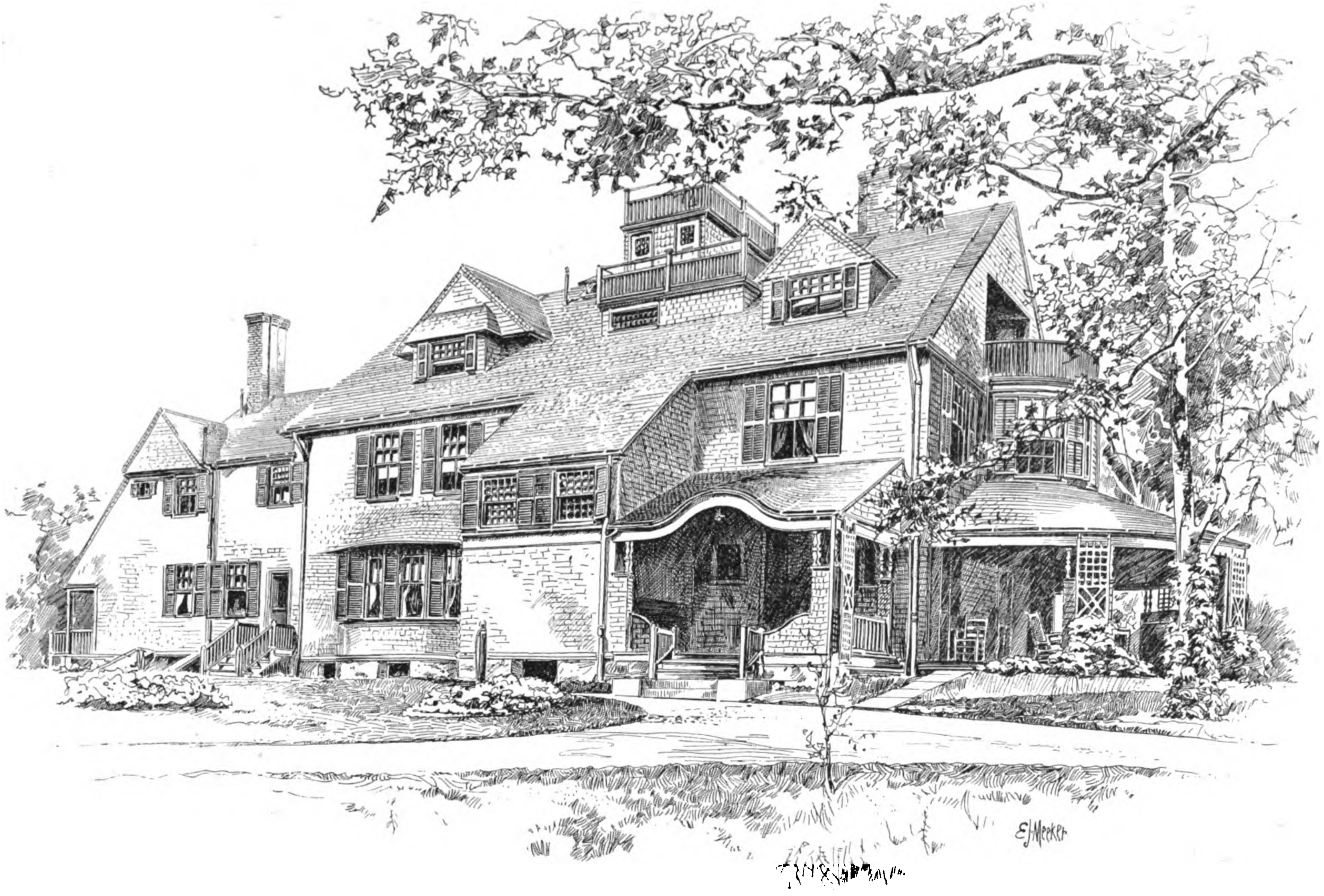
COMING MEETINGS.

THE annual convention of the American Society of Civil Engineers will open at Cresson, Pa., at 10 o'clock Thursday morning, June 26.

OUR ARCHITECTURAL ILLUSTRATIONS.

HOUSE AT MILTON, MASS.
W. R. EMERSON, ARCHITECT, BOSTON, MASS.

TRINITY CHAPEL, CHESTNUT, HILL, PA.
LINDLEY JOHNSON, ARCHITECT, PHILADELPHIA, PA.



THE ENGINEERING AND BUILDING RECORD ILLUSTRATED SERIES.

HOUSE AT MILTON, MASS.

W. R. EMERSON, ARCHITECT, BOSTON, MASS.

NEW YORK. VOLUME XXII.

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ENGINEERING SOCIETIES.

THE ENGINEERS' CLUB OF PHILADELPHIA held a meeting June 7, with Vice-President Wilfred Lewis in the chair; Howard Murphy, Secretary. There were 15 members present and one visitor, William P. Shinn, President of the American Society of Civil Engineers.

The Secretary presented, for Strickland L. Kneass, a description of a New Condensing and Refrigerating System.

THE BOSTON SOCIETY OF CIVIL ENGINEERS had an excursion to Worcester, Mass., June 17, by invitation of Charles A. Allen, City Engineer of that city. There were about 65 members of the Society in the party. Incidentally the party inspected the Cochituate dam now being constructed at Natick, Mass., and also the filtering beds, or sewage farm, connected with the Framingham sewage works. From there the party was conveyed by barges to South Framingham where the train was taken for Worcester, at which place it was received by City Engineer Charles A. Allen and Superintendent of Sewers Richard Forbes. After dining the visitors were conveyed to the new sewage disposal works at Worcester. These works are not yet in operation, so that a good opportunity was furnished to inspect their construction in detail. This system, a description of which appeared in this journal May 10, involves chemical precipitation, the chemicals being mixed in wooden tanks which discharge their contents into the open conduit or raceway through which the sewage flows from the gatehouse on its way to the precipitation tanks. From there, after chemical action has taken place, the sewage finally passes through the effluent channel into the river. For the present it is the intention to pump the sludge into the sludge well, whence it is carried by conduit across the river and discharged in the open ground, where it may be plowed in or possibly pressed into cakes and burned. It is expected to have the system in operation in about two weeks.

After inspecting the works and listening to an explanation of its features the party returned to Boston, having thoroughly enjoyed the trip.

The society held a regular meeting June 18, with Vice-President J. R. Freeman in the chair, S. E. Tinkham, Secretary, and about 55 members and visitors present.

Francis Blake, of Weston, Mass., Frank P. Johnson, of Waltham, Mass., George H. Nye, of New Bedford, Mass., and George C. Stoddard, of Newport, R. I., were elected members. Edward P. Fiske, of Boston, was elected an associate member.

A paper by Hiram F. Mills, C. E., was presented, entitled, "Purification of Sewage by Filtration and by Chemical Precipitation," referring to experiments made in the last few years by the Massachusetts State Board of Health, of which Mr. Mills is a member.*

A short account of the construction of the new sewerage system at Worcester was also given by the City Engineer, Charles A. Allen. Wilbur F. Learned, Assistant Engineer Boston Water-Works, read a paper on the "Chemical Treatment of Sewerage at Winchester, Mass."

Discussion followed each paper, various members participating.

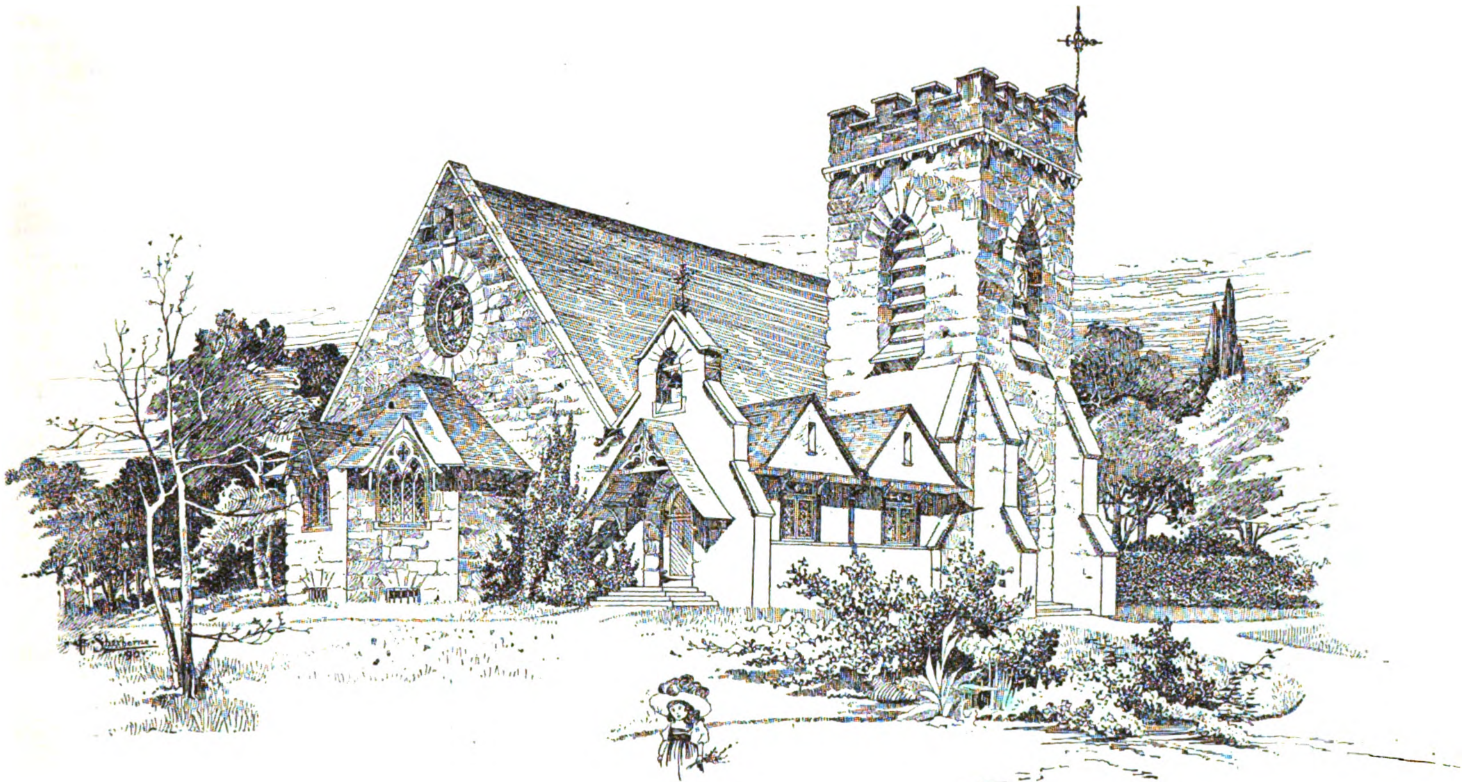
THE ENGINEERING ASSOCIATION OF THE SOUTHWEST held a meeting at Nashville, Tenn., June 12, President John MacLeod, of Louisville, Ky., in the chair, O. H. Landredth, secretary, and 32 members present.

Chairman MacLeod from the Committee on "Affiliation with the American Society," reported that it had been impossible for any member of the Committee to attend the meeting of the Committee of the American Society at New York, June 4, and asked the discharge of the Committee, which was granted. The subject of joining the Association of Engineering Societies was discussed and correspondence with the officers of the Board of Managers of that organization was submitted. The decision was referred to the Executive Committee of the Board, with power to act.

John B. Atkinson, of Earlington, Ky., presented a paper on "Coke Making in the Western Kentucky Coal Field." It dealt very extensively with a series of trials and experiments carried on at Earlington, Ky., to solve for that district the question of desulphurizing coke, which is made from slack coal only, carrying a higher percentage of sulphur than the coarser grades of coal. The author found the condition and character of the coal and the manner of the occurrence of the sulphur in the coal so different from that found elsewhere that no parallel could be drawn from outside experience. This was verified by repeating at Earlington, in succession and without avail, the methods which elsewhere were successful. Mr. Atkinson's work to date is only partially successful, but it is still being prosecuted, and it is hoped that it will be of the greatest commercial importance to the Western Kentucky coal belt, whose product is at present not available for iron making.

THE AMERICAN SOCIETY OF CIVIL ENGINEERS held a regular meeting June 18, with Vice-President A. Fteley in the chair.

The secretary announced the completion of arrangements for the Cresson convention, and that the attendance was expected to be very large, over 70 gentlemen and 30 ladies having arranged to go on the special train from New York, June 25. Several papers, in addition to those announced, have been presented for this meeting and the sessions. An adjournment was followed by the usual collation.



TRINITY CHAPEL, CHESTNUT HILL, PA.—LINDLEY JOHNSON, ARCHITECT, PHILADELPHIA, PA.

WATER-WORKS IMPROVEMENT AT SPRINGFIELD, MASS.

CLEMENS HERSHEL and Alphonse Fteley have made a report in regard to the projected improvement in the water supply of Springfield, Mass., substantially endorsing the scheme submitted by C. M. Slocum, the City Engineer, in 1889, and it is hoped that work will soon be proceeded with.

WATER was let into the New Croton Aqueduct for the first time in a regular way Tuesday. The purpose was to flush it out and test the working of the gates, etc., and a stream about 18 inches deep was allowed to flow about 20 miles to South Yonkers, where it was discharged through the blow-off there. The test was under the immediate management of Messrs. Rice, Gowan and Craven, engineers on the aqueduct, and was satisfactory.

THE New Jersey Court of Errors has sustained the decision of a lower tribunal refusing to permanently enjoin the city of Passaic from discharging its sewage into the Passaic River. The injunction was asked for by Newark, as the discharge tends to contaminate its present water supply, as well as that of Jersey City.

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*This paper will be noticed at length in a future issue.—EDITOR.

NEW ENGLAND WATER-WORKS ASSOCIATION CONVENTION.

(From our Staff Correspondent.)

PORTLAND, ME., June 12.

AT Wednesday's session, reported in part last week, a paper by Joseph C. Hancock, Springfield, Mass., was presented, entitled "Effect of Water Hammer in Large Pipes, and How Remedied." When water running through a pipe or inclosed conduit is suddenly checked the result is a concussion or shock, the same as when any moving solid is suddenly stopped. This concussion or shock, in the case of water, is commonly called water hammer. To a greater or less degree it may be avoided by closing gradually the passage through which the water is running. When the stopping of the flow of water in a main or large conduit is not so regulated the result is often the rupture of the conducting pipe or the starting of joints, the effect being nearly parallel to that of suddenly stopping a moving train, as in a collision. Just as by the application of the brake the train is gradually stopped without any injurious effect, so the shock of water hammer can generally be avoided by taking care to shut the gate slowly, closing by degrees the passage through which the water is flowing.

In the discussion which followed, W. H. Richards, of New London, Conn., recommended that a relief valve be placed at the point where the water hammer is first felt as at the gate.

Mr. Stacey, of Marlboro, Mass., thought that water hammer depended on the length of pipe and the velocity of the water flowing through it.

J. M. Clark, of Northampton, Mass., gave a brief description of a peculiarly constructed valve with a perforated plunger, partially automatic in its action, by which, in the case of a locomotive supplied from a stand-pipe, the water might be turned off suddenly without any water hammer. Water hammer was produced by the turning off of railroad station stand-pipes, and pipes were frequently ruptured when the supply was directly from the main. It was stated that building a tank to be supplied through a ball cock from the main, the stand-pipe taking its supply from the tank, was the only satisfactory thing to do. With that arrangement there was no trouble from sudden turning off of water.

THURSDAY MORNING SESSION.

The regular morning session was called to order at 10 o'clock, with President Dexter Brackett in the chair, and nominations by the committee being presented, officers for the ensuing year were elected, as follows:

President—Albert F. Noyes, City Engineer, West Newton, Mass.

Vice-Presidents—George P. Wescott, Treasurer Water Company, Portland, Me ; Charles K. Walker, Superintendent, Manchester, N. H.; F. H. Crandall, Superintendent, Burlington, Vt.; P. Kieran, Superintendent, Fall River, Mass.; William B. Sherman, civil engineer, Providence, R. I, and W. H. Richards, Superintendent, New London, Conn.

Secretary—R. C. P. Coggeshall, Superintendent, New Bedford, Mass.

Treasurer—Hiram Nevons, Superintendent, Cambridge, Mass.

Senior Editor—F. H. Parker, Burlington, Vt.

Junior Editor—Albert S. Glover, West Newton, Mass.

Executive Committee—Frank E. Hall, Superintendent, Quincy, Mass.; Dexter Brackett, Superintendent, Eastern Division, Boston; Charles W. Morse, Superintendent, Haverhill, Mass.

Finance Committee—Herbert F. Whittier, Registrar, Lawrence, Mass.; George E. Winslow, Superintendent, Waltham, Mass., and Frank A. Andrews, Assistant Superintendent, Nashua, N H.

Prof. William T. Sedgwick, of the Massachusetts Institute of Technology, gave a discourse on the "Utilization of Surface Waters for Drinking Purposes," drawing largely from a paper by W. H. Lindley, City Engineer of Frankfort-on-the-Main. The standards applied to drinking water are to-day much higher than they were years ago. The purest is spring water, but this does not exist in sufficiently large accumulated quantities to supply large communities, where it is necessary to secure an abundant supply. The first requisite is quantity rather than quality. Wells, cisterns and filter basins are insufficient in any but sparsely settled districts and most communities must eventually come down to river water, whether good or bad. River water is often much contaminated, as the Hudson River, which is so polluted by the cities on its banks emptying their sewage into its waters that Hudson River ice is shown to be very bad. That from the lakes in Massachusetts, even the worst of it, is better than Hudson River ice. There is great desirability of more legal protection from contamination of the sources of water supply, especially mountain lakes. River water may be purified by settling and filtering. By carefully regulated sand filtering it is possible to remove much of the brown color, certain chemical contaminations and a portion of the living germs. An accumulation of "dirt deposit," so called, the formation of a gelatinous membrane, is necessary for the proper action of the filter. Clean sand allows most of the bacteria to pass through, but this is prevented in great measure by the accumulation of this gummy membrane, which, therefore, is essential for the most effectual working of the sand filter. Where there is danger of the formation of ice, as in Russia, the filter should be under cover. The sand filters at Berlin, Germany, are very effectual in changing the polluted river into clear water. River water must be filtered rapidly and just the right kind of sand must be used and the work must be carried on in just the right manner. Yet, in spite of all care and precautions, there is great danger that some of the germs will pass through. Although the most of the color and the algæ may be removed from water by the sand filter we can never be certain that none of the germs have passed through. While the standards of physicians and hygienists are properly high, it should be borne in mind that the hygienist and sanitary engineer should understand each other's requirements. The removal by filtering of most of the foreign matters, including certain living organisms which prey upon them, leave to the bacteria present an undisputed field to multiply even more rapidly than before this purification, and accordingly water should be used as soon as possible after filtering.

In the discussion which followed, Desmond Fitz Gerald, Superintendent of the Western Division of the Boston Water-works, said that these problems were of growing importance. Every town, in considering its water supply, must have, first, quantity, and that too often without much regard to quality. It is remarkable how water purifies itself while running over a broken surface. Filtering is just beginning to have close attention from a scientific standpoint. Certain experiments for the purification of water are now being carried on at Chestnut Hill Reservoir, Boston, but these are only supplementary to those of the State Board of Health. At the Chestnut Hill Reservoir the experiments are being made with both continuous and intermittent filtering side by side to determine their relative value.

James C. Bayles, of East Orange, N. J., thought that filtering was chiefly mechanical. To true oxydation we must look for eliminating many injurious matters in water. Aeration plays an important part in the purification of water. Mr. Bayles gave some particulars of an apparatus for filtering, by which the oxydizing process was accomplished and the resulting water made as pure as possible.

In answer to a question as to the value of aeration, Professor Sedgwick said that it removed certain injurious gases which might be present. It is not yet known definitely just the size of filter necessary to purify a given amount of water per day. This must be determined by experiment.

A paper, entitled "Why I Favor the Use of Cement-Lined Pipe," was next presented by P. F. Crilly, Superintendent, Woburn, Mass. The vital requirements for service pipes are durability and freedom from corrosion. Cement-lined pipe exactly fulfills these conditions. Much of the disfavor in which such pipe is held is due to poor quality and inferior work in laying, through incompetency or dishonesty. Twenty to twenty-five years is the usual life of cast-iron pipe, so that the work of renewing it is constantly going on. Cement-lined pipe has been in use from 20 to 40 years, and the water which had passed through it was as free from rust and discoloration as when delivered to the pipes. In addition to its first cost being greater, cast-iron pipe is made still more expensive on account of the frequent renewals necessary. During the past year there have been only five repairs of all descriptions on the 43 miles of cement-lined pipes at Woburn, and of these repairs only two were of any importance. On the other hand, a case was cited where, after having been laid 13 years, cast-iron pipe was found to be badly corroded.

In discussing the matter Charles K. Walker, of Manchester, N. H., said that the question was, "Can the town take the risk of getting first quality pipe and of having it properly laid?" for unless the work is well done there is sure to be needless trouble and expense. Mr. Walker gave a very amusing account of the experience of a superintendent of a works where cement-lined pipe had been put in. The first year he was an enthusiastic advocate of it, the second year he admitted a few breaks, but meeting him the third year, Mr. Walker said, in his droll way, that he asked him how cement pipe was now, the answer came: "Good God! Charles, I'm nearly druv crazy. I git a complaint of a cellar fillin' up, and I go to shet off, when the wimen say: 'Look a-here, you; this is wash day, an' if you shet off your men hev got ter lug water for my washin'.'" Mr. Walker "brought down the house."

Mr. Allis, of Malden, Mass., said that the life of cast-iron pipe could be placed at 50 years, and it had lasted 100 and even 150 years. Certain soils, however, rapidly corrode cast-iron pipe. Opinions were also expressed by Messrs. Nevons, Dennett, Steben and others, strongly favoring cast iron rather than cement-lined pipes.

THURSDAY AFTERNOON.

At the Thursday afternoon session the convention listened to an address by A. Fteley, of New York, Chief Engineer of the Croton Aqueduct Commission. The most remarkable feature of this work was its magnitude, and the excavation of the tunnel extended through three years and four months, the first shovelful of earth being removed January 1, 1885. The total length of the tunnel is 30¾ miles; that of the aqueduct 33⅛ miles, and even in the dryest time it will yield a supply of 250,000,000 gallons of water per day. In the length of the aqueduct there are three blow-offs or vents, from which the conduit may be emptied. Under Harlem River the depth of the shaft is about 400 feet.

From the head gate house, at Croton Dam, there start in a bunch eight 48-inch mains. This gate-house cost $750,000. From an engineering point of view a very interesting fact was developed in experimenting on the permeability of brickwork by water under pressure, with special reference to preventing loss of water by this means. It was found by experiment that by coating brick with, say, two coats of Portland cement, as a paint, a loss of 100 parts of water was reduced to 1½ parts; an immense saving. Accordingly two miles of the Croton Aqueduct have been coated in this way to prevent loss of water by percolation under pressure. The address was illustrated by large profile drawings and lantern views. In answer to a question, referring to a report that had been current, Mr. Fteley stated that the internal pressure was too great to permit any sewage draining into the aqueduct.

On behalf of the committee appointed, W. H. Richards offered a report recommending that Hartford, Conn., be selected as the place for the next annual convention of the association, and that the secretary be instructed to transmit to the Mayor of Toronto the thanks of the association for his invitation to them to hold their next annual meeting at that place, which was prohibited by a clause of the constitution restricting meetings to places in New England. The recommendations of the report were adopted.

John A. Gould, Jr., Assistant Engineer, Boston, presented a paper on "Recording Gauges," in which the usefulness of these instruments and their various purposes, showing the height of water in stand-pipes, the pressure of water in mains, boiler pressure, etc., were briefly outlined.

A paper on "Water Meters; the Advisability of Their Use," was presented by G. A. Roullier, Superintendent, Flushing, N. Y. To establish uniform and equitable rates and a proper form of inspection of the consumption are two very important duties of those having the management of water-works. The water meter furnishes the most efficient means of meeting these requirements. As showing the great value of the water meter as lessening waste, etc., a few figures were given showing the practical working of the meters at Flushing. In 1886, with a pressure of 75 pounds at the pumps, the pressure at the office was reduced to 35 pounds, and the consumption was 120 gallons per capita. In spite of much opposition 100 meters were set where the greatest waste was supposed to be, and the pressure of 35 pounds was increased to about 42 pounds, the daily consumption per tap falling from 754 to 578 gallons. The system of metering was afterwards extended with so much benefit that the maximum daily consumption per tap for 1889 was the same as the minimum for 1886. There are now 630 meters set, and the coal consumption has been reduced 400 pounds per day.

In the discussion Mr. Fitz Gerald said that he believed in the water meter. In his own town he took the stand, three years ago, that on account of the great waste there should be no extension of the works without the introduction of meters. The system of metering has been adopted, and the present consumption is the same as that of a number of years ago.

W. R. Billings said that simplicity and permanence are the qualities in a meter more valuable than absolute accuracy in measurement.

Mr. Chace, of Taunton, cited an instance where, in the case of a dissatisfied water taker, the meter was taken out and tested, when it was found to under-register about 4 per cent. A meter out of order is generally in favor of the consumer.

With reference to this latter statement Mr. Brackett said that after passing 300,000 to 500,000 cubic feet of water the ⅝-inch meter will generally under-register 4 to 10 per cent., so that after passing this quantity he recommended that the meter be tested.

Further remarks on the subject were made by S. M. Allis, C. K. Walker, and J. W. Ringrose.

Some discussion followed on the different ways of charging for water meters in different places. Mr. Brackett stated that in Boston all the meters are put in and owned by the city, except in the case of very large meters, where rent is charged.

Mr. Hawes believed that the city should own the meters and charge rent for them, and that the consumers should not own them. Mr. Roullier said that it was the custom in Flushing for the consumer to buy the meter. The city, however, takes care of it and replaces it when worn out.

F. L. Fuller and others participated in this discussion.

On motion of Mr. Hawes, it was voted that the thanks of the association be extended to the Mayor of Portland, the city government and the Portland Water Company for courtesies shown by them to the association during its convention.

THURSDAY EVENING SESSION.

Promptly at 8 o'clock the convention was called to order by President Brackett. On recommendation of the Executive Committee it was voted that the status of James C. Bayles, of East Orange, N. J., be changed from associate to that of non-resident active member.

On suggestion of Mr. Allis, the subject of the "Minimum Size of Mains for Fire Supply" was brought up for discussion. Mr. Brackett said that in many cases the pipes in use are too small, and the time will come when the authorities will require larger ones. In the city of Baltimore were laid last year five or six miles of 4-inch pipe. Four-inch mains should not be used in any case for hydrant supply, and 6-inch mains in many instances are used too much in long lengths where a number of hydrants are to be supplied from one main.

Mr. Winslow gave some particulars of experiments conducted by J. R. Freeman to determine the resultant loss of pressure from drawing a number of streams from a 4-inch pipe used as a fire supply at a factory at Waltham. Four streams drawn from this pipe through 2 inch hose with 1-inch nozzles reduced the pressure to 34 pounds, the static pressure being 77 pounds. In the case of 6-inch pipe the pressure was reduced to 34 pounds by eight streams. With the fire pumps eight streams reduced the pressure to 38 pounds. The conclusion was that 4-inch pipes were insufficient, and, while 6-inch pipe would answer the demands in a great measure, larger sizes would be better. In an instance cited, where a 4-inch pipe was used for fire purposes, so great was the drain in the pipe that a faucet, opened at that time in a house near by, actually sucked air in.

Remarks on this subject were made by F. L. Fuller, J. A. Gould, Jr., S. M. Allis and others, and various experiences were given showing the inadequacy of 4-inch pipe for fire protection and recommending 6-inch pipe or larger for this purpose.

Mr. Brackett briefly described the method he had used for cleaning certain 6-inch water pipes in Boston, by which their conducting capacity was increased 300 per cent. Some particulars were given of the construction of the machine used for this purpose, which required a pressure of about 40 pounds to force it through the pipe and remove the obstruction.

Mr. Nevons referred to an unsuccessful attempt made in Cambridge to clean in a similar manner about 1,000 feet of 6-inch pipe. The machine used would not pass through even under a pressure of 45 pounds.

A paper by Joseph C. Hancock was next presented in which the question of the depth of lead necessary in pipe joints was considered. This depth should be 1½ to 2 inches, and not less than 2 inches for safety in high service pipes.

Mr. Winslow spoke of pipe laid in Waltham under contract which, in some cases, had a depth of lead in the joints of not more than half an inch, and as a consequence there had been many leaks in such joints.

Mr. Allis referred to the use of wooden plugs or wedges which he had heard had been used in the place of lead for calking pipe joints. In the discussion Mr. Nevons and others took part.

As a subject demanding serious consideration, Mr. Winslow called attention to the great inequality in the size of hose outlets on hydrants. He found that there were over 200 different sizes in the country. The standard size should be known by water-works superintendents on ordinary hydrants.

Mr. Brackett thought that there should be some standard of size of hose couplings and outlets on hydrants. In the case of the great Boston fire many of the out-of-town fire engines could not be used because their hose couplings would not fit the Boston hydrants. There are different standards of size in different cities, but these standards should be uniform. In the case of hydrants, some open to the left and others to the right. Of the former kind, those in Boston, Charlestown district, are being changed so as to open to the right.

Mr. Fuller thought that the association should take some action looking to the adoption of a uniform standard of size of hose couplings, hose outlets on hydrants and the direction in which the latter open.

At the close of the session a vote of thanks was given to the President, Dexter Brackett, and the Secretary, R. C. P. Coggeshall, and the meeting adjourned.

The following new members were elected, besides those reported last week:

Resident Active Members.—D. N. Clark, President Water Company, Portland, Me.

W. H. Childs, Superintendent Water Company, Manchester, Conn.

C. M. Brainard, Superintendent, Skowhegan, Me.

Theodore H. McKenzie, Superintendent, Southington, Conn.

Non-Resident Active Member.—B. D. McConnell, Superintendent Water-Works, Montreal, P. Q.

Associate Member.—Smith & Anthony Stove Company, Water-Works Supplies, Boston.

The association was complimented by a banquet at the Falmouth Hotel, given by the Portland Water Company, the Mayor and prominent citizens being present. The activity of ex-Mayor George T. Westcott, Manager of the Portland Water Company, in making the meeting pleasant and successful was thoroughly appreciated, which fact was manifested at the banquet.

The total registered attendance at the convention was 125. The list of members and visitors present was as follows:

James Barnie, Superintendent B. and L. Water Company, Biddeford, Me.

Charles H. Baldwin; Albert A. Blossom, Whittier Machine Company; Harold L. Bond, Supplies; Dexter Brackett, Superintendent Eastern Div. Boston Water-Works; Mrs Dexter Brackett; A. B. Daggett; Mrs. A. B. Daggett; F. W. Dean, Mechanical Engineer; C. N. Fairbairn; Frank L. Fuller, civil engineer; Albert S. Glover, Hersey Meter Company; Mrs. Albert S. Glover; W. N. Goddard, King & Goddard; X. H. Goodnough, State Board of Health; J. A. Gould, Jr., Assistant Engineer, City Engineer's Office; E. H. Gowing, Engineer; Wilbur F. Leonard, Assistant Engineer; J. A. Mitsch; Frank Polsey, Walworth Manufacturing Company; Edward H. Rice, Walworth Manufacturing Company; Fred H. Rounds; Daniel Russell, Steam and Hot Water Heating; William T. Sedgwick, Professor of Biology, Mass. Inst. of Technology; Smith & Anthony, Manufacturers; F. E. Stearns, Peet Valve Company; Frederick P. Stearns, Chief Engineer, State Board of Health; Eugene S. Sullivan, Superintendent, Mystic Division; James A. Tilden, Superintendent Hersey Meter Company; C. J. Underwood, Jr., ENGINEERING AND BUILDING RECORD; W. H. Ward; E. B. Williams, Fairbanks, Brown & Co.; A. W. Worthley, Manager American Frost Meter Company, Boston, Mass.

Timothy Woodruff, Superintendent, Bridgeton, N. J.

B. F. Steben, Manager, Brockville, Ontario, Canada.

Desmond FitzGerald, Superintendent, Western Division Boston Water-Works, Brookline, Mass.

F. H Crandall, Superintendent; F. H. Parker, Commissioner; Mrs. F. H. Parker, Burlington, Vt.

Willis E. McAllister, Superintendent, Calais, Me.

L. M. Hastings, City Engineer; Hiram Nevons, Superintendent; Mrs. E. B. Nevons, Cambridge, Mass.

A. H. Austin, Illinois Malleable Iron Company, Chicago.

H. H. Lowe, Superintendent; John F. Philbin, Water Registrar, Clinton, Mass.

James C. Bayles, President Spiral Weld Tube Company, East Orange, N. J.

William M. Hawes, Water Commissioner; Patrick Kieran, Superintendent; Weaner Osborne, Commissioner; William Walfemehl, Fall River, Mass.

Thomas C. Lovell, Superintendent, Fitchburg, Mass.

G. A. Roullier, Superintendent, Flushing, N. Y.

Charles W. Morse, Superintendent; Levi C. Wadleigh, President Aqueduct Company, Haverhill, Mass.

R Pattee, Holyoke Hydrant and Iron Works, Holyoke, Mass.

Edward L. Ross, Chapman Valve Manufacturing Company; Mrs. Edward L. Ross, Indian Orchard, Mass.

A. H Salisbury, Superintendent, Lawrence, Mass.

M. F. Brennan, Commissioner; W. A. Dickinson; Charles H. Hobson, Superintendent H. R. Barker, Manufacturing Company; Thomas Mather, of the H. R. Barker Manufacturing Company; Clarence H. Nelson, contractor; Arthur F. Salmon, Member Water Board; Millard F. Wright, Superintendent, Lowell, Mass.

Solon M. Allis, Superintendent, Malden, Mass.

Charles K. Walker, Superintendent, Manchester, N. H.

Fred B. Gleason; Robert D. L. Mortimer; James T. Murphy, Water Commissioner; George A. Stacy, Superintendent, Marlboro, Mass.

R. M. Gow, Superintendent, Milford, Mass.

Horace G. Holden, Superintendent, Nashua, N. H.

Carrol Ph. Bassett, civil engineer, 784 Broad Street, Newark, N. J.

R. C. P. Coggeshall, Superintendent; Mrs. R. C. P. Coggeshall, New Bedford, Mass.

J. W. Ringrose, Secretary, New Britain, Conn.

Edward H. Phipps, Superintendent, New Haven, Conn.

Walter H. Richards, Superintendent, New London, Conn.

E. W. Cate, President Water Board, Newton, Mass.

E. L. Abbott, Water Waste Prevention Company; Jarvis B. Edson, manufacturer; Alphonse Fteley, Chief Engineer, Aqueduct Commission; W. M. Geiring, Fairbanks, Brown & Co.; George H. Frost, *Engineering News*; Mrs. George H. Frost; Rudolph Hering, civil and sanitary engineer; John C. Kelley, Jr., National Meter Company; Henry C. Meyer, Editor THE ENGINEERING AND BUILDING RECORD; F. W. Shepperd, *Fire and Water*, New York, N. Y.

Horatio N. Hyde, Jr , Superintendent, Newtonville, Mass.

Jonas M. Clark, Superintendent, Northampton, Mass.

W. H. Whitcomb, President Water Company, Norway, Me.

T. J. Dibble, Standard Thermometer Company, Peabody, Mass.

Jesse Garrett, R. D. Wood & Co., Philadelphia, Pa.

Charles R. Dyer, Superintendent Meter Department; E. R. Dyer, Portland Water Company; George P. Westcott, Treasurer Water Company, Portland, Me.

Samuel M. Gray, civil engineer; Benjamin S. Terry, (A. W. Harris Oil Company) Providence, R. I.

Lewis M. Bancroft, Chairman Water Commissioners, Reading, Mass.

Nathaniel Dennett, Superintendent; Horace L. Eaton, City Engineer, Somerville, Mass.

A. E. Martin, Superintendent, South Framingham, Mass.

A. G. Pease, Superintendent, Spencer, Mass.

William J. Ranton, Superintendent Porter Manufacturing Company, Syracuse, N. Y.

William R. Billings; George F. Chace, Superintendent, Taunton, Mass

William Hamilton, Superintendent Water-Works, Toronto, Ont.

George Cross; Octavious Jones, Rensselaer Manufacturing Company, Troy, N Y.

Charles A. Barton, Water Commissioner; George E. Winslow, Superintendent, Waltham, Mass.

Fred A. Volk, Superintendent, Ware, Mass.

James L. Lusk, Captain Corps of Engineers, U. S. A., Washington, D. C.

Frank W Whitlock, Assistant City Engineer, Waterbury, Conn.

H. D. Winton, Engineer Hersey Meter Company, Wellesley Hills, Mass.

John C. Whitney, Water Registrar; E. T. Wiswall, Water Commissioner, West Newton, Mass.

George J. Ries, Superintendent, Weymouth Center, Mass.

Albert P. Barrett, Water Registrar; P. F. Crilly, Superintendent, Woburn, Mass.

Frederick W. Wilder, Treasurer Aqueduct Company, Woodstock, Vt.

George E. Batchelder, Registrar: George H. Carr, Union Water Meter Company; W. H. Moulton, Union Water Meter Company, Worcester, Mass.

Joseph A. Lockwood, Superintendent, Yonkers, N. Y.

The exhibits, under the management of Charles R. Dyer, of the Portland Water Company, were as follows:

Chapman Valve Manufacturing Company, Indian Orchard, Mass. Valves, Hydrants, etc.

American Frost Meter Company, Boston Water Meters.

Hersey Meter Company, Boston. Water Meters.

Union Water Meter Company, Worcester, Mass. Water Meters and Water Pressure Regulators.

Fairbanks, Brown & Co., Boston. Gate Valves, etc.

Whittier Machine Company, Boston. Water, Steam and Gas Valves.

The H R. Barker Manufacturing Company, Lowell, Mass. Water Motor, Pipe Fittings, etc.

Standard Thermometer Company, Peabody, Mass. Electrical Recording Gauges.

Holyoke Hydrant and Iron Works, Holyoke, Mass. Hydrants.

Porter Manufacturing Company, Syracuse, N. Y. Water Filter.

Peet Valve Company, Boston. Valves, etc.

Belknap Water Motor Company, Portland, Me. Water Motors, etc.

Illinois Malleable Iron Company, Chicago. Improved Cast-Iron Extension Stop-Cock Boxes.

Perrin, Seamans & Co., Boston. Railroad Supplies.

W. H. Gallison, Boston. Pipe Fittings, etc.

AT the recent annual general meeting of the English Institution of Civil Engineers the reports showed that during the past year there had been elected 3 honorary members, 32 members, 263 associate members and 3 associates, while one member had been reinstated. There were 87 deaths of members, and 51 names had been removed from the list from other causes. The total number of members is now 5,872, and the gross income of the Institute last year was £22,478. When the Institute was chartered, 67 years ago, it had 156 members and its annual income was £447.

CONSTRUCTION OF PARIS SUBWAYS IN SEWERS.

THE system of large sewers begun in Paris as early as 1851 proves each year the far-sightedness of the originators of the plans of laying all the water mains in an accessible subway. As early as the time of the first Empire a sewer 6 feet wide and 6 feet high was built in the Rue St. Denis, in which a 10-inch water-main was laid on projections of the side walls. Later, Mr. Mary, Director of Water and Sewer Works, increased the minimum width of sewers to 32 inches, which would allow of 3 and 4 inch mains being laid in the upper part. Up to this time all the sewers had been built of cut-stone masonry, the minimum thickness being 1 foot, but in 1851 Mr. Mills, one of the engineers of the department, advocated a sewer section of an oval shape outside, as well as inside, the walls being only 6 to 8 inches thick. Previous to this all the sewers had been built with side walls vertical on the outside. The oval section was adopted from London sewers, only applied to larger sections. Then Engineer Watier suggested for large intercepting sewers, a section with offsets on the inside forming sidewalks, with angle irons on the edge to be used as tracks for hand cars. The width of 4 feet between tracks suggested by him has been adopted in all the large sewers built since, and the side projections, besides being used as walks, form a support for the columns on which the water mains are laid.

Thus the dimensions of the Paris sewers are generally regulated, not by the amount of sewage liable to flow through them, but by the size of water mains that must be laid through any particular section. It is only in the largest intercepting sewers that the amount of sewage flow is considered in determining the size of the sewers. Mr. Belgrand, who laid out the present system of Paris sewers, and lived to see the larger portion of his works built, divided the sewer sections into 12 standard types, which form the normal basis for laying out the sewers of the city. The special type for a particular street is chosen with regard to the sizes and probable number of water mains needed for future use, and the grade. A few modified types have been twice added for special cases, but the 12 regular types are generally used, as shown in Table I. Water mains up to 24-inch are set on brackets; others on posts.

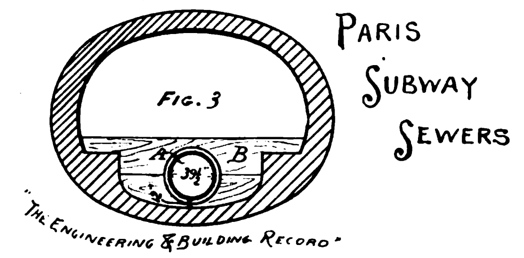
All these sewers or subways are built of rough limestone laid in beds of Vassy cement mortar with inside and outside coatings of cement mortar, the waterway being laid in Portland cement. The thickness of masonry varies from 8 to 20 inches at the top of the arch.

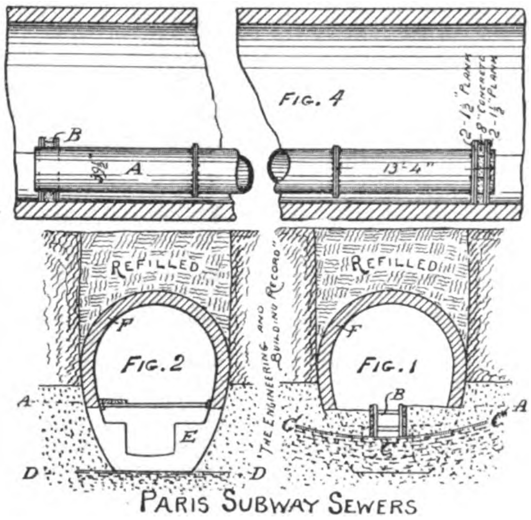
It has always been a rule to exclude all gas pipes from the sewers owing to danger of explosions from leaks and the presence of light used by the water-works or sewer laborers. But pneumatic tubes of the postal and telegraph department, electric wires of telegraph and telephone companies, and some electric light wires find place along the intrados of the arches. The space along the intrados is divided up between the telegraph, fire departments and telephone companies, which pay rent for six 12-inch rights of way which can contain some 350 lines. (See Vol. X., page 221, of this journal.) When the question of allowing all house sewage to run directly into sewers came up it was proposed to lay a small tile or stoneware pipe, closely fitted to the bottom of the waterway, thus forming a separate system, to reduce the amount to be pumped up for land treatment.

TABLE I.

Types.	Width.	Height.	Water-Way.	No and Size of Water Mains.	Remarks.
No 1	18' 8"	14' 8"	140" × 54"	....	No water pipes in main sewer to outfall.
" 2	17' 4"	17' 10"	48" × 38"	2 up to 44" in diameter..	Bv. Sebastopole.
" 3	13' 4"	13'	88" × 32"	2 up to 24" in diameter..........	Quai's.
" 4	12' 4"	12' 4"	48" × 28"	1 up to 44" and 1 small pipe.... .	Br. St. Michel.
" 5	10'	12' 8"	48" × 28"	1 up to 32" and 1 up to 24".	
" 6	8' 4"	10' 6"	32" × 14"	1 up to 44" and 1 small pipe.... .	
" 7	8'	11' 10"	48" × 28"	2 up to 16" and 1 small pipe...	
" 8	7' 8"	9' 4"	48" × 16"	2 up to 24" and 1 small pipe......	
" 9	8'	9' 2"	30" × 16"	1 up to 32" and 1 up to 12".......	
" 10	7'	8'	oval sect.	1 up to 24" and 1 up to 8"	
" 11	5'	7' 2"	"	1 up to 16" and 1 small pipe... ..	
" 12	4' 4"	7' 8"	"	1 up to 16" and 1 up to 4"	Ordinary type.

With this system of subways a great part of the digging up of streets common in other cities is avoided. Once a sewer is built in a street all the water main and house connection work is done in the sewer itself. The pipes are brought into place on trucks running on tracks laid in the sewer, after being loaded into the sewer from either one of the extremes on the quais or from an opening cut down from the street into the sewer. There being no irregular settlement somewhat lighter pipe can be used for the mains, which are all connected with short collar joints that can be easily driven off in case of any change to be made in the main.





PARIS SUBWAY SEWERS

In many places the soil in which these sewers were to be built was fine sand; but by lowering the ground water this sand stood well in cuts and Mr. Belgrand devised a method of construction as follows: The upper portion of the sewer, down to the level of the ground water, was built in open trench and the trench refilled. Then, by means of wells some 330 feet apart, dug below the bottom of the invert foundations, pumps were applied and the ground water lowered on the line of the sewer. Then by sheathing and bracing a trench was gradually dug down inside the sewer, between two consecutive wells till the water line was drawn below the foundation line. In this way it was possible to excavate for the lower portion of the sewer, which was built up in 13 foot sections, the only timbering required being a line of rangers on either side at the foot of the masonry previously laid in open trench, with cross bracing every 6 or 7 feet. Planks laid on this bracing served for a foot and rollway for bringing and removing materials. The main outlet collector was built in a similar way, but all in tunnel. The ground water was lowered sufficiently to allow of a rat-hole being dug, 32 by 64 inches from well to well, without timbering. This was then enlarged to 8 feet by 8 feet 8 inches, with timber frames every 5 feet, and finally widened out to 22 feet, the full width of the excavation, the centers set and the top arch of masonry built up. The lower half of the sewer was then excavated, as previously described, and masonry built in 13 to 20 foot sections, working both ways towards the pump wells.

This method is shown in Figs. 1 and 2 where the upper part, F, of the masonry was first built in a trench excavated only to the level A A, of ground water.

The ditch B was then dug, and reduced the ground water level to C C C, and finally to D D, Fig. 2, when the remaining excavation was made, and the rest of the masonry, E, put in in sections.

When the lining of the waterways of the larger sections needs repairs M. Darcey's method is used to have dry work and yet allow the sewage to flow.

This method was first used for repairs on the large collector. Four lengths of Chameroy pipe A (Figs. 3 and 4) (a sheet-iron pipe $\frac{3}{16}$ inch thick, coated inside and out with asphalt,) were used. Each pipe was 13 feet 4 inches long, 39½ inches in diameter, and weighed 1,375 pounds. They were joined together by bolted collars and tar felt packing. The ends were closed by wooden stoppers cut out of three thicknesses of 1⅝-inch plank nailed together and the whole floated into place. Here bulkheads B, formed of two thicknesses of 1⅝-inch plank, were fitted around each end and 8 inches of concrete run in between. The whole flow of the sewer was thus run through the pipe, leaving a clear space under it of a foot in which to make the repairs. The cost of the pipe was $360. The total cost of repairs at this and one other place further down the sewer, which was made by floating the whole pipe, dams and all, down the sewer, amounted to some $680.

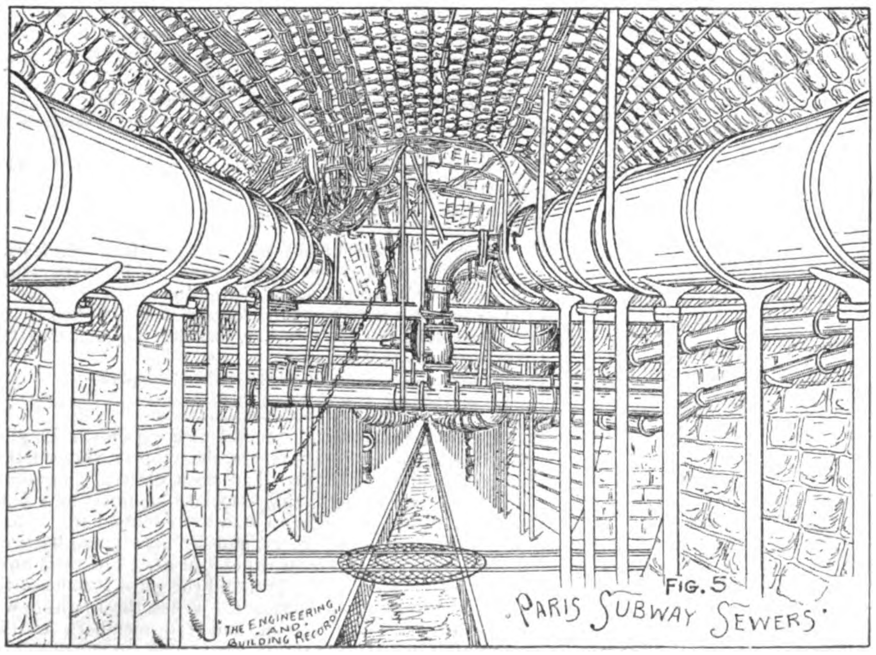

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FIG. 5
PARIS SUBWAY SEWERS.

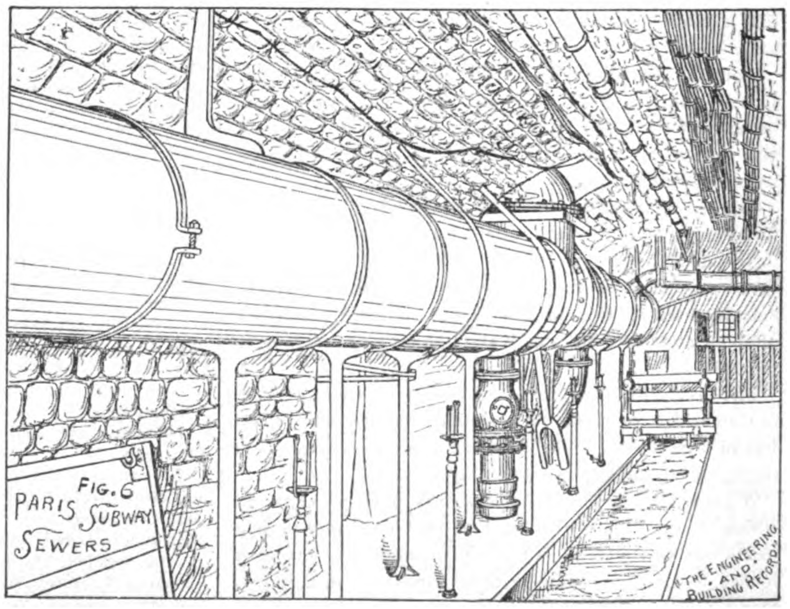
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FIG. 6
PARIS SUBWAY SEWERS

Figures 5 and 6 are prepared from photographic views of the interior of important sewers, and clearly illustrate the arrangement of pipe lines, etc. Figure 5 is a view in the Gallery Sebastopole at the junction of the Rue de Rivoli, and Fig. 6 is a view of the Chatelet chamber. Each shows mains for spring water and pipes for pneumatic postal service; also blow-offs, gates, footways and telegraph wires. Figure 5 also shows a main for canal water, telephone wires, the iron car track and turntable over the sewer way, and the intersecting pipe lines, etc., of the cross street. Figure 6 shows, also, lamp posts and a visitors' car.

MILL CONSTRUCTION.

In a paper entitled, "Methods of Reducing the Fire Loss," read at the last meeting, at New York, of the American Society of Mechanical Engineers, C. T. H. Woodbury referred to modern mill construction as follows:

In its design, a mill for any standard line of manufacture is not a building whose arrangement and proportions are fixed upon at the whim of the owner, but they must conform to certain conditions of dimensions, stability, light, and application of power to satisfy the requirements essential for producing the desired results at the lowest cost—circumstances and conditions to which capital has been mercilessly starved by close competition and the encroachments due to growing socialistic tendencies. As methods of manufacture change, so mill construction must in like manner be altered to conform to the new conditions.

Whatever changes may be made in methods of construction, the question of the fire hazard continues to be represented by an annual charge which differs from the other fixed charges of interest in that its ratio is a variable one and is based upon the estimated annual chance of fire. The more efficient the manner in which such a building can be arranged to resist fire, by so much will the hazard represented by the insurance premium become less.

Although a great deal depends upon construction, this hazard can never be reduced to zero, as that would indicate that the mill was absolutely fireproof. A fireproof mill, both in name and reality, must not only be built of incombustible material, but must also be capable of resisting any fire of its contents without destructive effects upon the structure. Such a building would be a commercial impossibility, both in regard to prohibitive costs and also the hindrances to manufacturing involved by a method of construction which would bear comparison with the casemates of fortifications, and is therefore unsuited to the conditions essential for the advantageous operation of machinery. It is apparent that the name of fireproof mills never deceived anybody, for the owners keep them insured, and the insurance companies charge a rate in accordance with their estimate of the hazard.

The destructive results attending fire in such buildings, whose iron and masonry construction is called fireproof, shows that some other form of construction is necessary to obtain the desired result of minimizing the annual cost of the maintenance of the invested capital, as represented by insurance, depreciation, interest, and taxation. There is little incentive for entering into unusual expenses in the construction of a manufacturing building for the purpose of increasing its resistance to fire, unless the additional interest on such increase in the investment is to be met by a corresponding reduction in the annual cost of the fire hazard. In addition to these questions involving the annual maintenance of the plant, the increase in the expense of the building above a certain point may prove poor management by locking up capital for too long a time, and may tend to prevent the improvements in arrangement and construction which are necessary for the most advantageous manufacturing.

The method of mill building known as slow-burning construction combines the advantages of low initial cost and great resistance to destruction by fire, the final result being that the manufacturing process is housed at the minimum annual cost.

The principal features of slow-burning construction may be illustrated by bits of experience drawn from many sources. The fundamental principle of such construction is to mass the material in such a way that there shall not be any concealed spaces about the structure, and that the number of projections of timber which are more easily ignited than the flat surfaces shall be reduced as far as possible: that iron portions of the structure shall not be exposed to the heat of any fire in the contents of the building, and furthermore that the isolation of the various portions shall be as complete as is feasible—both as respects one building to another and the various rooms and stories of the same building to each other.

Some of the more salient features of modern mill construction pertaining to questions of resistance to fire can be briefly related. Without entering upon the general subject of mill construction, the most important feature is that of the mill floors, which should be laid on beams, generally of southern pine, 12 by 14 inches, or 2 inches larger when required by unusual loads or longer span than 22 feet. These beams are placed from 8 to 10 feet apart between centers, and it is preferable that they should be made up of two pieces bolted side by side, with small blocks interposed to provide an air space of about an inch, as this will diminish the tendency to decay or to twist as the result of long continued seasoning. At the anchorage of the walls the beams should rest upon cast-iron plates secured into the walls and provided with a rib on the top 1½ inches in height projecting into a wide groove across the bottom of the beam and brought to a firm bearing by a pair of wedges driven into a groove each side of the iron tongue. It is important that an air space should be left in the wall each side and at the end of the beam to prevent dry rot, and that the bricks in the wall for about four rows immediately above the beam should be laid in dry sand. A preferable modification of this is to use a cast-iron box made to receive the end of the beam and separated from contact on the top, end and sides of the beam by ribs projecting on the inside of the box. As in the former case these iron supports are securely built in the wall. This arrangement is much more stable in anchoring the beams to the wall, and if by reason of fire the beams break they will slide out from their anchorage without injury to the wall as soon as the groove on the bottom of the beam clears the rib in the supporting plate.

At the columns, beams rest on cast-iron caps which should present a supporting area at least three times that of the cross section of the wood columns used, as the resistance of timber to longitudinal crushing is three times that of its resistance across the grain. The support from one column to the next should be made by cast-iron pintles, preferably those whose section is in the form of a Greek cross, as that presents advantages in the way of securely joining them to the wood columns. At the top of the pintle, a cast-iron plate should support the base of the column above. A flat plate with a projection in the middle securing the column by insertion into the core of the column is preferable to the cup form which is so frequently used, as the latter tends to retain moisture to the deterioration of the column by dry rot.

Timber columns are preferable to those of iron, unless the load is greater than can be sustained by timber—the limitation of a load on oak or southern pine of straight grain and free from knots being about 600 pounds to the square inch. Such columns, when subjected to destructive tests, give way by direct crushing, and for this reason the tendency of late years has been to make square instead of round columns. These offer no greater obstruction to the floor than the round columns and give about one-fourth extra resistance. Whenever the amount of load renders it necessary to use iron columns, they should be protected by wire lath and plaster or by some of the special tiles made for the purpose.

The floor planks for this type of floor are generally made of spruce plank from three to four inches in thickness, grooved on both edges and joined together by hard wood splines. These floor planks should be two bays in length, breaking joints at least every three feet.

Above this the top floor, of one 1¼ or 1½ inch hard wood is laid; and in some instances the resistance of the floor to fire is greatly increased by laying a coat of plaster on the floor plank before the top flooring is put on. But the general method of increasing the resistance of the floor to fire, is to cover the floor and beams on the under side with plaster laid on wire lathing. When anything of this kind is done care should be taken that the covering to the timber should not be hermetically sealed, as that course increases the tendency to dry rot, particularly if the timber is not thoroughly seasoned at the time of its application. There have been a number of failures of the strength of such construction on account of the disregard of this well known principle that it is not desirable to seal up the outside of unseasoned timber. This not only applies to the method cited above, but also to paints and varnishes which are laid on such work before it is thoroughly seasoned.

In mill floors of very large area care should be taken that the transverse shrinking of the floor should not pull the walls; and on large low structures which are far enough across to be affected by a very slight longitudinal shrinkage of the beams, other methods of anchorage than the one referred to should be adopted.

The mill roof is similar to the floor in many of its characteristics, the timbers being somewhat lighter. If the roof is higher in the middle the beams extend through the wall, and their ends properly cut serve as brackets for the roof planks which are continued to the ends of the beams, and thus make a finish without calling for the construction of hollow cornices with gutters.

There will be no trouble from condensation on such a roof in cold weather if the plank and roof boarding are three inches in thickness, unless some wet process be carried on which produces a large amount of vapor, like paper manufacturing; in this case it is advisable to make the roof four inches in thickness, also placing roofing felt between the plank and the roof boarding.

If it is desired to add finish by placing sheathing against the underside of the roof plank, such finish should be blind nailed, as the nails are good conductors of heat, and reaching to the colder portion of the roof, the moisture in the air will condense on the nail heads if exposed. It was formerly assumed that a double, sloping, hollow roof was necessary over a paper machine, but the above type of roof has been successfully employed for such purposes.

A coal tar concrete walk about the building will protect the foundations and also take care of water dripping from the roof. Under some circumstances the slope of the roof is reversed, being depressed at the middle and highest at the edges, the storm water being removed through gutters extending down through the middle of the building. This enables the walls to be extended above the roof, forming a parapet, which is a great defense against fire from exposure outside, and is a method of construction which is being generally followed in cities.

Such a mill floor and columns, while possessing in a very high degree features which offer resistance to fire, and are weakened only to a slight extent as they are slowly burned away under exposure to a very severe fire, also possess the merit of great economy, both as regards the low price of construction, and in that the floor is thinner in comparison with joisted floors of equal strength, saving in this respect for every floor in a building about 10 inches in height of wall, stairs, belting, steam pipes, and all vertical connections reaching from floor to floor—a saving which amounts to considerable in the total cost of building.

It is important, however, that floors should not be pierced with unprotected openings for stairways, elevators, or main belts. There is no record of such a mill floor, without belt or other holes in it, being burned through by a fire starting in the room below.

Floors near the earth in basements should be well ventilated, if there is a space between the floor and the surface of the earth; but, unless that space is continuous and 2 or 3 feet in height, it is better to lay the floor directly upon the earth, taking care to prevent dampness by putting in a layer of stones or cinders. Above this the sills for the floor are laid in a trench with coal-tar concrete, which is also laid between the sills, on a level with the top of them, and the floor boards are laid over this. When well-seasoned chestnut is used for this purpose it will last a great many years without dry rot. Cement concrete will cause timber to decay rapidly.

Windows for a mill should be placed as high as possible, as the illumination from the upper part of a room is much more uniformly diffused. The window sills should be sloping, in order that articles should not be left on them in a disorderly manner. The architectural effect is usually heightened by placing sashes as near to the line of the inside of the wall as possible, making the disclosure or opening around the sash on the outside as large as possible. Ventilation can generally be arranged more satisfactorily by means of stationary sashes, the upper part of which swings like a transom over a door. In places where the work will be disturbed by currents of air, a desirable form of window ventilator is made by deflecting a portion of the middle of the sash—about 18 inches in height and of same width—inward into the room, covering the top of the bracket-like projection thus formed with a cover which can be opened at will. The air from the outside is directed upward toward the ceiling, thus giving a uniform circulation in the room without causing rapid currents. In case the windows admit too much light, this can be readily modified by painting the inside of the windows with a mixture of turpentine with zinc white. The amount of obstruction desired can be readily fixed upon after a few trials.

In one-story mills, and in the upper stories of wide mills, it is necessary to introduce light through the roof. While the expensive English ridge and furrow roof gives a very soft and blended light, it is hardly adapted to the northern part of the United States, on account of the difficulties with snow, and monitor roofs or hipped skylights give the best satisfaction. If the latter are used, it is desirable in many instances that the lower part of the space under the skylight be separated from the room below by means of glazed sashes, placed flush with the ceiling. The monitor roof of a one-story machine shop affords an opportunity for a traveling crane with a minimum of building space.

Stairways should not be placed in direct communication between different stories of the mill, but in masonry towers, with substantial doors at each story. Stairways should be made in straight runs with square turns rather than spirally.

Elevators should be so arranged that they would not serve as a flue under any circumstances; but it is not necessary to place them in a tower outside of the building as elevators through any portions of mills can be safely placed at almost any point desired for sake of convenience, and the openings kept closed by means of automatic hatches.

The division of mills into various portions by means of fire walls is frequently not so efficient as assumed, by reason of the lack of fire doors to fulfill satisfactorily the purpose of resisting fire. The best form of fire door is that made of two thicknesses of matched boards, placed at right angles to each other and nailed together, being covered on the outside by tin, securely locked together and held to the door by numerous hanging strips. The door should be secured to the hangers by means of bolts, and not screws, and the rail upon which it runs should be strongly bolted to the wall. When closed, such door should fit into a jamb and be securely held in this manner against the wall. Such doors are frequently hung upon an inclined track, and, by some application of highly fusible solder at the catch, are so arranged that they will be closed by the heat of a fire, if not closed by hand. This same principle may be applied to fireproof shutters hung over various openings which necessarily exist in walls which are desired to form a fireproof separation between various portions of a building. A fire wall must extend through the roof, cutting off continuity of woodwork, especially at the roof cornices. The top of such a fire wall can be covered with tiling, which is made in special form for such purposes, better than by a stone coping.

In this treatment of the arrangement of buildings to resist fire, consideration has not been given to the cost of land, which is of itself an important factor in determining what arrangement will be the most expedient for an establishment. Where land is expensive, or where there are limitations in the space suitable for building, it is frequently necessary to build mills and shops higher than would be preferred under other conditions; but where circumstances will permit it, the one-story mill has been very successful, not merely in immunity from fire and very low cost per square foot of floor, but also in the advantages of manufacturing, particularly in regard to cost of supervision and movement of the stock in process of manufacture. These are questions which must be determined, not merely in regard to the various processes of manufacture, but the individual needs of each concern; the position of the fire risk in the matter being that the hazard of a building increases very rapidly with its height and to some extent with its area. The extension of one-story buildings over too large an area will not be commended, and certainly as regards the question of fire, it has a tendency to place too large a property in direct exposure to a very wide hazard.

Some textile mills have been built in the form of the block letter U, this form having been decided upon as giving the conditions of lowest resultant cost. One wing two stories in height, contains weaving; the other wing, three stories in height, contains carding and spinning; while the engine is placed in the connecting building. The pickers and the boilers are in outside buildings, so placed that they will not interfere with future extensions of the building into the form of the block letter.

In this connection there is but little reference to be made to storehouses, except to mention the necessity of the closest supervision of their contents. The preferable arrangement of stairways and elevators for such structures of more than one story in height is to place them in towers upon the outside of the building, not directly connected to the rooms, but reached by means of open galleries which lead from the door of the storehouse to a corresponding door in the tower at the same level. It is very important that the floors of storehouses should be made as tight as possible and provided with scuppers with swinging covers on the outside to discharge any excess of water thrown on them in case of fire.

A POOR TYPE OF HIGHWAY BRIDGE.

In Syracuse, N. Y., one of the principal streets is carried over the Erie Canal in the heart of the city by an old bridge, some of whose features are here shown, to illustrate the kind of design and constructien that was once accepted for an important structure and is yet allowed to remain in responsible service in a conspicuous place.

A prominent civil engineer of central New York said that this particular design was of frequent occurrence in that region.

Figure 1 is a diagram plan of half the bridge which is symmetrical about the center line C C, and carries two street car tracks, besides carriageways and sidewalks. E E are masonry abutments; D D, etc., are floor beams, and A, B and B are trusses with lateral bracing only between the outside pairs, as shown.

Figure 2 is a diagram of the heavy truss B, with cast-iron top chord and vertical posts, the latter I-shaped in cross section.

Figure 3 is a diagram of the sidewalk truss A with cast-iron top chord and web member connections at A and B, as shown in Figs. 4 and 5.

Figure 4 is a vertical longitudinal section through the top chord M at B, and Fig. 5 is a vertical cross section through the top chord at B. L and L are wrought-iron collars.

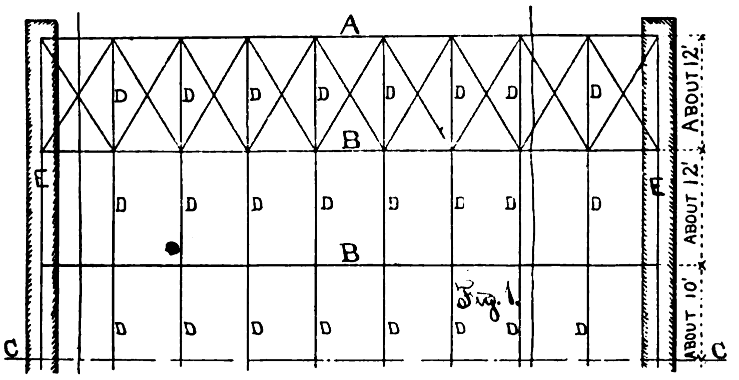
Figure 6 shows the details of a lower chord connection at the first, and Fig. 7 at the second panel point from the abutment.

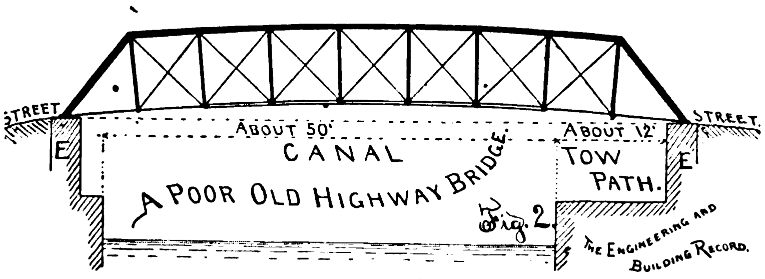
Figure 8 shows vertical and horizontal elevations of Fig. 7. C, Fig. 6, is the cast-iron vertical post and D is the floor beam. B and B are lower chord bars passing loosely through the cast block F, and E E are lateral rods.

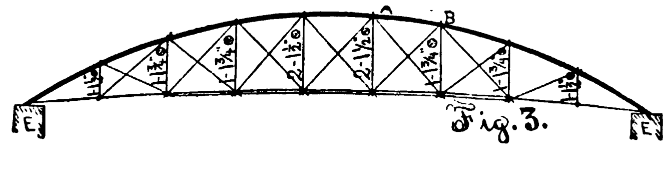
In Figures 7 and 8 D is the floor beam and I the cast-iron pin which was in several instances twisted several degrees from its proper position perpendicular to the axis of the bridge, so as to make with it the considerable angle x, as shown in Fig. 8.

H H, etc., are the lower chord bars lying in a slight groove at the end of the pin to which the laterals were secured by a tap bolt J. G G are main diagonals.

The illustrations are made from sketches of the structure and not from working drawings.




Street
About 50'
About 12'
Street.
E
Canal
Tow Path.
A Poor Old Highway Bridge
Fig. 2.
The Engineering and Building Record.



THE PROPOSED WATER-WORKS AT NEEDHAM, MASS.

Louis E. Hawes, Engineer to the Board of Water Commissioners of the town of Needham, Mass., in his recently issued report on the proposed water-supply system for that town, gives the following particulars:

A large collecting well, 22 feet in diameter and 22 feet deep, excavated at the Colburn Springs, stoned and bricked up in such a manner as to exclude surface water, thus insuring the entire draught to be from the water-bearing stratum below, roofed over and graded about is to be connected with pumping machinery located in a brick station, from which the water will be forced through a 10-inch cast-iron main in a straight line to Needham Common; thence to the top of Ryan's Hill, where it will enter a wrought-iron reservoir or stand-pipe.

The pumping station is to be built of brick, of sufficient size to accommodate two pumps and two boilers, and will have a chimney high enough to furnish draught at all times. The pumping engines will be of the compound condensing type, two in number, and each capable of doing the entire work. It is advisable to have two, as daily pumping will be required, and if an accident should happen to one no delay will be occasioned which might otherwise prove embarrassing. The street mains are to be of cast iron, from 6 to 12 inches in diameter, one short line only of 4-inch being used to complete a circuit. There will be 7.7 miles laid in the streets, and extensions can be made in outlying localities as the needs become apparent. At intervals along the lines are to be situated 57 hydrants, each having two 2½-inch nozzles and 6-inch connection; in addition to these there will be two large post hydrants, having four 2½-inch nozzles, with independent shut-offs and 8-inch connection, located, one at Needham Common and one at Highlandville Common. There will also be stop-gates, for the purpose of isolating any section of piping needing repairs. The sizes of the leading mains are so proportioned from the reservoir that with a pressure from high water elevation 350 feet above mean low tide in Boston Harbor, they are capable of furnishing at Needham or Highlandville Commons water enough for six 1⅛-inch fire streams or eight 1-inch, or ten ⅞-inch streams doing excellent service and maintain an efficient pressure at the hydrants while the streams are flowing and domestic consumption continues.

The reservoir is to be of wrought iron, 25 feet in diameter and 85 feet high, having a roof and holding, when full to high water mark 3 feet below the top, 301,000 gallons.

The reason for proposing an iron reservoir instead of an earthen one is that spring water deteriorates when exposed to light in an open reservoir, and an earthen reservoir covered with masonry is an expensive affair. The 2,000,000 gallon one about to be built at Newton being estimated to cost $51,750.

High water in the reservoir will be 350 feet above mean low tide in Boston Harbor, 84.2 feet above Newton's present reservoir, 30 feet above high water proposed for their new reservoir, and 26 feet higher than the Wellesley reservoir.

This will give a head at Highlandville Common of 164 feet, or 71 pounds pressure, and at Needham Common of 182 feet, or 79 pounds pressure per square inch.

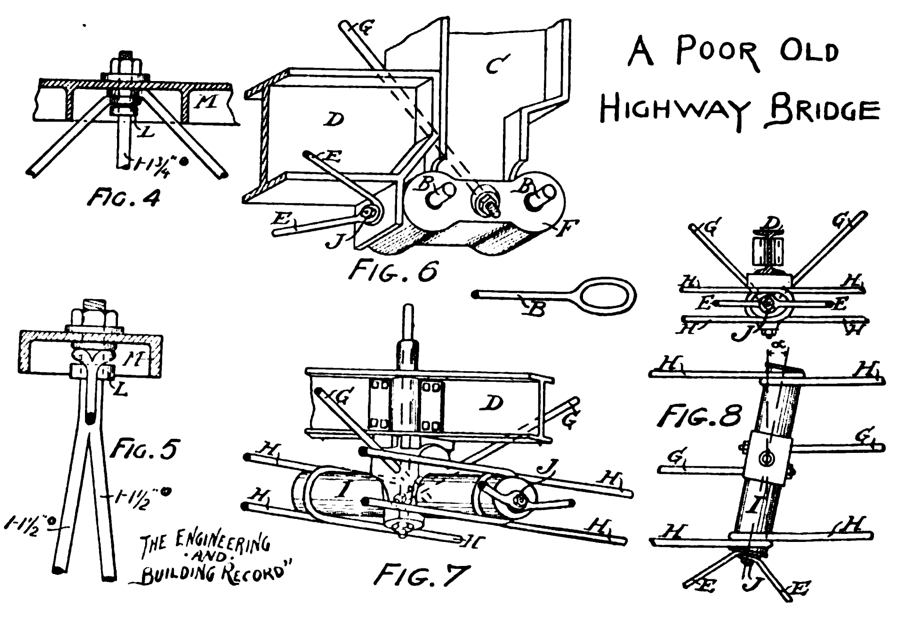
THE ONTON SUBMERGED RAILWAY.

The submerged railway at Onton, near Bilbao, Spain, which was built for facilitating the shipment of iron ore, has recently attracted considerable attention.

According to the different accounts published, the coast adjacent to the Onton iron mines is high and rocky, exposed to the full force of the sea, there being no harbors in the immediate vicinity. At the foot of the rocks there is an evenly sloping shore, which extends out to a considerable distance. It is upon this incline that a submerged track has been laid. The roadbed of the railway has a length of about 650 feet, and a width of 20 feet, upon which two sets of tracks, each of a gauge of 3 feet 3 inches, are placed, constituting a 4-rail railway. The slope is 5 feet per 100. The car which traverses this railway, and upon which the ore is conveyed from the cliffs to the ships, consists of a high iron tower made in the form of a pyramid, having a wide triangular base, and mounted on wheels, which run upon the quadruple railway track. The platform of the tower, upon which the load of mineral is placed, rises about 70 feet from the track, a height which is sufficient to raise it above the decks of ordinary vessels when the tower is run alongside. This great rolling tower is operated automatically. It is connected to the shore by means of a strong wire cable, which passes over pulleys secured to the rocks. At the landward end of the cable there are attached some weighted trucks which move up and down upon an incline. These form a counterbalancing weight for pulling the tower, when empty, in towards the shore.

The mineral to be loaded upon the vessels is brought from the mines, which are not far distant from the coast, by a rope railway. From the mineral dumps upon the heights the mineral is conveyed part way down the cliff through a shoot, the end of which projects beyond the cliff, and when the empty tower is drawn to shore by the

A Poor Old Highway Bridge



weighted trucks it automatically opens an end gate in the shoot, when the mineral drops upon the platform in a continuous stream until a weight of ore (about 100 tons) sufficient to overcome that of the counterbalancing weighted trucks has fallen upon the platform. When this takes place the tower, by its own gravity, begins to move down the inclined railway, and the gate of the shoot automatically closes. The tower continues to glide down the inclined railway through the water until it reaches the side of the ship, which is anchored fore and aft, and then by a throw of the lever, the platform of the tower being inclined, the whole load upon the platform is almost instantly deposited upon the ship, going down through slides into her hold. As soon as the discharge of the load takes place the counterbalancing trucks begin to draw the tower inward again towards the shore, and thus the operation of moving the tower backwards and forwards automatically, and automatically loading and discharging it, is carried on with the greatest regularity. About 5,000 tons of ore per day can be put on board ship by means of the railway, which can be worked, it is stated, even when the sea is very rough. The total cost of the railway and shipping arrangements is said to be less than $20,000. The railway has been designed by, and constructed under the superintendence of, Senor D. M. Alberto de Palacio.

MISSISSIPPI RIVER WATER.*

By the courtesy of Major Mackenzie, Corps of U. S. Engineers, I am enabled to give some results of experiments to ascertain the amount of sediment held in suspension by the waters of the Mississippi River at Burlington, Iowa, in 1879. During the months of April, May and June the water was taken from the river in a sediment measure constructed especially for this purpose. The measure consists of a hollow steel cylinder closed at the top and bottom by fixed brass plugs, the top plug being provided with an opening closed by a conical valve which is held firmly to its seat by a spiral spring, and by means of a cord attached and brass clamps is opened as desired. The measure may be attached to a pole and lowered to any depth desired. The water was taken at depths of 1 and 12 feet below the surface at a point where the water was 18 feet deep. The amount of water obtained at each observation was equal to the capacity of the measure, which was found to be 2,375 grains. The water was emptied into glass jars and allowed to settle. After having settled a given time it was syphoned off, except about half an inch in the bottom of each jar. The syphoned water was placed in a new jar for further examination, and the residual water, after being thoroughly shaken, was filtered through a pair of filter papers which had previously been carefully balanced so as to be of exactly the same weight. After the filtration the papers were dried, and the difference in weight was adopted as the weight of the sediment. The above process was repeated until no deposit was preceptible. It was found that all except clay would settle in 24 hours, and clay in about 100 hours, although in some cases the water would retain a milky appearance for a few weeks. The proportion of sediment to water is so small that a long series of observations would be necessary to give definite data.

I might add that some very extensive experiments were made at St. Louis, Mo., by James H. Seddon, Esq., C. E., on the settlement of sediment in the water supply of that city. Now as to the quality of water, it does seem to any reasonable mind that in so large a river the sewage and objectionable water it contained would be destroyed in the revolving currents of the waters and be ground up and out of existence.

We have situated on our stream cities varying from 500 to 50,000 inhabitants and from 20 to 60 miles apart. The water on analysis is found free from all objectionable water save clay in suspension and about 10 degrees of hardness. * * * The one objection to our river waters is the spring freshets, coming down in torrents, carrying a large amount of sediment and mud at these times; if a settling or storage reservoir could be had it would help most water supplies out of the difficulty.

We clean out our reservoir once a year and find the mud from one to two inches deep. The capacity of same is about 2,000,000 of gallons, and in addition to this we flush our mains about every two months, using the full opening of pipe, and in a 10-inch main, about one mile and a quarter long, it takes 15 minutes to do the work under a head of 190 feet; so you can see how much sediment accumulates in this pipe. That the river water is liable to be contaminated there is no doubt, but with such volumes of water pouring down its bed the objectionable water will have little effect on the water supply. Whether artesian well waters are more healthy than our river waters remains yet to be determined. I believe there is no data on record to show the effect of either supply on the health of the inhabitants using one or the other.

THE MANCHESTER SHIP CANAL HOSPITALS.

The hospitals here illustrated have been built by Contractor T. A. Walker at intervals along the line of the Manchester Ship Canal, for the men employed on the work. These hospitals are private institutions, built to supplement the large public institutions previously existing in each of the large terminal cities of the canal.

The buildings are of wood, with corrugated iron roofs. The upper floors are devoted to sleeping rooms and all the hospital rooms are on one level, arranged as shown in Fig. 1, which is a plan of the first story. Figure 2 is an elevation from X X, and Fig. 3 is an elevation from Z Z, Fig. 1. A is the scullery; B, coal room; C larder; D, nurses' sitting room; E, kitchen; F, doctors' sitting room; G, dispensary; H, waiting and operating room; I, linen room; J, emergency ward; K, women and children's ward; M, men's ward; L, nurses' room, commanding all the wards; N, lavatory, and V V V water-closets. S S, etc., are chimneys.

BOOK NOTICES.

The Natural Law of Relation Between Rainfall and Vegetable Life, and its Application to Australia. By Franz A. Velschow, C. E.; published by Edward Stanford, London, S. W.; price, One Shilling.

The title of Mr. Velschow's interesting paper gives almost all the information necesary for the prospective reader to form an estimate of its general character. Briefly stated, the paper gives the results and conclusions arrived at after 18 months' sojourn in the South Sea and Australia, where the author was engaged in irrigation schemes and other similar works of improvement. The striking contrast between the climates of Australia and China, the former country suffering severely from periods of drought although favorably conditioned in other respects, led to an investigation as to the probable causes. These are set forth in the pamphlet before us, together with interesting facts and comments.

Two diagrams accompany the text, illustrating the hypothesis that dried-up land is covered by an air cushion which has uninterrupted occupation of the land as long as the drought lasts, and which generally requires some extraordinary agency, such as a thunderstorm, to put it in motion.

ANNUAL REPORTS.

East Saginaw, Mich., Fifth Annual Report of the Board of Public Works; R. W. Roberts, City Engineer.

East Saginaw, Mich., has a population of 35,000, and covers 6.6 square miles. It has 91.28 miles of streets, of which 53.19 are graded, 5.18 planked, 10.39 paved, 0.33 macadamized and 16.18 unimproved; and 118.75 miles of sidewalks, of which 110.64 are plank, 1.67 concrete, 0.34 flag and 0.10 coal tar and gravel.

There are 29.31 miles of sewers and 16.15 miles of tile drains and 40.90 miles of water mains and 277 hydrants.

To look after all this, except the water-works, the City Engineer receives a salary of $2,100, and his other office expenses, including salaries of assistant engineer, draughtsmen, rodsmen, inspectors, etc., amounted to $2,408, among which is an encouraging item of $13.31 for testing cement.

The report of the Board proper is mainly a condemnation of the cedar-block pavement, and is given nearly in full elsewhere.

Of streets graded in 1889 there were 1.21 miles, costing $3,297. The price per lineal rod varied from 74 cents to $2.23, and for earthwork from 22 to 35 cents per cubic yard. Sapless cedar-block paving was laid on eight streets for a total distance of 1.08 miles, and at a cost of $20,815. In one case the cedar blocks extended the full width of the paving (38 feet), and were curbed with Medina stone, but in the other cases they only occupied the center of the street, with cobble stone gutters and curbs.

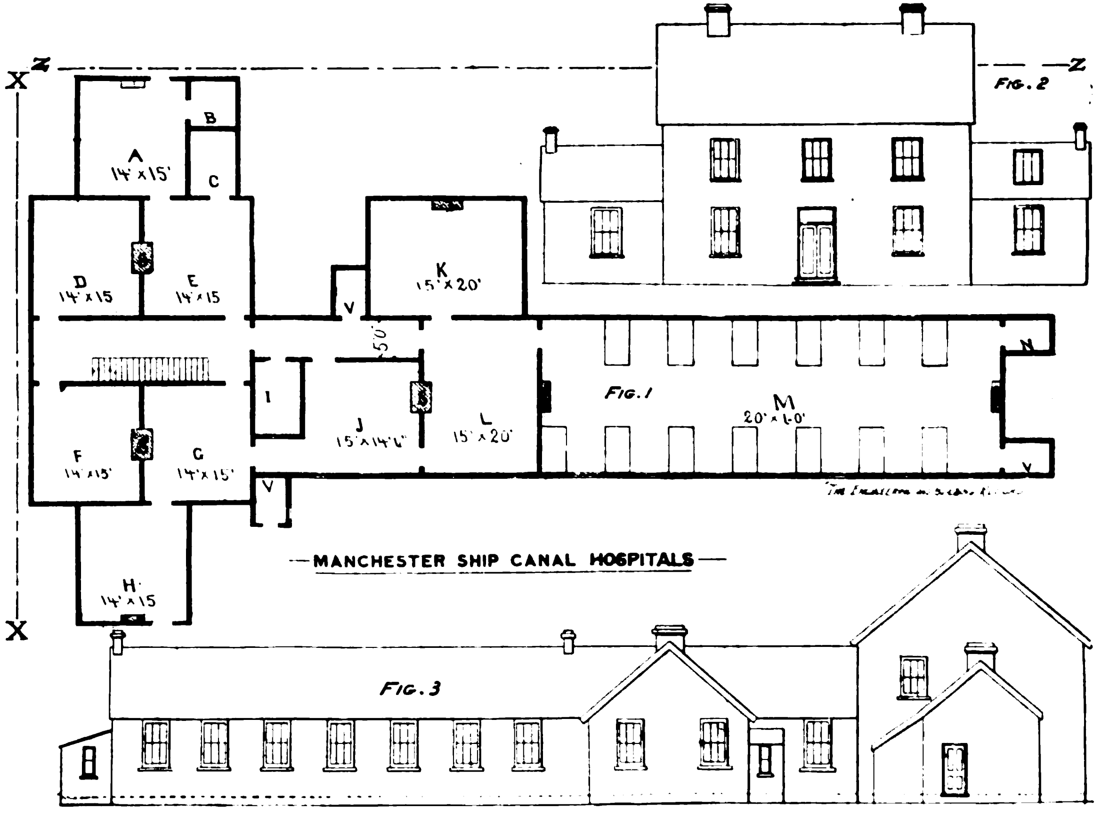
Of sewers 2.73 miles, from 50x75-inch brick to 15-inch pipe were constructed, at a cost of $33,039, and 140 new connections were made, making 2,151 in all, of which 1,279 are in actual use, and 872 are stopped at the curb. Of 3-inch tile drain under street pavements 2.04 miles was laid, at a cost of $1,657.

Permits were issued for 260 new buildings, to cost $353,648, and 142 permits for additions, alterations, etc., to cost $41,701.

The City Engineer finds one of the principal causes of deposits of dirt and sewage in the sewers to be the use of perforated manhole covers in the dirt streets, as in such cases he invariably finds dirt in the bottom of the sewer, underneath the manhole. While admitting the importance of perforated manholes for ventilation, he recommends that when used on dirt streets they be so "trapped" as to prevent the dirt from falling through into the sewers.

Annual Report of the Water Board of the City of Malden, Mass.; for the year ending December 31, 1889.

In this report the Commissioners briefly review the work of the year, and, among other matters, touch upon the equalization of water rates. Considerable space is devoted to the report of the Superintendent, Solon M. Allis, in which is given, in detail, the cost of the different branches of work performed during the year, together with a general statement of the condition of the works. A report of the "Commission on Additional Water Supply," and the report of the Water Registrar, George W. Barrett, make up the concluding portion of the pamphlet. Several illustrations accompany the several reports, one of them showing the new pumping station, and another the old pumping station at Spot Pond. In addition to these there are views of the new stand-pipe and of the new pumps, and a blue print illustrating the method of lowering a 12-inch syphon into the river.



—MANCHESTER SHIP CANAL HOSPITALS—

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* From a paper on "Waters of the Mississippi River," by William Molis, Superintendent Muscatine, Iowa, Water-Works, presented at the Chicago meeting, May 20-23, of the American Water-Works Association.

ANNUAL REPORTS.

THE water-works report for Dayton, O., for 1889, Charles E. Rome, Secretary, shows that 9,637 feet of 4 and 6 inch mains were laid during the year, making about 51½ miles in all; 12 fire hydrants added, making 485 in all, and 531 services put in, making 2,536 in all. The amount charged to current expense account was $28,150, and to construction account $44,203, the latter amount including $38,332 paid on new machinery, which included a 10,000,000 gallon Gaskill pumping engine, put in operation during the year. There were 858,956,555 gallons of water pumped during the year and 4,020,575 pounds of coal burned. The average domestic pressure was 53 pounds, but 4,569,250 gallons were pumped against a fire pressure of 109 pounds.

THE water-works report of Lawrence, Mass., for 1889, A. H. Salisbury, Superintendent, shows that there were 6,594 feet of 1, 6 and 8 inch mains laid during the year, making 296,477 feet in all; 5 hydrants set, making 502 in all; 129 services added, making 4,713 in all, and 172 meters set, making 1,213 in all. The amount charged to maintenance account was $17,867, while $15,981 was charged to construction account. There were 960,848,662 gallons of water pumped against an average head of 183.20 feet, and 1,514,520 pounds of coal burned.

Questions and Answers.

All questions relating to building construction, paving, sewerage, water supply, or kindred subjects, will be welcomed in this column provided they relate to matters of general interest and are not such as should properly be referred to a consulting engineer. Answers will be carefully prepared and a proof of both question and answer mailed to the inquirer as early as proper consideration will permit. They will be published for the benefit of other readers as soon as convenient. The full name and address should be given, not necessarily for publication, but as a guarantee of good faith, and to facilitate further correspondence in case the question is not sufficiently explicit.

Inquiries of the Editor, in order to secure prompt attention, should *not be written on the same piece of paper as a communication* to the *Publishing Department.* Letters renewing subscriptions are sent to a clerk in the publishing office, and matter for the Editor, if in the same enclosure, is likely to be overlooked unless it is on a separate piece of paper, so that it may be promptly sent to the Editor.

BEAM BRACKETS ON CAST-IRON COLUMNS.

F. GOUDARD DE LACHAU, architect, writes: "Will you kindly let me know where I could find any data in regard to the strength of shoulders—or brackets—cast with cast-iron columns in order to support beams?"

[We do not know of any published data in regard to the strength of beam brackets on cast-iron columns. If any of our readers do we should be glad to hear from them on the subject.

A beam bracket on a column is essentially a cantilever and subject to bending and shearing stresses, both of which should be calculated, although unless the bracket is unusually long the bending stress will in most cases be found to be so small as to be of little consequence compared to the shearing stress, and if the latter does not amount to more than 3,000 or 4,000 pounds per square inch the bracket will usually be safe enough if the casting is sound. In estimating the section which resists the shear the bracket should not be supposed to be sheared off clean, which would give too large a section, but the probable direction of the fracture should be estimated by the eye, as shown by the broken line on the profile of C in the figure, and only the area of the metal at that point should be considered as effective in resisting the shear or other stress.

When a beam butts against a column it will usually be necessary to provide a rib to which the web of the beam may be bolted in order to secure it in place, and if this rib G be continued around the flange of the beam, as shown, so as to connect with the bracket H it will give additional strength and security to each. If the rib runs up far enough to nearly reach the top flange of the beam it might perhaps with the bolts support the beam in case the bracket should prove defective, at least long enough to permit the danger to be averted. The rib should not quite reach the upper flange at first lest the whole load should be borne there instead of on the bracket.

The rib and bracket just described were for a 10½-inch beam. Rib I and bracket K, were for a 15-inch beam, and in this case the rib had so much projection as to require to be strengthened by two supplementary ribs, though this was mainly to prevent accident in handling.

In case the beam is tangent to the column it can be best supported on a bracket C and drawn up against ribs L L by bolts D D, with the same precautions as before against giving a bearing under the top flange.

In arranging the brackets on a column care should be taken to have the common center of gravity of all the loads coincide as nearly as possible with the center of gravity of the cross section of the column, as if these centers are distant from each other by an amount equal to any material fraction of the column's diameter, the pressures on the column will be very unequally distributed, perhaps even causing tension on one side with a tendency to fail by buckling in that direction under a much less load than could be borne with perfect safety if central.

A great danger attending the use of beam brackets on cast columns is that of hidden flaws and shrinkage cracks or strains, whose existence can rarely be discovered until too late, and which are especially liable to occur in or near the bracket, owing to the irregularities of surface and thickness at that point.

To avoid this danger as far as possible, abundance of metal should be used in the brackets, but rather in the way of large ribs than of excessive thickness, which, by irregular shrinkage, is apt to invite the danger it seeks to prevent. It will also be well to make all fillets around the bracket as large as can conveniently be done without interfering with the beam, as sharp angles are very apt to cause strains and cracks in cooling.

With all precautions, however, the cast bracket is an uncertain dependence for a heavy load, and where great weights have to be carried in this way and a wrought-iron column is for any reason undesirable probably the best thing to use is a wrought-iron key, as at A.

The illustration shows the upper ends of two of the columns of the large boiler house, called "Station B," of the New York Steam Company on Greenwich Street. Economy both of space and of cost rendered the use of cast columns desirable, but the excessive loads to be carried on the brackets and the disastrous consequences of explosions, etc., in case of failure were serious objections to the use of cast brackets.

The problem was finally solved by coring a hole through the column and introducing a wrought-iron bar or key A, 3 inches wide, 6 inches thick and 32 inches long, on the ends of which rested the upper chords B B of the main floor girders that carried the boilers. These columns were 20 feet long, 16½ inches outside diameter, and varied on the different floors from 1¼ to 1 inch in thickness. The girders were lattice, four feet deep, in pairs, and though not directly attached to the columns they were tied together by plates and hooked over the keys so that they could not get away.

The reduction of the section of the column caused by the hole for the key did no harm, as the total load above the bearing of the key was reduced in nearly the same proportion by what was taken off at that point. Brackets E E gave additional support to the key, which, however, was strong enough without them. The arrangement was simple and satisfactory, and while cast brackets might have answered all purposes, the keys gave an assured security that well paid for their slight additional expense. Even a cast-iron key similarly used would probably be more reliable than a cast bracket.

At F is shown the base of the column next above and the method of fitting the two together by turned and bored surfaces. It will be noted that the columns merely set one on top of the other, being steadied only by the beams. This is all well enough after the building is up, but during erection it will usually be found very convenient to have a flange connection between the columns on successive floors, so as to secure them from being accidentally knocked over while setting the girders or doing other work.]

PUBLICATIONS RECEIVED.

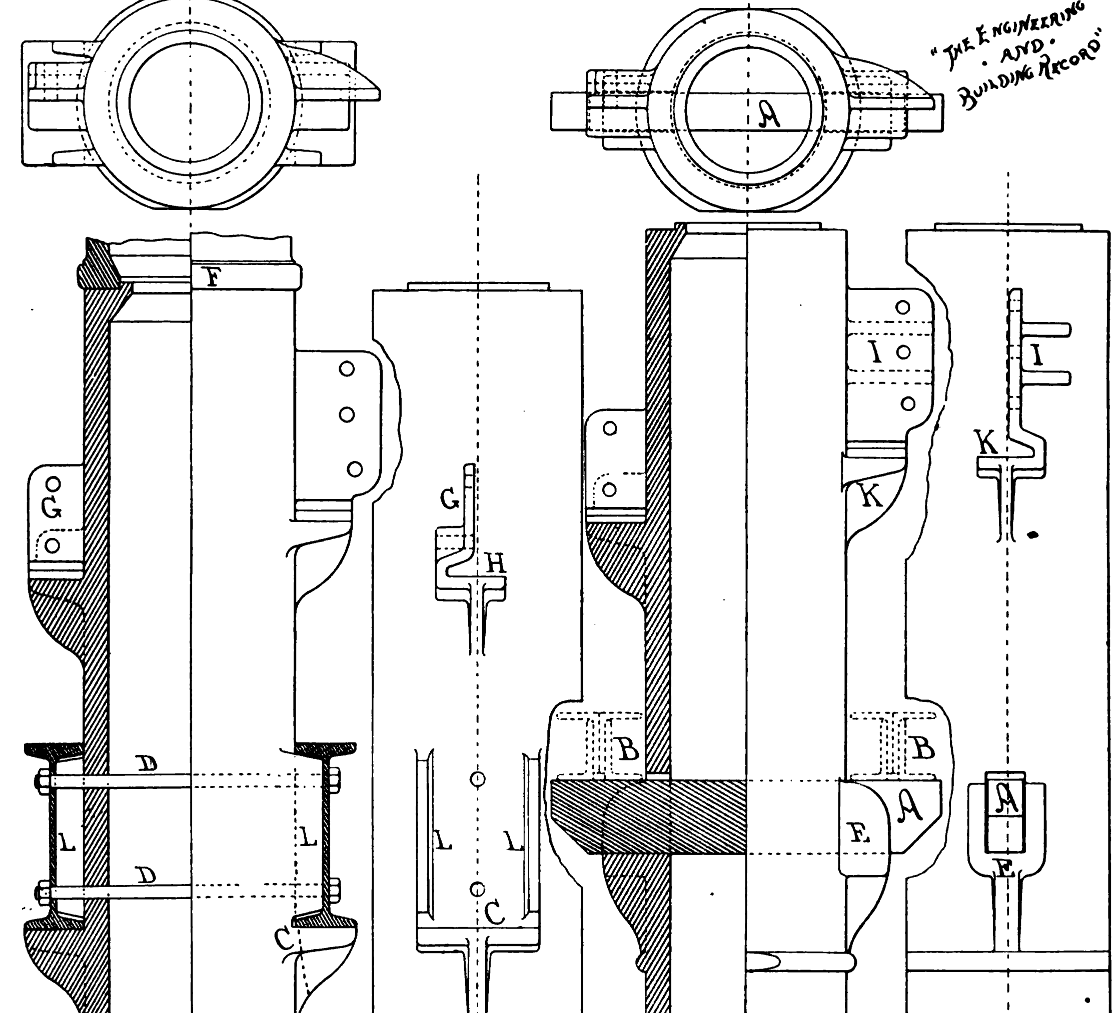
REPORT OF THE HEALTH OF LIVERPOOL DURING THE YEAR 1889; With Map Showing the Localities of the Fatal Prevalence of Fever; by J. Stopford Taylor, M. D., Medical Officer of Health for the City and Port.

REPORT OF THE BOARD OF WATER COMMISSIONERS OF THE TOWN OF NEEDHAM, MASS., ON WATER SUPPLY; May, 1890; pp. 29.

THIRD ANNUAL REPORT OF THE BOARD OF PUBLIC WORKS OF THE CITY OF DULUTH, MINN., for the year ending February 28, 1890; including a report on the extension of the sewerage works, etc., by Rudolph Hering and Andrew Rosewater, consulting engineers, and a plan for a combined railroad and highway bridge across the ship canal on Minnesota Point, by Alfred P. Boller, C. E.; pp. 104.

TWELFTH ANNUAL REPORT OF THE CONNECTICUT STATE BOARD OF HEALTH; for the year ending November 30, 1880, with the Registration Report for 1888 Relating to Births, Marriages and Deaths; pp. 195; 1890.

BEAM BRACKETS.



DOMESTIC PLUMBING HEATING LIGHTING & VENTILATION ENGINEERING

NEW YORK STEAM COMPANY TANK CONNECTIONS.

THERE are given herewith four views, showing the feed and blow connections with the boilers and the connections with the tank in the cellar of the building of the New York Steam Company. Into this tank all water of condensation is discharged and pumped back into the boilers together with a supplementary water supply from the city water mains.

The water of condensation enters through the 6-inch return main R, Figs. 5, 6 and 7. The feed pump suction connection to the tank is made at the lower part and is marked P. When, as is practically always the case, not a sufficient quantity of water of condensation is returned to the tank to supply the boilers, the deficiency is made up by admitting water from the city mains to the tank. This city water supply, which, at the station, is under a pressure of about 28 pounds per square inch, comes through the pipe D, from which a branch is taken by a tee. In this branch is a regulating valve V, controlled by a float in the tank through the intervention of the lever L (Fig 5). There being only a light pressure in the tank, the water under city pressure can readily enter. When the water level in the tank reaches the proper height the float closes the valve V and shuts off the street water supply. Should it become necessary, for any reason, to discontinue temporarily the use of the tank so that the feed cannot be taken from it, the valves E E (Fig. 5) are closed and the water from the street, coming through the pipe D, passes on through the prolongation D' direct to the pumps and thence into the main feed pipe F from which the smaller feed pipes *f* lead off to each boiler. The feed for each boiler is controlled by means of valves in these last mentioned pipes, worked from the boiler room by the rods *v*. The pipes G G, leading from the tank, connect with a glass water gauge. The pipe H is an exhaust pipe from the feed pumps, discharging into the tank, and the pipe K is an exhaust pipe from the tank to the roof, fitted with an automatic valve which opens and permits exhaust steam to escape to the roof when the pressure in the tank reaches a certain point. Should the cold water tank supply pipe, in which the regulating valve V is fitted, require shutting off to repair the valve or for some other reason, the tank may receive its auxiliary supply of cold water through the pipe J leading from the pumps. The blow and some of the feed connections are more clearly shown in Fig. 8; C is a check valve, while A is a special check and stop valve.

A large pump regulator, placed a short distance from the tank, controls the steam supply to the feed pumps so that the water supply to the feed mains always equals the demand. This regulator, briefly described, consists of a large vertical cylinder fitted with a properly guided piston. Steam at boiler pressure is admitted above the piston and the water discharge pipe from the pumps leads below it and passes out again at the other side of the regulator cylinder. All the feed water must thus pass through this cylinder. Should all the feed valves at the boilers be closed, the water, discharged by the pumps beneath the regulator piston, will increase the pressure until it rises above the steam pressure above the piston. Accordingly the latter will rise and through the intervention of a lever system will shut off the steam supply to the pumps. When the feed valves are again opened the water pressure will fall below the steam pressure, the regulator piston will descend, and the steam supply valve to the pumps will be opened. If only some of the boiler feed valves are closed while others remain open, the pump regulator will only partially shut of steam supply to the pumps, and these will run at reduced speed, the water supply in every case being regulated according to the quantity drawn off for the boilers.

It is proper to explain here that the feed connections to the boilers, as shown in Figs. 6 and 8, are not those in regular use, but are what may be called emergency connections. The feed pipes ordinarily employed run up in front of the boilers from the main feed pipes F and discharge into the steam drums. There are no special features in their arrangement, hence they are not shown in the illustrations.

Figure 5, it will no doubt be understood, represents a side view of one end of the tank with the piping; Fig. 6 is an end view, and Fig. 7 a top view.

SCHEMES are under consideration which will, if carried out, devote about 2,700 acres of land about London to public use for ever.

BOSTON PLUMBING LAW.

THE City Council of Boston, Mass., has recently amended the ordinances as follows :

SECTION 1. Sections 16 to 29, inclusive, of chapter 48 of the Revised Ordinances of 1890, are hereby amended to read as follows ·

REGULATIONS FOR PLUMBING.

SEC. 16. Every plumber, before doing any plumbing work in a building, shall have his name and place of business registered in the office of the Inspector of Buildings; shall, except in the case of repairs which do not involve any change in the location of a water fixture or trap or of a waste, drain or ventilating pipe, file in the office of said inspector, upon blanks to be provided for the purpose, a description of all work to be performed, and shall obtain from said inspector a permit to do such work; he shall give immediate notice to said inspector of any change of his place of business.

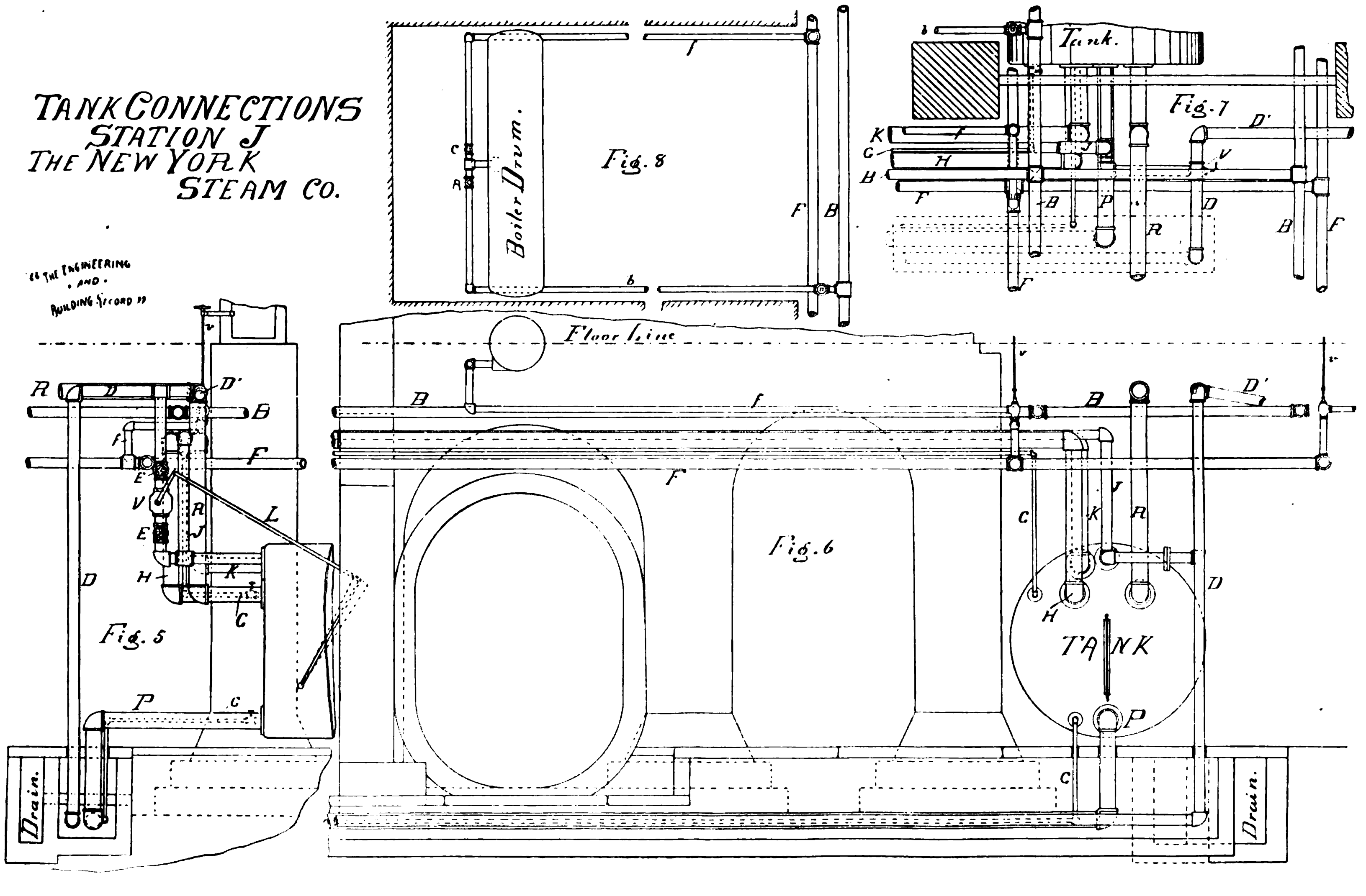
SEC. 17. Every building provided with water from the city or other water supply shall have a drain-pipe for the conveyance of waste water and sewage into the public sewer, or, if there is no sewer, into a sufficient and proper cesspool easily accessible for inspection and cleaning, and such drain-pipe shall not be used for the drain-pipe of any other building.

SEC. 18. Every such drain-pipe within the building, and for at least five feet outside the foundation walls thereof, shall be of what is known in the market as "extra heavy double thick cast-iron soil-pipe," not less than four inches in diameter, sound, free from holes and other defects; shall be laid in a trench, securely ironed to walls, or suspended by strong iron hangers; shall have a continuous fall towards the sewer, and shall, either outside or inside and near the foundation wall of the building, be supplied with a suitable trap having an accessible clean-out.

SEC. 19. The drain-pipe of every building hereafter erected, and of every building already erected in which an additional water-closet is hereafter placed, and of every building already erected in which a water-closet is moved from a place within the building to a room not having a window or other opening immediately to the air on the outside of the building, and within 12 feet of such window or opening, shall be of the same diameter throughout its entire length, and be carried above the roof of the building at least two feet.

SEC. 20. A separate and suitable trap shall be attached to every waste-pipe connecting a water fixture or rain-water leader with a drain-pipe; and such trap shall be placed as near as practicable to such fixture or leader, and no water fixture, trap, or pipe shall be connected with the drain-pipe except by means of a trap.

SEC. 21. Waste-pipes from safes under water-closets, urinals, or other fixtures, or from tanks or cisterns, or from refrigerators or other receptacles in which provisions are stored, if connected with the drain-pipe, shall be run to some place in open sight into an open tray connected by a suitable trap with the drain-pipe.



SEC. 22. Every waste-pipe from a kitchen sink of an eating-house, hotel, restaurant, or other public cooking establishment, shall be connected with a grease-trap placed as near as practicable to the sink, and easily accessible for cleaning.

SEC. 23. A ventilating pipe, of a size not less than the waste-pipe to which the trap is attached, continuously inclining upward from the top of the trap, and running as directly as practicable at least three feet above the roof of the building, shall be tightly attached to each trap. Every ventilating pipe shall be of what is known in the market as extra heavy double thick cast iron, or brass or lead, and the ventilating pipe for every water-closet shall be of not less than two inches in diameter when the ventilating pipe is less than 30 feet in length, and of not less than 3 inches in diameter when the ventilating pipe is more than 30 feet in length; no chimney flue shall be used as a ventilating pipe. Two or more ventilating pipes may be connected together, or may be connected with the drain-pipe above every waste-pipe entering the drain pipe.

SEC. 24. A tank or system shall be connected by a pipe not less than one inch in diameter with every water-closet or line of water-closets in a building, so that water therefrom will thoroughly flush the water-closets.

SEC. 25. All iron pipes before being put in place shall have been tested by the water or kerosene test, then coated inside and outside with coal tar pitch applied hot, or with paint, or with some other equivalent substance; connections of iron pipes shall be run with molten lead thoroughly calked; connections of iron with lead pipes shall be made with brass ferrules, thoroughly soldered to the lead, and the connection of the ferrules with the iron pipe run with molten lead thoroughly calked; changes in directions shall be made with curved or Y branches.

SEC. 26. Water pipes in places exposed to frost shall be securely cased and packed with mineral wool or other equally good substance.

SEC. 27. Plumbing work shall not be covered or be concealed from view until after the work has been examined by the said inspector; and he shall be notified by the plumber when the work is sufficiently advanced for inspection.

SEC. 28. Plumbing work shall not be used until the same is in good condition, as shown by the water test made by the plumber in the presence of the inspector.

SEC. 29. No steam exhaust pipe shall be connected with any ventilating, waste or other connecting pipe, nor with any drain-pipe inside of the trap of the drain-pipe placed near the foundation wall of the building.

PROHIBITIONS AND PENALTIES.

SECTION 1. Chapter 49 of the Revised Ordinances of 1890 is hereby amended by inserting between sections 25 and 26 the following sections.

SEC. 26. No person shall do any plumbing work in a building, or cover from view or use such work, in violation of the regulations for plumbing contained in chapter 48 of this ordinance.

SEC. 27. No person shall connect any steam exhaust pipe with any ventilating, waste, or drain pipe in a building, inside of the trap of the drain-pipe placed near the foundation wall of the building.

And said chapter is further amended by inserting between sections 36 and 37 the following section:

SEC. 37. No person shall place, or drop and suffer to remain in any street, any merchandize of any kind, or any gravel, sand, or other material, or any noxious, offensive, or refuse matter or substance.

Notes and Queries

on Domestic Engineering.

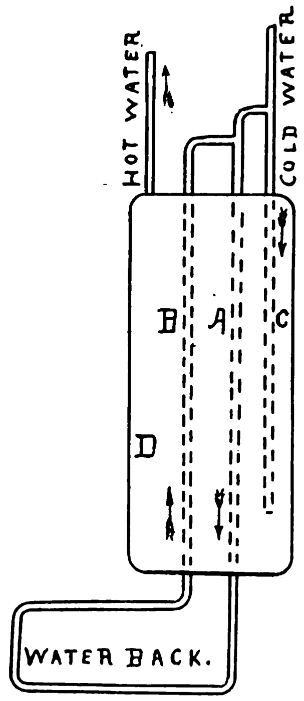
Communications relating to the practical details of plumbing, heating, lighting and ventilation will be welcomed in this column. The writer's true name and address must always be given, but an assumed name may be used for publication if preferred.

HOT WATER BOILER WITH HOT WATER HEATING COIL.

A STAUNTON, VA., correspondent sends a sketch of a bath boiler, here reproduced, explaining that in that section of the country they have a very strong limestone water. What he wants to know is whether with this form of arrangement the stopping up of the water-back with lime will be prevented; also, whether the water in the boiler can be heated in as short a time as in the ordinary form of boiler; and, finally, whether the water in passing through A B will not find its way into the pipe C.

The principle of the boiler is the same as that utilized in many forms of water heaters now on the market, the pipes within the heaters, however, serving for the circulation of waste steam instead of hot water, as in the present case. These heaters, as our correspondent undoubtedly knows, all work more or less successfully. In the particular case under consideration the water heating capacity, or the rapidity with which the water in the boiler D will be heated by the circulation of hot water in the pipes A B, is simply a question of heating surface in the pipes A B and in that part forming the water-back. With sufficient surface, relatively, to the amount of water in the boiler D, we do not see why good results should not be reached. The tendency of hot water from the pipes A B to enter the pipe C is slight; not worth considering, in fact, unless the connection were of so very large a diameter as to admit of circulation within the pipe itself. The chance of this is remote. Some heat will go to the cold water in the inlet pipe by conduction, but this will be slight.

The theory in this case of the prevention of lime obstruction in the water-back obviously is that the water which is once admitted to the pipe system A B and the water-back extension practically remains there, unchanged in quality, except so far as that change is concerned which occurs after it is heated for the first time by circulation through the water-back. This first heating would have the effect of causing a separation of some of the scale-forming impurities held in solution, after which there would be no tendency to form a further deposit. The pipes A B and water-back would probably not be stopped up by this comparatively small amount of initial scaling, though, in the course of time, if the water contained in them be drawn off occasionally and fresh water let in from the cold water supply pipe, new deposits would be formed, which would ultimately, if this drawing off and refilling be repeated often enough, clog the pipes.



HOT WATER COIL FOR BOILER

The scale-forming matter in the water which is heated in the boiler D by the pipes A B would be deposited in the boiler itself, and not interfere with the working of the water-back.

THE PEPPERMINT TEST FOR PLUMBING.

CHARLES F. WINGATE, of New York, writes: "Your directions for making peppermint tests are incomplete. In my practice I try to use a large amount of very hot water—several gallons—poured down from the roof into soil and waste pipes, so as to heat them thoroughly. An ounce of oil is entirely inadequate. I never use less than three ounces and usually six or eight ounces of the best; the cheap adulterated oils are valueless. But the peppermint test is very uncertain in its results. The smoke test is far preferable."

[The amount of peppermint needed of course depends on the size of house and extent of drainage system. The reply we quoted contemplated a small country house. We also prefer the smoke test, but this cannot be applied without a special machine.]

THE prize offered by the *Cosmopolitan Magazine* for a plan for a public bath has been awarded to John G. Howard, of New York, and two meetings have been held looking to the erection of the structure in the city. It is proposed to have a public laundry, as well as baths for both sexes, and to charge small fees for the use of each. Among the men named as interested in the scheme are Bishop Potter, President Seth Low, of Columbia College; Cornelius Vanderbilt, Brayton Ives, Abram S. Hewitt, the Rev. Edward Everett Hale, Erastus Wiman, Joseph H. Choate, Col. John A. Cockerill, William Astor and Richard M. Hunt.

EDWARD SOUTHWICK PHILBRICK.

MR. PHILBRICK was a valued contributor to this journal from the time it was started to the day of his death, and readers will be glad to see a full biographical notice of him, prepared by his friends and associates. The following article was prepared by Albert H. Howland, Desmond FitzGerald and Walter Shepard, Committee of the Boston Society of Civil Engineers; read April 17, 1889, and published in the *Journal of the Association of Engineering Societies:*

Edward Southwick Philbrick, son of Samuel and Eliza (Southwick), was born November 20, 1827, and died February 13, 1889. He was descended from Quaker ancestry that had been native to the shores of Massachusetts Bay from near the date of the settlement of Boston. He was born in Boston, but except during early infancy his home was always in the adjacent town of Brookline. His father was a merchant in Boston, a director in several corporations, and for thirty years treasurer of the Massachusetts Anti-Slavery Society.

In 1843, after fitting for college at the Brookline High School, he entered the Sophomore class at Harvard College. Paternal consent to this step, however, was conditional upon his living at home, walking the three miles each way to and from college daily, and spending no time on the study of Greek. These requirements were strictly complied with, but the restriction as to Greek prevented his receiving the customary degree on the completion of his course; at a later date, however, in recognition of his merits in other directions, the degree was conferred as of the class of 1846, to which he belonged. In the list of its members are the names of Senator George F. Hoar, Dr. Calvin Ellis, Dr. Charles D. Homans, and Professors Francis J. Child, George M. Lane and Charles E. Norton.

In the summer of 1847, after spending a few months in the office of the late Samuel M. Felton, he began field work on the Rutland and Burlington Railroad, in Vermont, holding the position of assistant engineer on location and construction. Upon this work he was engaged some three years. Then going to Canandaigua, N. Y., he was employed in the construction of some branches of the Erie Railway. He held here the position of resident engineer of location and construction, and this work occupied another three years till near the end of 1853.

The decade that included these six years was marked by striking advances in the application of iron to bridge work. The great Conway and Britannia tubular bridges were built; the Victoria tubular bridge over the St. Lawrence at Montreal was begun; suspension bridges were built over the Ohio at Wheeling and the Niagara at Lewiston; and the great railroad suspension bridge at Niagara Falls was finished. Several of these structures were near the territory within which Mr. Philbrick was engaged in railroad building, and the subject of iron bridge construction so strongly engaged his attention that he soon took an opportunity to extend his knowledge of such structures as well as of public works in general.

A few months after he had finished work in Western New York he sailed for Europe, and remained abroad a year and a half. Several months were spent at Paris in professional studies. Then much of the time, with knapsack on his back, he traveled through Great Britain, France, Belgium, Austria, Italy and Turkey. Passing beyond Europe he extended his travels to Egypt and Syria, spending in these countries the last six months of his stay abroad. Mr. Philbrick was a close observer, and being, furthermore, the possessor of a retentive memory, he gathered during these travels a store of information that was a frequent source of surprise to those with whom he conversed, minute details even not escaping him, especially such as had a professional bearing.

In the summer of 1855 he returned home and soon afterwards entered the employ of the Boston and Worcester Railroad as Assistant Superintendent and Engineer. For five or six years he was engaged in improving the location of the road and rebuilding some of its structures. A bridge that he designed and built during this period, namely, the "Arsenal Bridge," in Brighton, should be mentioned in this connection, not on account of its size (for it is merely a plate girder of 87 feet span in the clear) but as an instance of his early preference for riveted work, and as evidence of the soundness of his judgment in selecting at that day a type of structure for spans approaching even 100 feet, that after a quarter of a century's experience has come to be pretty generally approved as the most suitable. This was built in 1860. In the early part of the next year Mr. Philbrick again spent several months in Europe.

Near the beginning of 1862, after Port Royal had been captured by the Union forces, and had become the refuge of the negroes of the neighboring country, true to his inherited anti-slavery principles and his own convictions, Mr. Philbrick undertook the organization of labor on a dozen or more abandoned plantations in that and the neighboring islands, including the education and training of the freedmen as citizens. Many volunteers from this vicinity accompanied and assisted him in the work, which was carried on for two years under the direction of the United States Treasury Department on government account. Subsequently the Government sold the plantations for taxes, and the work was continued by a corporation formed for that purpose, which was successful commercially as well as in respect to its main purpose.

After the war closed Mr. Philbrick was employed upon some town improvements in Brookline, and connected with some manufacturing enterprises. In 1869 he was appointed by the Governor of Massachusetts Inspecting Engineer of the Boston, Hartford & Erie Railroad, to which the State had made a loan of $3,000,000.

About this time the Boston and Albany Railroad was formed by the consolidation of the Boston and Worcester and the Western railroads. The traffic of the road increased to such an extent that the work of rebuilding its bridges in iron was decided upon and Mr. Philbrick was appointed Consulting Engineer and had charge of it. A large number of bridges were built, mostly between Worcester and Albany. The type he adopted was the riveted lattice, or for small spans the plate girder. The most notable among these bridges was that over the Connecticut at Springfield, and it occasioned a good deal of controversy as to the comparative merits of riveted and pin-connected trusses. Without entering into the details of the question (for the controversy is by no means ended) it seems proper to say that Mr. Philbrick's judgment is supported by the practice of some of the largest and best managed roads and that even pin-connected bridges in recent years have been made to conform in some features to the riveted type. Mr. Philbrick's preference for riveted connections did not extend to very large spans. Other works on the Boston and Albany Railroad constructed under his charge were the large Union Station at Worcester, and the grain elevators in Boston, that at East Boston being notable on account of the difficulties encountered in securing good foundations.

Near the close of 1868 the State of Massachusetts contracted for the completion of Hoosac Tunnel. The Troy and Greenfield Railroad Company had previously received State aid to the amount of several million dollars to build the tunnel and connecting railroad, but after 20 years' efforts much the larger part of the tunnel remained unfinished and the State had come into possession. A year or two after the contract was made Mr. Philbrick was consulted upon some questions that arose as to alignment and quantities, and was soon afterwards appointed Consulting Engineer to the Governor and Council for this work, and held that position till the tunnel was opened. The amount of this contract was over $4,500,000. The accuracy with which the headings met was remarkable; at two miles from the east portal, where the heading from the central shaft was met, the deviation was only $\frac{5}{16}$ of an inch in line and 1¼ inches in level. Besides the tunnel proper there was a large amount of work in improving the line and building iron bridges on the connecting road, of which Mr. Philbrick was engineer.

The improvement of the flats at South Boston was also carried out under Mr. Philbrick's charge, and is a work of considerable local importance. The State contracted for building the sea walls and filling a portion of the flats in the latter part of 1873. A large area adjacent was owned by the Boston & Albany Railroad, and a contract was made for filling this at the same time. Mr. Philbrick had charge of this also. The territory thus made available now forms the terminal grounds of the New York & New England Railroad, provided with extensive freight sheds, grain elevator and wharves and docks for ocean steamers, distant only about a half mile from the post-office. These sea walls are notable for their substantial construction, and the Harbor Commissioners say, in one of their reports, that "no work, to their knowledge, has been undertaken in any harbor of our country superior in its design or workmanship to the plan and execution of the heavy sea wall, so far as it has progressed."

When the growth of the town of Brookline necessitated a public water supply the construction of the works was intrusted to Mr. Philbrick. The supply is taken from a filtering gallery near Charles River at a point a few miles from the town. These works were constructed during 1874–5 at a cost of half a million of dollars.

As a sanitary engineer, Mr. Philbrick had a wide reputation and was esteemed an eminent authority. The building, ownership and care of nearly a score of houses gave him opportunity for long continued experiment and a practical knowledge of the actual conditions to be met. The results of his experience in this branch of engineering were given to the public in a book on "American Sanitary Engineering," in pamphlets on "Defects in House Drainage and Their Remedies," and on "Disposal of Sewage in Suburban Residences," and in contributions to periodicals and discussions at society meetings. The publications form an interesting and important part of the sanitary branch of engineering literature. They have been extensively used in the practice of engineers and are often referred to as standard works on the subject.

Included in his professional practice were consultations as to the foundations of Trinity Church and the new public library building in Boston; service on commissions to award damages for diversion of water by the city of Worcester from Blackstone Valley and by the city of Cambridge from Stony Brook, and to investigate the causes and management of the Great Fire in Boston; reports on sewerage in several neighboring towns; building of highway and railway bridges over the Merrimac at Haverhill, and others of less note. New England is the field where most of his professional work has been done. Domestic ties and the care of a large property tended to prevent him from seeking other fields.

His membership in our Society dates from June 8, 1874, and in the American Society of Civil Engineers from May 6, 1876. The transactions of the latter contain several of his papers and discussions, among which is a paper on the South Boston Flats improvements.

Marked characteristics of Mr. Philbrick were a directness, simplicity and candor that won the confidence of those with whom he dealt. These qualities with his practical knowledge and varied experience caused his services to be sought for where the construction of expensive works demanded unquestioned fidelity and ability. With contractors he was sometimes considered rather strict, but he was fair-minded and considerate and ready to yield if he found himself in error. He was a man of varied interests; the newest book and the latest achievement of science received his attention.

Mr. Philbrick was free from all ostentation, and while professional duties and the care of his property and of trust funds engrossed much of his time, there were many enterprises benevolent in nature or aiming to promote the general welfare which received his active and devoted support. Well known among these is the Massachusetts Institute of Technology, of whose corporation he had for many years been an active member. In benevolent efforts his aim was to avert as well as to relieve misfortune and suffering.

As a citizen he was public-spirited, independent in politics, and deeply interested in whatever tends to promote good and honest government, often devoting time and money to this end though seeking for himself no conspicuous part.

In religious belief he was a Unitarian and served as treasurer of the First Unitarian Church in Brookline for many years.

On the 16th of September, 1857, he married Miss Helen M., daughter of the late Alfred Winsor, of Brookline, who, with his mother, now 96 years of age, are the survivors of his household.

The works of the engineer often receive but little of the popular appreciation that their merits deserve. They may be located in remote and unfrequented places, or buried where the light of day never reaches them; often they are so unobtrusive that they seem to be almost a part of nature's own handiwork. Hence there is a peculiar satisfaction, when an occasion like this makes it fitting to recount them, in considering what a monument it is that he leaves behind him in the highways that bring to the people the products of a continent, the structures over which millions pass in safety, the warehouses where the food of the nations is stored, the grounds where the products of the world are distributed, the appliances that secure health to our homes. Such works bear witness to his skillful designing, fidelity in execution, patient toil in overcoming obstacles that seem almost insurmountable, foresight in providing for emergencies, correctness in reasoning, and an integrity that will not deviate from an honest course to secure in a day the profits of a life-time. Such qualities will be freely ascribed to Mr. Philbrick; and the warm personal esteem of those who knew him well will ever cause them to hold him in grateful remembrance.

BERLIN TELEPHONES.

In Berlin the erection and maintenance of telegraph and telephone wires is placed under charge of a special department, with what is called a Councillor of the Post Office at the head. From some statistics printed in *Kuhlow's* it appears that nearly 1,000 men are employed in laying and repairing the telephones in this city. In addition, there are about 600 persons employed in the switch stations. The telephone was opened with 50 subscribers. The number of speaking places now exceeds 13,000, and the new applications show no sign of diminishing. Thirty-six officials are at present employed on the erection of overhead telephones. Last year there were eight other officials from other postal districts temporarily examining the wires here. The 28 erecting sections employ 15 wire superintendents, 60 men for preparatory work and 239 permanent and temporary workmen and assistants. There are, further, 45 slaters, 38 tinsmiths and 44 slaters' laborers who are provided by a private contractor in accordance with contract. There are, therefore, 477 persons employed on the overhead telephones, inclusive of the 36 officials. In the fiscal year 1889–90 they erected 34,390 meters of lines with wooden posts and 101,287 meters with iron posts and 7,491,536 meters of wire, or one-fifth the circumference of the earth and three-fifths its diameter. Further, 3,306 speaking places were established, and 1,427 transferred from one place to another, most work being done between the 1st of April and the 1st of October. On an average between 15 and 16 new speaking places were established on every working day of the year.

CAPACITIES OF BLOWERS AND EXHAUST FANS.

The following tables show the guaranteed air supply and air removal of leading forms of blowers and exhaust fans. They are taken from a paper on "The Ventilation of Buildings," by A. R. Wolff, published in the April number of *The Stevens Indicator*.

The figures given, as Mr. Wolff explains, are often exceeded in practice, especially when the blowers and fans are driven at higher speeds than stated. The ratings, particularly of the blowers, are below those generally given in the manufacturers' catalogues.

TABLE I.

Showing Quantity of Air Supplied to Buildings by Blowers of Various Sizes.

Diameter of Wheel (in Feet.)	Ordinary Number of Revolutions per Minute.	Horse-Power to Drive Blower.	Guaranteed Capacity in Cubic Feet per Minute Against a Pressure of One Ounce per Square Inch,
4	350	6.	10 635
5	325	9.4	17 000
6	275	13.5	29.018
7	250	18.4	42,700
8	200	24	46,000
9	175	29	56,800
10	160	35.5	70 340
12	130	49.5	102,000
14	110	66	139,000
15	100	77	160,000

Of course if the resistance exceeds the pressure of one ounce per square inch, of above table, the capacity of the blower will be correspondingly decreased, or power increased, and due allowance for this must be made when the distributing ducts are small, of excessive length, and contain many contractions and bends.

TABLE II.

Showing Quantity of Air Moved by an Approved Form of Exhaust Fan.

Diameter of Wheel in Feet.	Ordinary. Number of Revolutions per Minute.	Horse-Power to Drive Exhaust Fan.	Guaranteed Capacity in Cubic Feet per Minute, the Fan Discharging Directly from Room into Atmosphere.
2.0	600	0.50	5,000
2.5	550	0.75	8,000
3.0	500	1.00	12 000
3.5	500	2.50	20,000
4.0	475	3.50	28,000
5.0	350	4.50	35.000
6.0	300	7.00	50,000
7.0	250	9.00	80,000

It should be noted that the capacity of exhaust fans here stated, and the horse-power to drive them, are for free exhaust from room into atmosphere, and that the capacity decreases and the horse-power increases materially as the resistance, resulting from lengths, smallness, and bends of ducts enters as a factor. The difference in pressure of Tables I. and II. is the main cause of variation in the respective records. The fan referred to in Table II. could not be used with as high a resistance as one ounce per square inch, the rated resistance of the blowers in Table I.

BOOK NOTICES.

THE DISPOSAL OF HOUSEHOLD WASTES. By William Paul Gerhard, C. E.; pp. 195; published by D. Van Nostrand Co.; price, 50 cents.

Mr. Gerhard's little book is one of Van Nostrand's well-known "Science Series," and in it the author discusses at some length the important question of how to dispose of the waste matters of the household in the safest, least disagreeable, and most efficient and economical manner. The treatment of the subject is chiefly from the householders' point of view, and will accordingly commend itself to the average reader. The subject itself is of current interest and importance, and we have no doubt, therefore, that the little work will prove a most welcome source of information to a large number of people. An appendix gives three interesting sets of specifications—one for laying house drains and pipe sewers; another for building a tight cesspool; and, finally, one for a sub-surface irrigation system for a country house. Suggestions for a sanitary code fill up the concluding pages.

TRADE PUBLICATIONS.

OFFICIAL REPORTS OF VARIOUS DUTY TRIALS OF THE GASKILL PUMPING ENGINE.

The above volume, dated 1890, has just been issued by the Holly Manufacturing Company, of Lockport, N. Y. It contains the reports of 27 different duty trials of Gaskill pumping engines made since 1882, at various cities, and will be found full of matter of interest and value to engineers generally. Many of the reports go into the details of the methods of testing followed, representing desirable examples of the way such work should be carried out. The book embraces 224 pages and is profusely illustrated.

STEWART CERAMIC COMPANY.

We have received from the Stewart Ceramic Company, of 312 Pearl Street, New York, price-list and illustrated catalogue describing the various kinds of wash-tubs manufactured by them, together with directions for finishing and setting same.

CONTRACTING NEWS DEPARTMENT.

A WEEKLY RECORD

OF SPECIAL INTEREST TO CONTRACTORS, BUILDERS AND MANUFACTURERS OF ENGINEERING AND BUILDING SUPPLIES.

CONTRACTING INTELLIGENCE

Our readers will oblige us by notes, clippings, or any information which will put us in the way of obtaining early and reliable news for our "Contracting Intelligence." *Information of importance sent to us exclusively, and not elsewhere published will be liberally paid for.*

Persons who make any use of the information they find in these columns we trust will not omit to mention THE ENGINEERING & BUILDING RECORD as the source

For works for which proposals are requested see also the "Proposal Columns," pages i-ii-47.

WATER.

For Additional Water Items see Proposal Columns.

NILES, MICH.—Recorder W. Landon writes: "Nothing has been done towards water-works as yet."

GENOA, ILL.—City Clerk D. W. Hartman writes: "Our Town Council have called a special election for June 21, to take an expression of the people as to whether they want water-works or not. The system contemplated is the Holly system, with tank system of reservoir. I think the vote will be for, and that the work will be started in the near future."

CINCINNATI, O.—It is now proposed to connect the Covington and Newport, Ky., water service with the system belonging to this city, by laying pipes across the bridges. It is said that the supply of these adjacent places is more than sufficient for their own use, and that at least 15,000,000 gallons daily can be furnished to Cincinnati. This remedy is only proposed until Cincinnati can secure her own permanent and sufficient supply.

SOUTHAMPTON, N. Y.—The movement for establishing a system of water-works in this village, mentioned in a recent issue of this paper, has assumed definite shape, and a company is about to be organized for the purpose of building a plant, the estimated cost of which is $35,000. The matter is being managed by the summer residents of the place, headed by Dr. G. Thomas, who can furnish further particulars.

BROOKLYN, N. Y.—At a meeting of the Board of Aldermen, held June 16, a resolution was submitted asking that the Commissioners of Public Works be given authority to construct a water stand-pipe upon the grounds of the Prospect Heights reservoir, the cost not to exceed $65,000, and that bonds for the amount necessary be issued. The resolution was referred to the Committee on Water and Drainage.

FREEHOLD, N. J.—This place has voted to own the proposed water-works, consequently the system will be established by the city.

VERNON, CONN.—This town has voted to build a dam and lay a 4-inch water-main for a water supply for the almshouse.

CHICAGO, ILL.—The Chicago High Water Pressure Company has been incorporated in this city to construct and operate water-works. Capital stock, $5,000,000. W. C. Baine can furnish information.

NEW BRITAIN, CONN.—The Water Commissioners are having plans made for new mains.

JACKSON, MICH.—Efforts are being made to procure a suitable water supply for this place.

BETHEL, ME.—The taxpayers of this place have organized and are making efforts towards securing a system of water-works.

OWOSSO, MICH.—The City Clerk at this place writes: "This city owns its own water-works and has just voted $20,000 for additional improvements for same. Four miles of additional pipe will be laid, 18 hydrants, a new supply of water developed and a reservoir well 36 feet in diameter are among the contemplated improvements. W. R. Coates, of Kalamazoo, Mich., is the engineer."

SAVANNAH, GA.—The City Council, at an adjourned meeting June 11, authorized the committee on water to build independent water-works on the Springfield plantation, at an approximate cost of $250,000, and to put down two more wells on the present water-works tract for immediate relief, to obviate the necessity of using river water.

SPRINGFIELD, MASS.—The report of the Water Commissioners to the City Government, submitted June 16, which was unanimously accepted, has, it is said, solved the question of obtaining a pure water supply for this city. The report calls for an appropriation of $100,000, to purchase water rights and privileges and pay land damages to bring 7,000,000 minimum and 25,000,000 maximum gallons of pure water per day, through 1,700 feet of 53-inch wrought iron pipe and three miles additional canal, to a 10-acre reservoir at the head of the Ludlow structure, which is to be fed principally by brooks and seven streams. The plan also contemplates a waste gate and sluices for drawing down dry the Ludlow reservoir when the independent system is perfected, and the cleansing of its bed by fresh water slushing and other methods. There is said to be no doubt that the appropriation asked for will be voted at the next meeting of the City Government, and the work immediately entered upon, the Legislature having already granted the privilege to the city to remedy itself in this matter.

SALT LAKE CITY.—An extensive system of water-works is to be built here, contemplating an expenditure of about $1,000,000.

BURRELL, PA.—The Burrell Water Company is to establish a plant at this place. For particulars address John D. Boyle, as above.

LAKE GENEVA, WIS.—A plant is to be established at this place by the Lake Geneva Water and Light Company. The proposed expenditure is $40,000. James E. Heg can furnish particulars.

SIOUX CITY, IOWA.—It is reported that the water supply of this city is inadequate and that steps are to be taken at once towards increasing it or establishing a new system. Superintendent of Water-Works Sullivan can furnish details.

HACKENSACK, N. J.—The local water company is preparing to extend its mains to Maywood.

PARNASSUS, PA.—This place is to have a system of water-works. For details address Joseph P. Chappeu, as above.

COHOES, N. Y.—At a meeting of the Common Council, held June 17, the City Chamberlain was authorized to sell on July 7, bonds in the sum of $25,000, for the purpose of raising money to defray the expense of extending the water mains and making necessary repairs to the water-works plant. Mayor Garside can give details.

MADISON, N. J.—At the election held here June 16, the measure to appropriate the sum of $75,000 for water and light was carried.

FLEETWOOD, PA.—City Clerk J. K. Merkel writes: "It has been decided to get water in our town, but when and how is not decided yet. Might be able to inform you later."

SPRING CITY, TENN.—H. T. Price, Recorder writes: "The franchise has been granted for water-works by the Councilmen of Spring City, but I am unable to inform you when work will commence. Hon. H. T. Wilson, General Manager of the Anglo-American Association can, perhaps, give the desired information."

WATER-WORKS.—See our Proposal Columns for information regarding water-works and water-works furnishings at the following places: St. Paul, Minn; Binghamton, N. Y.; Columbus, O.; Montreal, Can.; East Liverpool, O.; Winchester, Mass.; Mansfield, O.; Providence, R. I.; Ottawa, Ont., Brooklyn Village, O.; Des Moines, Iowa; Glenville, O.; Fargo, Dak.; St. Louis, Mo.; Ogden, Utah; Galesburg, Ill.

SEWERAGE.

For Additional Sewerage Items see Proposal Columns

WILMINGTON, DEL.—Additional sewers have been ordered by the city officials.

NEW ROCHELLE, N. Y.—The following bids for the construction of sewers and drains were received by Horace Crosby, civil engineer, June 14:

BIDDERS.	15-inch Pipe, Lineal Feet.	12-inch Pipe, Lineal Feet.	10-inch Pipe, Lineal Feet.	8-inch Pipe, Lineal Feet.	6-inch Pipe, Lineal Feet.	5-inch house connections, Lineal Feet.	Y's, each.	Rock, Cubic Yard.	Concrete, Cubic Yard.	Broken Stone, Cubic Yard.	Manholes, each.	Flush Tanks, each.	Lamp Holes, each.	Other Items.	Total.
William F. Croft, New Rochelle	$1.25	$1.15	$1.50	$1.03	$0.83	$0.88½	$1.00	$3.17	$6.00	$1.00	$40	$65	$15	$2,208.00	$46,237.40
Molloy Bros., New Rochelle	1.40	1.21	0.91	0.75	0.65	0.57	.30	3.00	3.75	.90	40	75	12	1,664.24	39,744.58
Van Vranken & Duell, Schenectady, N. Y.	1.02	0.98	1.32	0.82	0.53	0.43	.41	2.47	5.00	2.00	45	60	8	2,904.80	38,073.28
George E. Clark, New York City	1.25	1.20	1.10	0.95	0.70	0.60	.72	3.50	6.00	2.25	50	75	15	1,826.80	46,984.80
M. J. Leahy, New York City	2.20	1.65	1.65	1.65	1.62	0.70	1.55	2.25	3.50	1.60	75	80	10	2,118.70	56,443.70
J. H. Edwards, New York City	1.60	2.20	1.10	0.90	0.72	0.42	.50½	3.05	6.00	1.10	55	100	5	2,365.80	50,731.94
J. H. & J. R. Byron, Mt. Vernon	1.23	1.20	1.29	0.93	0.70½	0.40	50	3.25	5.00	2.25	50	75	18	1,904.00	45,664.03
Fogg & Scribner, New York City	1.50	1.35	1.00	0.87	0.75	0.60	1.00	2.40	5.00	1.50	50	80	15	1,526.10	41,025.85
Frank P. Bertram, New York City*	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....

* Informal; withdrawn.

Contract awarded to Malloy Bros., June 18.

OGDEN, UTAH.—T. A. Perkins, City Engineer, writes: "Time for bids on sewer pipe and cement is extended to June 30." See our Proposal Columns.

ST. PAUL, MINN.—Kirkland & Starkey have been awarded the contract by the Board of Public Works for the construction of the Arlington Hills sewer system, at $53,243. The bids were as follows: Kirkland & Starkey, $53,245; William J. Preston, $58,000; Patrick Doherty, $62,191; Walter C. Doherty, $62,473; Stockton & Lindquist, $66,000; James Forrestal, $66,500; Thornton & Shaw, $71,900.

MITCHELL, S DAK.—The City Council has formally resolved to construct a Main Street sewer and sink a second artesian well.

BINGHAMTON, N. Y.—The following proposals for the construction of the Trout Brook and Trout Street sewer have been opened by the committee: Thomas Craig, Trenton, N. J., $21,000; E. A. Matthews, Binghamton, $17,400; Geo. W. Stow, Binghamton, $17,840. No award has been made.

GREEN BAY, WIS.—The officials of this city are discussing the question of establishing a system of sewerage. Mayor Elmore of this city and W. F. Goodhue, C. E., of Milwaukee, Wis., have discussed the matter, and it is probable the important steps will soon be taken. The Mayor can furnish information.

LA SALLE, ILL.—Work will soon be commenced on system of sewerage for this city, designed by Chester B. Davis, of Chicago, Ill. About three miles of 10, 18 and 24 and 36 inch sewers will be built this summer.

PHILADELPHIA, PA.—The Sewer Committee has approved the report of the subcommittee on main sewers, to which was referred the matter of the proposed expenditure of $240,000 appropriated for the construction of main sewers.

PETOSKEY, MICH.—Village Clerk A. C. Huntley writes: "A system of sewerage for this village is in contemplation, and survey made by Prof. C. E. Green, of Ann Arbor, Mich., who is preparing profiles, etc., and probable expense. The system is not an absolute certainty this season, but it is quite probable that the matter will be pushed through this season."

HOLLEY, N. Y.—City Clerk W. S. Housel writes: "A numerously signed petition of property owners, for sewers on certain streets, was presented to the Board of Sewer Comsioners of this village on June 13. The Board has appointed a meeting to be held July 1 to hear persons for and against the construction of such sewers, in accordance with the map and plan of a system of sewerage for this village, as approved by the State Board of Health. The outlook for sewers seems favorable."

ELGIN, ILL.—Numerous sewer extensions are to be made at this place. Address Alderman Brydges, as above.

BRIDGES AND IRON STRUCTURES.

For Additional Bridge Items see Proposal Columns.

WINDSOR LOCKS, CONN.—It is reported that the New York, New Haven and Hartford Railroad Company contemplates the building of a bridge across the Connecticut River above this place.

JEFFERSON, TEX.—The plans for a number of bridges to be erected in this county are about completed, and proposals for their erection will soon be wanted. For further information address the Marion County Commissioners, at this place.

PUEBLO, COL.—An iron bridge, to cost $10,000, is to be erected at this place.

QUINCY, MASS.—Mayor Porter has petitioned the County Commissioners to enlarge the overhead bridge and approaches over the Old Colony Railroad at Hancock Street, this place.

SIOUX CITY, IOWA.—The Iowa Railroad Commission has decided to accede to the prayers of the city officials in the matter of placing a viaduct over the railroad crossings on lower Fourth Street, and the structure will be erected at once. Mayor Palmer, of this city, can furnish details.

AUSTIN, TEX.—The Hardeman-Willbarger Bridge Company has been incorporated to build a bridge across Red River, at Austin. Capital stock, $50,000.

SHELBURNE FALLS, MASS.—The following bids for the construction of an iron bridge over the Deerfield River at this place from plans and specifications by Edward S. Shaw, Consulting Engineer, of Boston, were received by the Bridge Committee of the towns of Shelburne and Buckland, June 12, and the contract was awarded to the Vermont Construction Co: Vermont Construction Co., St. Albans, Vt., $14,999; Penn Bridge Co., Beaver Falls, Pa., $16,200; Boston Bridge Works, Mass., $16,202; Rochester Bridge Works, Rochester, N. Y., $16,369; King Bridge Co., Cleveland, O., $16,610; Groton Bridge Co., Groton, N. Y., $16,750; Berlin Bridge Co., East Berlin, Conn., $17,290; Hilton Bridge Co., Albany, N. Y., $17,500; Canton Bridge Co., Canton, O., $18,000; Pittsburg Bridge Co., Pittsburg, Pa., $18,326; Wallis Iron Works, Jersey City, N. J., $20,800; New Jersey Steel and Iron Co., Trenton, N. J., $22,067.

RIVERTON, VA.—Town Clerk J. W. Morgan writes: "S. S. Turner, Esq., of Front Royal, Va., is President of a company which proposes bridging the south branch of the Shenandoah River at this place immediately."

NEW HAVEN, CONN.—It has been voted to appropriate the sum of $45.000 for the purpose of erecting a bridge over the Housatonic River, at Birmingham, Conn.

FRONT ROYAL, VA.—G. W. Cone writes from this place as follows: "The Front Royal and Riverton Improvement Company propose to build at once a 300-foot iron road bridge across the Shenandoah River at Riverton, Va. Information may be had by addressing the Vice-President, Geo. Wm. Cone, at Riverton, Va."

TRENTON, N. J.—The following bids for the construction of an iron bridge were received by Symmes B. Hutchinson, County Solicitor, June 14: New Jersey Steel and Iron Co., Trenton, N, J., $1,435; Milliken Bros., 55 Liberty Street, New York, $1,560; King Bridge Co., $1,520; Dean & Westbrook, $1,510; Variety Iron Works, Cleveland, O., $1,700; Finley & Lachicotte, York, Pa., $1,780; Groton Bridge Co., Groton, N. Y., $1,780; Berlin Bridge Co., East Berlin, Conn., $1,575.

MERIDEN, CONN.—There is a project here to bridge the tracks at Cooper Street. Address Mayor Paige for details.

BLOOMFIELD, N. J.—Plans for a bridge over the river at James Street are being prepared by County Engineer Owen.

DRESDEN, O.—The Smith Bridge Company, of Toledo, O., has been awarded the contract for the superstructure of a bridge over Wakatomika Creek, at this place, for $36.20 per lineal foot. Length of span, 123 feet C, to C of end pins. Steel truss and I beams for floor joists, floor 3-inch oak plank. Capacity, 2,000 pounds per lineal foot. Roadway, 18 feet.

KNOXVILLE, TENN.—Reports say that extensive repairs will be made to the bridge over Gay Street. The Chamber of Commerce is interested.

ASHEVILLE, N. C.—An iron bridge is to be built here by the Asheville Improvement and Construction Company. W. W. Barnard, the Secretary, can furnish particulars.

LITTLE ROCK, ARK.—A location for the proposed bridge, to be erected between Broadway and Main Street, has been decided on by the Commissioners.

NEBRASKA CITY, NEB.—A special meeting has been called by the County Commissioners and the City Council to vote July 8 on the proposition to issue $100,000 in bonds to the Nebraska City Highway Bridge Company to aid in building a wagon bridge across the Missouri River at this place.

GLASGOW, VA.—It is said that the Rockbridge Company, of this place, is interested in a movement to place a bridge over the North River, between this place and East Glasgow.

NEW ALBANY, IND.—A bridge is to be erected over Knob Creek, by the County Commissioners.

BRIDGES.—See our Proposal Columns for information regarding bridge construction at the following places: Dalton, Ga.; Mt. Vernon, O.; Columbus, O.; Albany, N. Y.; Salinas City, Cal; Foreman, N. D; Mitchell, Dak.; Pembina, N. D.; Eureka, Cal.; Alder Point, Cal.; Evansville, Ind.; Duluth, Minn.

NEW DEPOTS.

SPOKANE FALLS, WASH.—The Northern Pacific will soon erect a new depot at this place.

BENWOOD, W. VA.—Extensive shops and sheds will be erected here by the Baltimore and Ohio Railroad Company.

ELLENSBURG, WASH.—New repair shops are to be erected at this place by the Northern Pacific Railway.

RAILROADS, CANALS, ETC.

CINCINNATI, O.—George Hornung, engineer in charge, reports that the Mt. Auburn Electric Road is to be extended, and the plant is to be increased by 2-80,000 Watt. generators, 2-160 horse power engines and 2 boilers. They are ready to receive bids on engines and boilers. Address as above.

EL PASO, TEX.—Railroad.—The contract for grading, bridging, track laying, and the material for the first 100 miles of the Pecos Valley Railroad, from Pecos City, Tex., to Eddy, N. M., has been let to W. C. Bradbury & Co., of Denver. The work is estimated to cost $1,000,000.

STREET-WORK AND PAVING.

PATERSON, N. J.—The Paterson Plank Road Committee of the Bergen County Board of Freeholders decided, June 17, to macadamize the plank road through the village of Carlstadt.

PHILADELPHIA, PA.—The Council's Highway Committee has authorized the expenditure of the sum of $255,000 for paving certain streets in this city.

AMSTERDAM, N. Y.—All the proposals for furnishing 175,000 fire-clay paving brick were rejected by T. E. Crane, the engineer, June 10, as they exceeded the maximum figure named. New bids will soon be wanted.

WILMINGTON, DEL.—Considerable paving to be done at this place.

ZANESVILLE, O.—T. B. Townsend & Co. have been awarded the contract to pave 3d, 4th, 5th, Market and Marietta streets with vitrified brick at $1.29 per square yard, total cost.

GAS AND ELECTRIC-LIGHTING.

CUERO, TEX.—This place is to establish an electric lighting plant.

CHEHALIS, WASH.—This place wants electric lights.

KEESEVILLE, N. Y.—An electric lighting plant is soon to be established at this place. Address the Town Clerk for details.

AKRON, O.—The local electric light company will make important extensions to its plant.

WARE, MASS.—The Ware Electric Light Company will make improvements to its plant.

STOCKTON, CAL.—The Stockton Electric Company has been formed here. Cash capital, $1,000,000. F. E. Birge is at its head.

HUNTINGTON, ARK.—An electric light plant, 750 lights capacity, is to be established at this place by the Huntington Cotton Company.

MORRILLTON, ARK.—The taxpayers of this place have decided to establish an electric lighting plant.

HOQUIAM, WIS.—Reports say that the Aberdeen and Hoquiam Electric Railway Company is to establish an electric light plant at this place in connection with its street railway.

GRAND RAPIDS, MICH.—The City Clerk has been authorized to advertise for proposals for lighting the city for the ensuing year.

OWEGO, N. Y.—This place is to be lighted by electricity.

SUMMIT, N. J.—An electric light plant is proposed for this place. Address A. A. Smalley for information.

NEW YORK CITY.—The Commissioners of the State Reservation, at Niagara, have decided to light the State Park by electricity.

SCRANTON, PA.—The Wightman Electric Manufacturing Company has been incorporated here, with a capital stock of $30,000.

BURRELL, PA.—This place is to be lighted by gas.

LEBANON, N. H.—This place has voted for electricity as an illuminating power.

RAPID CITY, S. DAK.—A gas company is to be established at this place. For particulars address the Hon. W. T. Coade, of Chicago, Ill.

STREATER, ILL.—The Streater Gas and Light Company has been incorporated at this place, with a capital stock of $100,000. Address W. R. Gillett for particulars.

HAMILTON, ONT.—The plant of the Hamilton Electric Light Company is to be increased.

LOGAN, UTAH.—An electric light plant to have a capacity of 1,000 lights is to be established at this place.

PEORIA, ILL.—An electric light and gas plant is to be established at this place by the Peoria Gas and Electric Light Company. Estimated cost, $750,000. Address F. C. Crowley for details.

CAIRO, ILL.—The Citizens' Electric Light and Power Company will establish a plant at this place, at an estimated cost of $20,000. Henry Wells can furnish particulars.

HOT SPRINGS, ARK.—Reports say that the Hot Springs Electric Light Company will put in a plant with a capacity for about 1,500 incandescent lights.

GARDEN CITY, ILL.—The Garden City Electric Light and Power Company will establish a plant at this place. Estimated cost, $25,000. Address C. A. Buell, for particulars.

COMO, N. J.—An electric light plant will be established here by Henry H. Yard. Como, Belmar, Spring Lake and Sea Girt are to be lighted.

HAYWARDS, CAL.—An electric light plant is to be established at this place by S. D. Ingram and others.

QUINCY, ILL.—The Quincy Gas and Electric Light Company has been incorporated at this place to establish a plant. Estimated outlay, $400,000. Address, for details, Marion Pickett, as above.

BLAINE, WASH.—An electric light plant is to be established at this place by the Blaine Electric Light and Power Company. Cash capital, $50,000.

ST. PAUL, MINN.—Incorporated is the Grand Forks, Minn., Water, Light and Power Company, to construct electric light and power plants at that place. The capital stock is $100,000 and the incorporators are L P Ordway, Charles S. Rogers and others.

TECUMSEH, MICH.—An electric light plant will be established here by a local company, with a cash capital of $30,000.

DETROIT, MICH—The United Electric Company has been incorporated at this place with a capital stock of $50,000.

FAIRBURY, NEB.—The people of this place are discussing the electric light question.

KALAMAZOO, MICH.—Improvements and extensions are to be made to the local electric light plant.

TARPON SPRINGS, FLA.—An electric lighting plant is to be established at this place by the Occidental and Improvement Company.

WOODVILLE, PA.—The people of this place have voted for electric lights.

MACON, MO.—This place is to establish an electric lighting plant.

STUART, IOWA.—The Hawkeye Electric Manufacturing Company, of Davenport, Iowa, proposes to establish an electric light plant here. Neal Wilkin, of the above concern, can furnish particulars.

BINGHAMTON, N. Y.—This place is to have electric lights. Address, for details, Geo. W. Dunn, as above.

ELECTRIC RAILWAYS.—New electric railways will be established, and improvements will be made to those already built, at the following places: College Point, N. Y.; Brooklyn, N. Y.; Salem, Mass.; Newton, Mass.; Prescott, Arizona; Cairo, Ill.; Milwaukee, Wis.; Newark, N. J.; Orange, N. J.

GOVERNMENT WORK.

WASHINGTON, D. C.—The following proposals for the work specified at the places named were opened on the given dates by the Supervising Architect of the Treasury Department:

Plattsburg, N. Y.—Steam heating apparatus, low pressure, for the United States Court House and Post Office at this place. Opened June 18. Bidders: John Lyon, Washington, D. C., $2,548.88; Thos. Costello, Plattsburg, N. Y., $3,769; Kelly, Jones & Co., Elmira, N. Y., $3,093; Jas. & R. H. Walker, Baltimore, Md., $3,416 87; Q. M. Evans Construction Co., New York City, $4,227; Samuel I. Pope & Co., Chicago, $3,575; Chas. A. Crosley, New York City, $2,418.

Detroit, Mich.—Basement and area walls of the United States Custom House at this place. Opened June 18. Bidders: Jos. L. Gearing, Detroit, Mich., $167,365, pier granite, Bedford; $168,248, pier granite, Berea; $169,938, pier granite, Amherst blue stone; $171,414, pier granite, cream buff Amherst; $173,140, pier granite, blue Bedford; $175,928, pier granite, Prentice brown; $182,560, pier granite, Portage entry; $144,250, blue Bedford; $123,851, Berea and cream buff Amherst; $128,219, Berea and Prentice brown; $120,528, Berea; $124,183, blue Amherst; $130,667, buff Bedford; $141,461, blue Bedford; $180,565, Medina; $201,807, granite; $203,436, Minn. granite. E. F. Gobel, Chicago, $163,500, Ohio blue sandstone. Patrick Knapp, Detroit, $116,654, Bedford limestone. David Knapp, Detroit, $181,225, granite and limestone. A. Chapoton, Detroit, $178,495, Bedford lime; $213,495, granite throughout; $178,495, Berlin buff; $215,642, Louis Falls granite; $178,495; Amherst; $188,495, Portage red sandstone. McCarthy & Baldwin, Washington, D. C., $149,431, all granite; $132,609, granite and Indiana sandstone. John Moore, Syracuse, N. Y., $149,000, Bedford; $209,000, granite.

WASHINGTON, D. C.—The Secretary of the Navy, June 17, awarded to Samuel I. Moore & Co., of Elizabethport, N. J., at their bid of $250,000, the contract for the construction of a steel practice cruiser of 800 tons displacement, for which bids were opened on June 10. The contract for the armored cruiser has been awarded to William Cramp & Sons, of Philadelphia, Pa., at their bid of $2,985,000, on their own plans.

INDUSTRIAL.

ALBANY, N. Y.—The specifications for the lock lengthening, authorized by the last Legislature will, it is said, be ready in a few days, when proposals for doing the work will be wanted. Superintendent Hannan has also furnished plans, etc., for a new canal bridge at Rochester, and for dredging the Hudson River, between Troy and Coxsackie, and the work will soon be advertised.

UNION, N. J.—This place has voted the sum of $42,500 for public improvements.

POSITIONS VACANT.

TOO LATE FOR CLASSIFICATION.

THOROUGHLY QUALIFIED MECHANICAL Engineer desires position as Superintendent, or would act as agent for manufacturer. Undoubted references. Address "ENGINEER," care of THE ENGINEERING AND BUILDING RECORD, 1050 Drexel Building, Philadelphia. 4

PROPOSALS.

(Continued from page ii.)

PUMPING ENGINE, ETC., Mansfield, O.—Proposals are wanted until June 25, for furnishing a pumping engine and boilers. Address the Trustees of the Mansfield Water-Works, as above.

COURT HOUSE, Lake Charles, La.—Proposals are wanted until July 7, for the erection of a Court House at this place. Address Adolph Meyer, President of the Police Jury, as above.

PAVING, Toledo, O.—Proposals are wanted until June 30 and July 7, for paving certain streets. Address C. H. Durian, City Clerk, as above.

IRON BRIDGES, Mt. Vernon, O.—Proposals are wanted until June 30, for the construction of numerous iron bridges. Address the Board of County Commissioners, as above.

BREDGING, Albany, N. Y.—Proposals are wanted until July 1, for doing certain dredging. Address Edward Hannan, Superintendent of Public Works, as above.

BRIDGE, Dalton, Ga.—Proposals are wanted until June 28, for the construction of an iron bridge at this place. Address J. C. Norton, as above.

RESERVOIR DAM, Winchester, Mass.—Proposals are wanted until June 25, for completing the South Reservoir dam. Address Percy M. Blake, engineer, as above.

BUILDING, Macon, Ga.—Proposals are wanted until June 30, for the erection of a brick building. Address W. D. Williams, as above.

BUILDING, Oil City, Pa.—Proposals will be received until July 3, by H. C. Sweeney, City Comptroller, for the construction of new city building of brick and stone, with terra-cotta trimmings, to cost $20,000. Ground area about 5,000 square feet, 40 feet high, with tower 88 feet high. Address E. A. Curtis, architect, as above.

ROAD, Atlanta, Ga.—Proposals are wanted until July 14, for the construction of a gravel road. Address Major J. W. Scully, Quartermaster, U. S. A., as above.

BRIDGES, Albany, N. Y.—Proposals are wanted until July 1, for the construction of a lift bridge over the Erie Canal, in this city. Address Edward Hannan, Superintendent of Public Works, as above.

PAVING, Allegheny, Pa.—Proposals are wanted until June 30, for paving certain streets. Address James Brown, Comptroller, as above.

PAVING BLOCKS, Norfolk, Va.—Proposals are wanted until June 25, for furnishing 3,000 tons, more or less, of second-class granite paving blocks. Address Adam Treadwell, Chairman Board of Street Commissioners, as above.

WATER-WORKS, Somerset, Ky.—Proposals are wanted, no date, specified, for the construction of a system of water-works. Address A. M. Parsons, Box 159, as above.

GRANITE AND BRONZE WORK, ETC., New York City.—Proposals are wanted until June 25, for the erection of granite and blue stone steps, platforms, cornices and parapet walls, bronze railings, brick arches, iron beams, etc., required on Morningside Park, at the three octagonal bays and three entrances adjoining the avenue on the westerly side of the Park, and the entrance at One Hundred and Tenth Street and Manhattan Avenue. Address the Department of Public Parks, as above.

BRIDGE, Salinas City, Cal.—Proposals are wanted until July 1, for the construction of a bridge over the Carmelo River. Address T. J. Riodan, County Clerk, as above.

PROPOSALS.

STREET WORK, Cleveland, O.—Proposals are wanted until June 26, for doing work on certain streets. Address C. G. Force, City Civil Engineer, as above.

BRIDGES, Columbus, O.—Proposals are wanted until June 30, for the erection of an iron and steel bridge over the Sciota River, at Rich Street crossing. Address Frank J. Reinhard, County Auditor, as above.

BRIDGE, Mitchell, Dak.—Proposals are wanted until July 7, for building a bridge at this place. Address R. T. Robinson, County Auditor, as above.

BRIDGE, Foreman, N. D.—Proposals are wanted until July 7, for the erection of a bridge over the Wild Rice River Address Charles Afdem, County Auditor, as above.

PAVING, Gloversville, N.Y.—Proposals are wanted until June 30, for furnishing, etc., about 13,000 square yards of cedar-block paving. Address F. H. Wilmarth, City Clerk, as above.

CANALS, Albany, N. Y.—Proposals are wanted until July 8, for doing work on certain of the State canals. Address Edward Harman, Superintendent of Public Works, as above.

Building Intelligence.

We solicit from each and every one of our readers information relating to projected buildings in their locality, and should be glad to receive newspaper clippings and other items of interest.

ABBREVIATIONS.—*b s*, brown stone; *br*, brick; *br st*, brick store; *b s dwell*, brown-stone dwelling; *apart house*, apartment-house; *ten*, tenement; *e*, each; *o*, owner; *a*, architect; *b*, builder; *fr*, frame.

NEW YORK.

86 E 9th st, br workshop and store; cost, $16,000; o, Hattie K Hilton; a, F Goudard de Lachau.

S s 177th st, 70 e Manhattan av, 6 br flats; cost, $108,000 all; o, Ed Cunningham; a, H Davidson.

S s 104th st, 76 E Madison av, 3 br flats; cost, $57,000 all; o, Elizabeth Johnston; a, A B Ogden & Son.

W s 8th av, 70 e Madison av, br ten; cost, $12,000; o, H Lutzberg; a, J W Cole.

336–338 W 11th st, 2 br flats; cost, $36,000 all; o, J Reagan; a, J W Cole.

N w cor 116th st and 5th av, br flats; cost, $40,000; o, J Walker; a, Andrew Spence.

W s 116th st, 34 w 5th av, 4 br flats; cost, $88,000 all; o and a, same as above.

206 Spring st, br factory; cost, $15,000; o, N Y Pie Baking Co; a, C E Hadden.

N s 53d st, 250 w 9th av, 2 br flats; cost, $40,000 all; o, C Natale; a, A Huttira.

N s 103d st, 80 e West end av, 3 br dwells; cost, $43,000 all; o, A Walker and Martha A Lawson; a, M F V Ferndon.

342 W 14th st, br office bldg; cost, $8,000; o, J Pettit; a, J M Farnsworth.

438–42 E 9th st, 2 br flats; cost, $30,000 all; o, Bertha Von Barber; a, F Wennemer.

N e cor 10th av and 90th st. br flats; cost, $25,000; o, Ida M Hamilton; a, J A Webster.

E s 10th av, 25 n 90th st, 3 br flats; cost, $54,000 all; o and a, same as above.

N s 72d st, 250 e 9th av, br dwell; cost, $50,000; o, J A Kohn; a, Buchanan & Diesler.

Cor 9th av and 124th st, 4 br flats; cost, $100,000 all; o, J Smith; a, E E Gandolfo.

S e cor 81st st and 10th av, br flats; cost, $100,000; o, J Casey; a, G A Bagge.

S s 81st st, 42 e 10th av, 2 br flats; cost, $100,000 all; o and a, same as above.

S s 81st st, 116 e 10th av, 4 br flats; cost, $120,000 all; o and a, same as above.

N e cor Broadway and 82d st, 5 br flats; cost, $64,500 all; o, L & V Brandt; a, J Brandt.

W s Washington av, 35 s 180th st, 3 fr dwells; cost, $12,000 all; o, J Massinnio; a, J J Vreeland.

3 West 23d st, br club house; cost, $40,000; o, Union Club; a, Bruce Price.

S s 127th st, 312 w 9th av, br flats; cost, $50,000; o, W M Moran; a, R R Davis.

St John's College Grounds, br school; cost, $100,000; o, St John's College; a, J M Farnsworth.

W s Park av, 102 n 79th st, br dwell; cost, $17,000; o, J McDonnell; a, Thos Graham.

N e cor 3d av and 16th st, br store; cost, $50,000; o, A C Clark; a, G H Guibel.

10 Cannon st, br flats; cost $20,000; o, Fay & Stacom; a, C. Rentz.

762–766 Broadway, br store; cost, $75,000; o, S Dessan; a, Schneider & Herter.

BUILDING INTELLIGENCE.

ALTERATIONS—NEW YORK.

121 Madison av, br hotel; cost, $50,000; o, Madison Ave Co; a, H Pierson & Co.

1 W 34th st, br clubhouse; cost, $30,000; o, Lessee Manhattan Club; a, Bruce Price.

S e cor 41st st and Broadway, br hotel; cost, $15,000; o, I Plant; a, E Thomson.

42 University pl, br shop; cost, $11,500; o, J Moss; a, G M Huss.

290 5th av, br dwell; cost, $12,000; o, L P Hollander; a, not given.

BROOKLYN.

N s 33d st, 200 w 5th av, 7 fr dwells; cost, $17,500 all, o and a, W E Kay.

667 Lafayette av, br dwell; cost, $10,000; o, M A Scull; a, L C Holden.

N s Jefferson av, 174 w Stuyvesant st, 4 br dwells; cost, $20,000 all; o, W C Bush; a, J E Dwyer.

W s Bedford av, 24 n Gates av, 2 br dwells; cost, $18,000 all; o, D Winant; a, A Hill & Son.

N w cor Bedford and Gates avs, br dwell; cost, $14,000; o and a, same as above.

N s Eastern Parkway, 160 w Troy av, fr dwell; cost, $9,000; o, W S Bloch; a, Parfit Bros.

S s Madison st, 90 w Hamburg av, 4 fr dwells; cost, $15,200 all; o, E F Wildmer; a, Thomas Engelhardt.

S w cor Bergen st and Ralph av, 2 fr dwells; cost, $8,000 all; o, C Schildt; a, same as above.

N s Eastern Parkway, 200 w Troy av; fr dwell; cost, $9,250; o, J W Bloch; a, Parfit Bros.

S s 15th st, 150 s 4th av, 5 br dwells; cost, $27,500 all; o, G Keymer; a, W Corrigan.

N s Green av, 300 w Reid av, 3 br dwells; cost, $15,000 all; o, Thomas Washs; a, W J Murphy.

N e cor Bushwick and Flushing aves, 5 fr dwells; cost, $40,000 all; o, J Manneschmidt; a, F Holmberg.

N s Ridgewood av, cor Railroad av, 10 fr dwells; cost, $20,000 all; o, W H Baker; a, not given.

S s 7th st, 35 w 5th av, 5 br dwells; cost, $20,000 all; o, A G Calder; a, W H Calder.

N s Douglass st, 291 e Albany, 7 br dwells; cost, $21,000 all; o, Mullin & Konce; a, J E Dwyer.

N s Douglass, 100 e Albany av, 10 br dwells; cost, $40,000 all; o, D C Ross & Co; a, J E Dwyer.

N w cor St Mark's pl and Albany av, fr dwells; cost, $12,000; o, C M De Camp; a, F B Langston.

N s 1st st, near Dunton pl, 5 br dwells; $35,000 all; o, G R Brown; a, not given.

Cor 1st st and Whitehill pl, 2 br dwells; cost, $80,000 all; o and a, same as above.

434–436 Fulton st, br theatre; cost, $65,000; o, Alex Herman; a, J D Allen.

N w cor Garfield and Polhemus pl, br dwell; cost, $13,000; o, Martin & Lee; a, C Werner.

THE Editor of THE ENGINEERING AND BUILDING RECORD is always glad to receive items of news for the Contracting News Department. But such items are not considered news except when the prices and particulars of the award of a contract are given.

The announcement that ——— has sold ——— to ——— without giving the *prices* and particulars concerns only the buyer and seller. Such notices are always excluded, except in the case where a certain firm is stated to have taken a certain contract, the execution of which would require that they should buy certain materials. Such an item would be used if deemed of more than local interest, because it would suggest to some readers the possibility of their making a sale or securing a sub-contract.

BUILDING INTELLIGENCE.

ALTERATIONS—BROOKLYN.

452 Washington av, br dwell; cost, $10,000; o, J W Wisner; a, M A Morris.

S s 12th st, 475 e 7th av, br dwell; cost, $9,000; o, Ansonia Clock Company; a, not given.

201 Montague st, br dwell; cost, $12,500; o, L I Loan and Trust Company; a, W B Tubby.

N e cor Sidney Place and Livingston st, br church; cost, $13,000; o, Rev T F Ward; a, T F Houghton.

S w cor Bedford av and Rodney st, br club house; cost, $20,000; o, Hanover Club; a, P J Lauretzen.

N w cor Water and Washington sts, br box factory; cost, $12,000; o, R Gair; a, B Finkenseiper.

MISCELLANEOUS.

BOSTON, MASS.—Virginia st nr Bird, 1 fr dwell; cost, $8,000; o, Wm H Saywood; a, John A Fox; b, Burke Bros.

497 Beacon st, 1 br dwell; cost, $23,000; o, Seth R Baker; a, E N Boyden; b, E Lynch.

Sedgewick st nr Allston st (Dor.), 1 fr dwell; cost, $8,000; o, a and b, J H Beale.

647–49 E 6th st, double fr dwell; cost, $14,000; o, D B Jutton; a and b, W T Eaton.

8 A Monument sq, Chsn, 1 br apart; cost, $20,000; o, Albert Lincoln; a, Wm. Wright; b, J F Nyhan.

Boylston st, W R, 1 br passenger station; cost, $10,000; o, O C R R; a, Geo S Morrill; b, Jos Ross.

Central st, W R, 1 br passenger station; cost, $10,000; o, a and b, same as above.

140–44 Walnut av, 3 br dwells; cost, $25,000; o, Dunbar estate; a, Geo A Avery; b, W T Eaton

Marlborough st cor Exeter st, 1 br apart; cost, $80,000; o, Seth R Baker; a, E N Boyden; b, Davis Rand.

FT. WORTH, TEX.—Noth ing over $7,000 in value to report.

MILWAUKEE, WIS.—20th and Prairie sts, dwell; cost, $7000; o, Victor Schlitz; a, Ch Gombert; b, Chas Duchow.

13th and Sycamore sts, dwell; cost, $9,000; o, Leupold Heller; a, Crand & Barkhausen; b, W Leupold.

Oneida and Milwaukee sts, business block; cost, $30,000; o, B M Weil; a, as above; b, G Posson.

MINNEAPOLIS, MINN.—244–49 S Colfax av, 2 fr dwells; cost, $14,000; o, Louis Baker; a, J Leck.

1701 3d av, S, fr dwell; cost, $9,000; o, S H Matteson; a, W H Dennis; b, Abbott & Moore,

57–61 S 4th st, br addn to *Tribune;* cost, $10,000; o, A J Blethen; a, W H Dennis; b, L Frederickson.

1707–9 4th av, N, br store and flat; cost, $20,000; o, S Wyatt; a, A W Spaulding; b, M Salmon.

1811–21 2d av, N, fr tenement; cost, $9,000; o and a, W J Smith; b, L B Johnson.

1914–18 E Franklin av, fr stores and flats; cost, $7,500; o, a and b, Jno Kelly.

2407 Irving av, S, fr dwell; cost, $10,500; o, a and b, J S O'Donnell.

61–65 N 11th st, br flats; cost, $8,000; o, Mrs J W Field; a, Orff Bros; b, J Congdon.

2115 Kenwood boul, fr dwell; cost, $7,000; o, W J Bishopp; a, Bertrand & Keith; b, J Congdon.

2104–6 N Aldrich av, fr block of flats; cost, $8,500; o and b, J W Taylor; a, J H Record.

NEW HAVEN, CONN. — Nothing over $7,000 in value to report.

OGDENSBURG, N. Y.—Nothing to report this week up to $7,000.

POTTSVILLE, PA.—Nothing over $7,000 in value to report.

ST. LOUIS, MO.—S w cor Jefferson av and Gamble st, br medical college; cost, $35,000; o, St Louis College of Physicians; b, Phil Riechers.

N e cor 16th and Walnut sts, br factory; cost, $50,000; o, J G Butler; a, Henry Roach; b, sub let.

BUILDING INTELLIGENCE.

ST. LOUIS, MO.—Lindell and Boyle avs, br dwell; cost, $9,000; o, Dr I N Love; b, T C Higgins.

Delmar and Newstead avs, 2 br dwells; cost, $17,000 all; o and b, T C Higgins.

S e cor Compton av and Morgan st, br dwell; cost, $15,000; o and b, B M Proetz.

4th and Spruce sts, br warehouse; cost, $135,000; o, Samuel Cupple's R E Co; a, Eames & Young; b, C E Clark.

4th and Locust sts, br office bldg; cost, $700,000; o, Security Building Co; a, Peabody, Stearns & Furber; b, same as above.

Lindell and Boyle avs, br dwell; cost, $13,000; o, A Steer; b, J Mahon.

Broadway and Lamie sts, br power house; cost, $52,000; o, St Louis R R Co; b, R W Morrison & Co.

Lafayette and Theresa avs, br dwell; cost, $7,200; o, Dr A Flickenger; b, J H Dunlap.

Lindell and Vandeventer avs, br dwell; cost, $22,000; o, F W Humphrey; a, Eames & Young; b, J Guedry.

Delmar and Vandeventer avs, br dwell; cost, $9,000; o, J N Booth; b, H R Becker.

N w cor 12th st and Cass av, br factory; cost, $10,000; o, G V Brecht Supply Co; b, sub let.

Olive st, 2 br bldgs; cost, $10,000; o, S T Bleyer.

Jefferson av and Gamble st, br bldg; cost, $35,000; o, St Louis College of Physicians.

Delmar av, 2 br bldgs; cost, $17,000.

Compton av and Morgan st, br bldg; cost, $15,000; o, B M Proetz.

Page and Spring avs, 2 br bldgs; cost, $6,800; o, C A Watson.

Spruce st, bet 7th and 8th sts, br warehouse; cost, $135,000; o, Sam Cupples Real Estate Co.

4th st, bet Olive and Locust sts, office bldg; cost, $700,000; o, Security Building Co.

Lindell av, bet Boyle and Newstead av, br bldg; cost, $13,000; o, Albert Steer.

Lafayette av, br bldg; cost, $7,200; o, Dr A Fleckinger.

Laclede av, br bldg, cost, $6,800; o, N W Perkins,

Lindell av, br dwell; cost, $22,000; o, F W Humphrey.

Delmar av, br bldg; cost, $9,000; o, J N Booth.

ST. PAUL, MINN.—Nothing over $7,000 in value to report.

URBANA, O.—A City Hall will be erected here at a cost of $25,000. Address City Clerk, as above.

A $20,000 school house will be erected here. The Clerk of the Board of Education can give information.

UTICA, N. Y.—Architect W H Symonds has prepared plans for a $20,000 building here.

WALTHAM, MASS.—Nothing over $7,000 in value to report.

WATERLOO, IOWA.—Plans have been prepared for a $9,000 building at this place. Address I T Coolidge, as above.

WILKES BARRE, PA.—Public square, br store and dwell; cost, $11,000; a, M Burgunder; b, M B Houpt.

WINCHESTER, KY.—A factory building will be erected here at an estimated cost of $23,000. Address architects E F and W S Brickell, Olean, N. Y.

WINDSOR, ONT.—A $20,000 school building will be erected here. Address architect J G McLean, 9 Medbury Building, as above.

WORCESTER, MASS.—Salisbury st, br bldg; cost, $15,000; o, Society of Antiquity; a, Barker & Nourse; b, not let.

South Worcester, fr dwell; cost, $7,000; o, St Matthew's Episcopal Church; a and b, J B Woodworth.

Front st, alteration of business block; cost, $8,000; o, R C Taylor; a and b, J W Patstone.

ZANESVILLE, O.—Nothing over $7,000 in value to report.

THE ENGINEERING & BUILDING RECORD
AND
THE SANITARY ENGINEER.

A JOURNAL FOR THE ARCHITECT, ENGINEER, MECHANIC, AND MUNICIPAL OFFICER.

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STREET INTERSECTIONS ON STEEP GRADES.

OF all the problems that confront the city engineer in planning a system of street grades perhaps the most difficult is to determine the proper arrangement of a street intersection where one or both streets have much inclination, since to avoid excessive side slopes on one street it is necessary to increase the grade of the other and *vice versa*, and the proper balance between the two is not easy to settle, especially as the whole question is further complicated by the requirements of the intersecting sidewalks.

The simplest and, as far as side slopes are concerned, the best solution would be to keep the intersection level, with all corners at the same elevation, but this is not necessary on light grades and much increases the steepness of heavy ones, besides introducing an unsightly break in the vertical alignment, so that it can only be viewed as a condition which, however desirable for some reasons, can only be approximated and never realized, except when both streets rise or fall both ways from the intersection. On the other hand, to continue steep grades across intersections has the effect of introducing dangerous side slopes in the streets that are thus crossed, and the result is that the grades at intersections are practically a sort of compromise between what we would and what we must.

Unfortunately this compromise is seldom determined by any fixed rule, the grades being usually "fudged" according to the judgment or convenience of the engineer, resulting in great irregularity in practice and much uncertainty in securing the most satisfactory results. It is for this reason that we desire to call special attention to the careful treatment which this subject has received in the recent report of Rudolph Hering and Andrew Rosewater on the Sewerage and Paving of Duluth, of which an extended abstract is given elsewhere in this issue. The arrangement of grades at intersections therein recommended, although designed on general principles, agrees closely with what has been found to be good practice in Duluth and will therefore answer for any other locality, for no steeper grades are practicable there or elsewhere than those for which this arrangement was intended.

Our object in calling attention to this report, however, is not so much to point out its merits, which will be sufficiently obvious to those who have studied the matter, as to invite criticism and discussion and especially some relation of experience in regard to a subject of very general interest to city engineers, but about which, as far as we can learn, little or no general discussion has ever been had.

In such a discussion the following questions might be of special interest, namely: Whether at intersections it is better to adopt certain maximum slopes or to make the slopes bear a certain proportion to those of the intersecting streets, and what those maxima or proportions should be? What is a safe slope on the diagonal from corner to corner at intersections, considering the effect of centrifugal force on vehicles turning the corners and how it would be effected by crowning the streets? How to avoid having the sidewalk higher at the curb than at the house line on steep intersections without causing an excessive side slope in the intersecting sidewalk, and under what circumstances it is advisable to introduce steps in the sidewalks to avoid abrupt steeping of the grade. On these and similar points we have no doubt that some of our readers can contribute valuable information.

RECORDS OF UNDERGROUND STREET WORK IN NEW YORK.

IT is peculiar, to put it mildly, that while the space underneath the streets of New York is given up to a network of pipes of various kinds to supply public needs, all nominally under the supervision of the Department of Public Works, the latter is to-day almost completely ignorant of the character and general arrangement of the underground work, or, at best, knows little more about it than the average citizen. Water pipes and sewers have perhaps been kept track of more or less carefully, but the disposition of steam and gas pipes, electric conduits, pneumatic tubes, etc., is something upon which the Department is hopelessly in the dark. And yet it is but reasonable to think that this matter is strictly within its province, and that full information should be in its possession of the exact location, character, and purpose of every pipe buried in the streets. Just why the Department knows next to nothing of all this is one of the many interesting questions pertaining to the local government which the citizens are left to answer for themselves.

The gas companies, the electric companies, and the steam company, and the several other establishments having underground systems, each know where to find their conduits when, for some reason, they are to be unearthed, but there is not in existence a single map showing the positions which these subterranean pipes occupy relatively to one another at the present time. When the New York Steam Company began operations about nine or ten years ago, the work of preparing a map of this kind was taken in hand and, for a time, was conscientiously carried out. This map was, and is to-day, the only one of its kind and is an example of what, on a comprehensive scale, would be available in the Department of Public Works if the management there had been carried out judiciously and on a common sense basis. The lack of such information as a map of this kind would give was very strikingly brought to light on the occasion of the recent explosion at the corner of Broadway and Fulton Street. That there were there steam pipes, gas pipes, water pipes, sewers and various electric conduits was, of course, taken for granted, but, in truth, nobody knew, or knows now, anything definite about it. The utter ignorance, in fact, of the underground character of the streets at what ought to be the proper source of authoritative information on the subject would be laughable were it not so serious a matter. The street work records—called so by courtesy—of the Department of Public Works of New York are indeed aptly comparable to those which many small country towns are supposed to have of their street systems of water supply and other underground pipes, the details of which, after they are once covered up, are, and remain, unknown except when brought to light by experimental excavation.

It is not too late, however, even now to remedy all this. For a practically small sum of money a serviceable chart of what is beneath the streets could readily be made. Its need has been demonstrated over and over again. Let the preparation of such records be insisted upon and there will then be available, moreover, a rational and sound basis upon which to discuss the imperative questions of street and subway engineering.

BRIDGEPORT MACADAM ROADS.

THE Bridgeport, Conn., *Standard*, in a notice of the book "Pavements and Roads," recently issued from this office, quotes fully from the discussion on thin roads at Bridgeport between E. P. North, who described them in these columns, and James Owen, of Newark, N. J., saying in conclusion:

> Since these articles were written considerable has been added to the mileage of Bridgeport's good roads, and hundreds of visitors from all over the country have inspected them and the methods used in their construction, and have given testimony of their worth. It is no longer an open question whether they are practicable or not, for Bridgeport has settled that in the affirmative, and her example is being followed in many places where the best roads possible for a small outlay are desired. We do not know whether Mr. Owen, of New Jersey, has ever been here to see our roads or not, but we trust that if he has not he will soon come, and that Mr. Pierce and the gentlemen of the Board of Public Works will do the honors.

TROY POLYTECHNIC ALUMNI MEETING.

THE annual dinner of the Alumni Association of the Rensselaer Polytechnic Institute was held at Troy, N. Y., Tuesday evening, June 17, with about 60 members and guests present, and the annual meeting was held the next day. There was considerable discussion of Institute affairs, including the advisability of eliminating French, German and botany from the course, but no definite action was taken. In connection with the annual register a resolution was adopted requesting any person who knew the address of a former member of the Institute who was not a graduate to forward it to the director.

A resolution was also adopted making the Institute diploma sufficient for membership in the Alumni Association, abolishing initiation fees and including the graduating class among those to whom the Treasurer's circular shall be sent. William H. Doughty, Joseph C. Platt, Jr., and C. C. Waite, were appointed a committee to arrange for getting the subscriptions of classes to the building fund as speedily as possible.

Officers were elected as follows: President, J. J. Albright, '68; First Vice-President, Clark Fisher, '58; Second Vice-President, W. H. Doughty, '58; Third Vice-President, W. B. Cogswell, '52; Recording Secretary, W. P. Mason, '74; Corresponding Secretary, C. W. Crockett, '84; Treasurer, J. H. Caldwell, '86; Directors, Elias P. Mann, '72; E. Ray Thompson, '76; Joseph A. Powers, '80; Montgomery Waddell, '84; E. S. Kibbe, '86; Necrological Secretary, H. B. Nason. Townsend V. Church, Treasurer, submitted his report, which was adopted. The report showed that there was $60 cash on hand. There are no outstanding debts.

NOTES.

THE Columbus Branch of the Ohio Society of Civil Engineers has dissolved because of want of interest in the organization among members.

A PROJECT for building a second large hotel in New York City by the Astors is announced. It is to front 100 feet on Fifth Avenue and 125 feet on Fifty-ninth Street 14 stories high, and cost $1,100,000. Work will begin next fall, and the building is to be finished in 1892. It is also annnounced that P. H. Drugo and Frederick Wagner will build an 11-story hotel on another corner at the intersection of the same streets, at a cost of $650,000, excluding the land.

THE University of Vermont conferred the degree of Civil Engineer this week upon graduates as follows: Asaph T. Brookins, Shoreham, Vt.; George H. Claflin, Westfield, N. Y.; Eddy S. Jackson, South Walden, Vt.; Herbert M. McIntosh, Bethel, Vt., and John M. Perham, Brookfield, Vt.

THE Building Committee of the London County Council has reported against permitting a manufacturing concern to erect a wrought-iron chimney stack because "in view of the public safety the Committee had no option but to refuse permission for the erection of iron factory chimneys, which were likely to become dangerous after twenty years or less." The Committee's recommendation was agreed to by a large majority.

NOTICE is given in the London *Engineer* that the owners of that publication have organized a joint stock company for conducting the business. The new arrangement is accompanied by no change in management, and is made as a matter of business convenience.

THERE was still another subway explosion in New York City Monday, this time in an electric subway manhole at the corner of Sixth Avenue and Twelfth Street. The manhole cover was thrown up and the brickwork, etc., somewhat disturbed, but there was no person injured.

A FIRE at the old pumping-works station of the waterworks at Nashville, Tenn., the other day, disabled the engines. One of the engines in the new station is being repaired, and there are some fears of a troublesome scarcity of water.

OBITUARY.

H. L. HIGDON, engineer on the Wichita Valley Railroad, died at Lampasas, Tex., June 11.

FRANK MONTGOMERY, C. E., of Hancock, N. Y., died at Boca Negra, Mexico, June 1, from injuries received in a railroad accident.

FRANK H. ANDREWS, of New York City, President of the Globe Iron and Spring Works and Secretary and Treasurer of the Baker Heating Company, died June 21, aged 38 years.

WILLIAM SEARS, of Newton, Mass., died Wednesday at the age of 86. Mr. Sears was a contractor and builder. He built 30 churches in Boston, and most of the depots, stations and freight houses on the Worcester, Old Colony, Fitchburg, and Eastern Railroads. Mr. Sears obtained the charter and called the first meeting to organize the Northern Pacific Railroad Company, and was in the Board of Directors five years.

CHARLES ACKENHEIL, M. Am. Soc. C. E., Chief Engineer of the New York extension of the Baltimore and Ohio Railroad, of the Staten Island Rapid Transit Company and of the Baltimore and New York Railroad, was killed in an accident to a train on the Baltimore and Ohio Railroad June 20. Mr. Ackenheil was born in Baden-Baden and educated at Heidelburg, came to this country from Germany 20 years ago, and had been continuously with the Baltimore and Ohio Railroad except for a short time of service on the Rochester and Pittsburg Railroad. He designed the Arthur Kill bridge and was in charge of the projected improvements of the Baltimore and Ohio Road on Staten Island. He was 48 years old.

PERSONAL.

CHARLES W. BORLAND, County Surveyor of Lancaster, O., has been elected City Engineer of his city.

JOHN Y. CUYLER has been appointed Consulting Engineer by the Brooklyn, N. Y., Park Commission.

ROBERT M SAUP has been re-elected Superintendent of the Zanesville, O., Water-Works.

H. C. BABBITT, civil and sanitary engineer, of Columbus, O., has been elected City Engineer of Sidney, O.

L. S. WAKEFIELD, of Sioux City, Iowa, has been appointed Chief Engineer of the Pacific Short Line Railroad.

CHARLES F. MCKIM, architect, of New York City, was given the honorary degree of Master of Arts by Harvard College this week.

PHILIP GOLAY has been appointed Engineer in Charge of Government Locks and Dams on the Monongahela River, with headquarters at Morgantown, W. Va.

PROFESSOR R. C. CARPENTER, of the Michigan Agricultural College, has been appointed to a professorship in Cornell University, and will move to Ithaca, N. Y., in August.

WILLIAM T. GOULD has resigned his position on the Mobile and Ohio Railroad to accept a position as Resident Engineer of Construction on the Northern Pacific Railroad.

THOMAS J. JOHNSON, Consulting Engineer of Savannah, Ga., has been appointed Assistant Engineer of the Chicago Drainage Commission, with charge of technical investigations.

WILLIAM T. BLUNT, of Cleveland, O., Engineer on Harbor Improvements on Lake Erie, has been appointed Assistant Engineer of the Chicago Drainage Commission, with charge of surveys.

F. MEREDITH JONES, recently connected with the Southern Mexican Railway, has been appointed Chief Engineer of the Vera Cruz Land and Construction Company, with headquarters at Mizantha.

W. A. VAUGHAN, Superintendent of the Saginaw and Mackinaw Division of the Michigan Central Railroad, will, on July 1, become the General Superintendent of the East Tennessee, Virginia and Georgia Road.

WILLIAM M. REESE, of Memphis, Tenn., Engineer on the Mississippi River Improvements, has been elected Assistant Engineer of the Chicago Drainage Commission, in charge of investigations pertaining to construction.

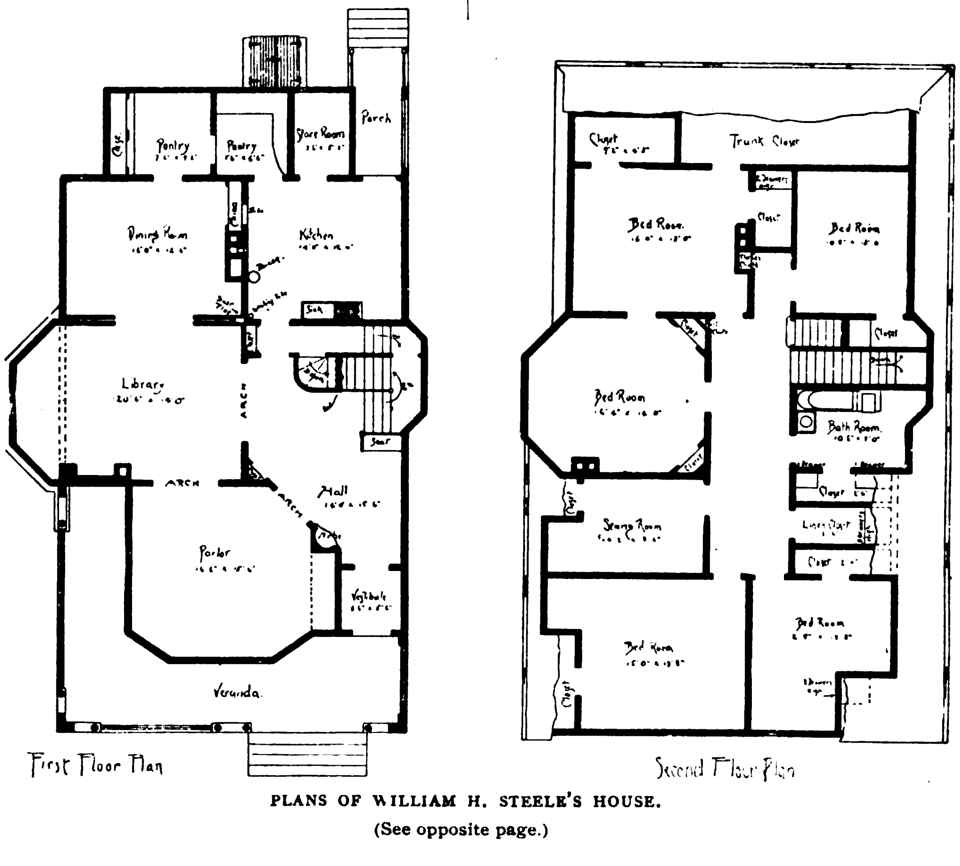
LIEUTENANT COLONEL RICHARD N. BATCHELDER has been appointed Quartermaster-General by President Harrison, with the rank of brigadier-general. He was chief quartermaster of the army of the Potomac during the war, and it is announced that he is appointed on his record.

PROF. GEORGE W. PLYMPTON has been appointed by Mayor Chapin of Brooklyn member of the Board of Experts on the terminals of the Brooklyn Bridge. This appointment, with those of Mr. Bucholz and Mr. Spencer made, respectively, by President Howell of the Bridge Company and Mayor Grant of New York, fills the Board. Mr. Plympton is Professor of Physical Science and Engineering in the Polytechnic Institute of Brooklyn.

OUR ARCHITECTURAL ILLUSTRATIONS.

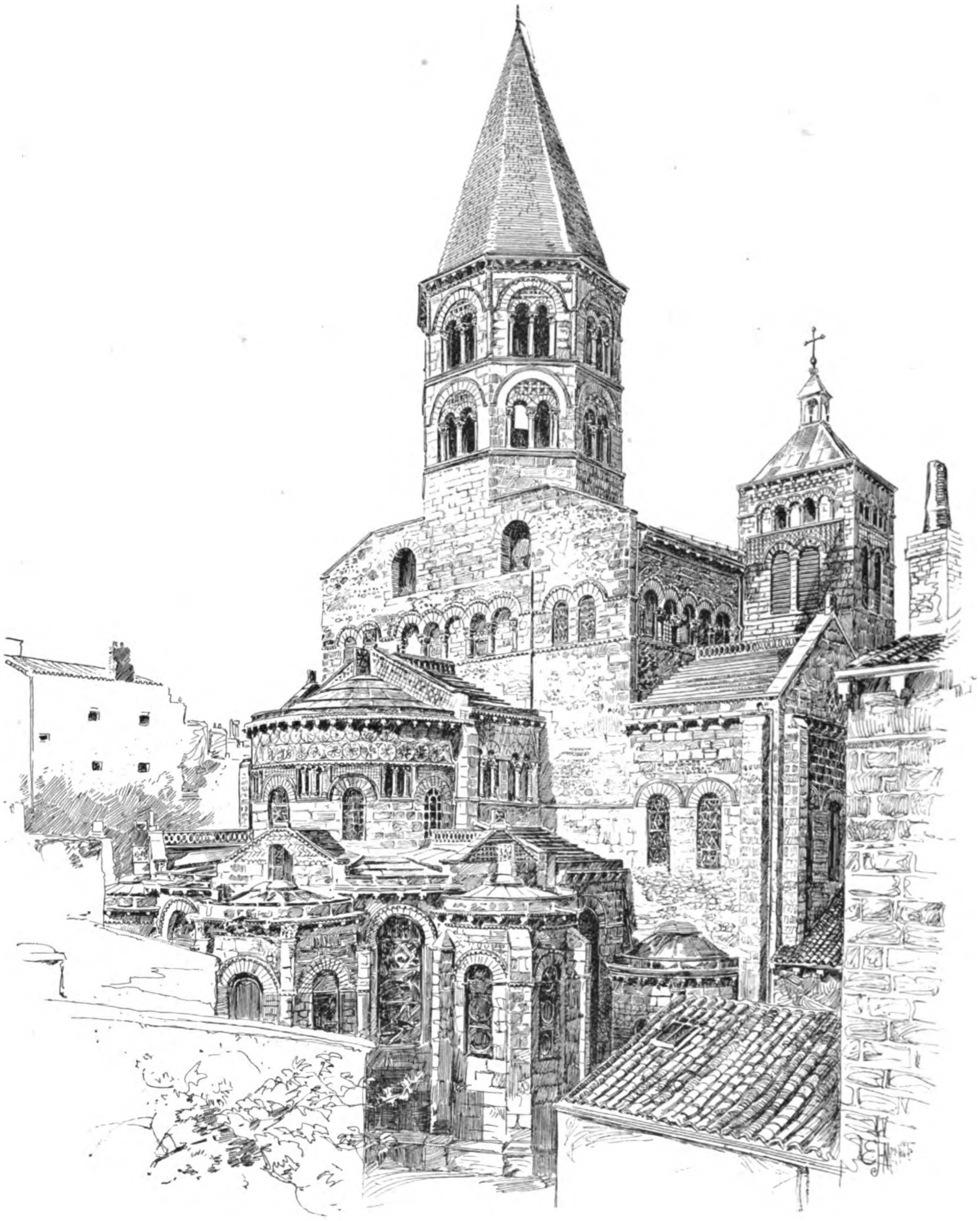
CHURCH AT CLERMONT-FERRAND, FRANCE.

HOUSE OF WILLIAM H. STEELE, RUTLAND, VT.
E. G. W. DIETRICH, ARCHITECT, NEW YORK CITY.



PLANS OF WILLIAM H. STEELE'S HOUSE.

(See opposite page.)



THE ENGINEERING AND BUILDING RECORD ILLUSTRATED SERIES.

CHURCH AT CLERMONT-FERRAND, FRANCE.

NEW YORK. VOLUME XXII.

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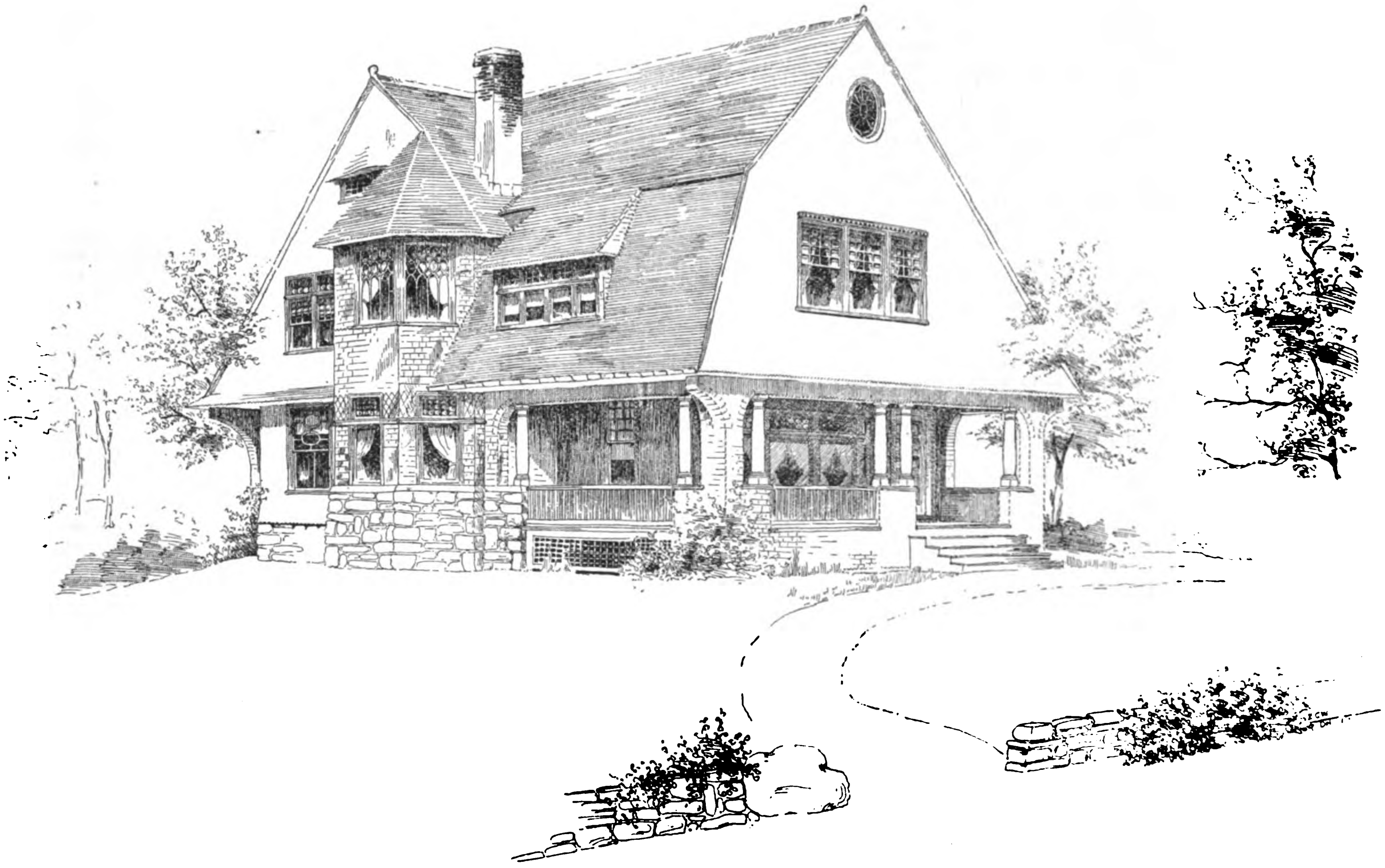
ENGINEERING SOCIETIES.

THE ENGINEERS' CLUB OF ST. LOUIS held a meeting June 18, with Vice-President Burnet in the chair, W. H. Bryan, Secretary, and 17 members and 3 visitors present.

The Secretary read Professor Charles C. Brown's paper on "River Pollution in the United States." The author treated streams used for water-supply only, streams used for drainage purposes only, and streams used for both water-supply and drainage. The paper was confined principally to the consideration of the latter class. The author gave some account of the work done in different States investigating the pollution of streams, accompanying his remarks by tables showing the results of chemical analysis of a large number of samples of water. There was brief discussion by Messrs. Beahan, Seddon and Holman.

THE MINNEAPOLIS ENGINEERS' CLUB at the June meeting listened to a paper by Walter S. Pardee, architect of the Minneapolis Board of Education, on "The Ventilation of Public School Buildings." The paper was illustrated by diagrams. President William A. Pike was chosen to represent the club at the Cresson convention of the American Society of Civil Engineers.



HOUSE OF WILLIAM H. STEELE, RUTLAND, VT.—E. G. W. DIETRICH, ARCHITECT, NEW YORK CITY.

(For plans see opposite page.)

ARCHITECTURE AND DEMOCRACY.

Harpers' Magazine for July contains a suggestive and hopeful article by Robert S. Peabody, architect, of Boston, in which the author endeavors to show "that architecture has flourished, and that most vigorously when the common people were the only masters of the State; that the rise and wane of its glorious periods have occurred impartially under monarchies, empires, republics and democracies, and that popular power has not heretofore stood in the way of progress in the art of building." Conspicuous examples of Italian work in the 13th century are cited to support this claim, and notwithstanding the fact that a distinguished professor is quoted as saying that "there is no hope for real literature or art, so hopelessly vulgar and sordid is American life," Mr. Peabody records numerous examples to justify his faith that the "hope of the future in art, as in many other fields of human endeavor, lies, as the years go on, with our ambitious, prosperous and appreciative democracy."

LETTER FROM ENGLAND.

LONDON, June 12, 1890.

THE Sanitary Institute announces that a deputation of their members has visited Brighton with a view to the arrangement of the congress and exhibition to be held there at the end of August. The pavilion buildings will be utilized, the large dome, the corn exchange and the picture gallery being all devoted to the purpose. The secretary states that applications for space are considerably in excess of those for previous exhibitions, and that there will be some difficulty in meeting the wishes of intending exhibitors.

The Council on Education has inaugurated the system of state grants in support of technical education by voting the sum of £5,000 for grants-in-aid during the financial year of 1891–92. The minute accompanying the vote states that teaching must be in the use of the ordinary tools used in handicrafts in wood or iron, given out of school hours in a properly fitted workshop, and connected with the instruction of drawing. That is to say, the works must be in drawings to scale previously made by the students. This is undoubtedly a step in the right direction, inasmuch as the inability to make and work from drawings is one of the most pronounced features of the present day amongst the general body of handicraftsmen.

The question of nuisance arising from destructors for ordinary refuse is of course one vitally affecting the adoption of this article. There has been for some time past considerable complaint in connection with a destructor belonging to the Commissioners of Sewers of the city of London, situated in Lambeth, and the Local Government Board has been appealed to in the matter. Mr. Ritchie, the president of the Local Government Board, in reply to a question in the House of Commons, stated that the inspector of the Board had examined the structure and its working. Mr. Fletcher had reported that if the refuse were wholly burnt no smell would arise, but owing to the absence of a combustion chamber it could not be kept throughout at a strong red heat so that the gases from the furnace could be completely burnt. He was of opinion that there was reason to believe that some of the sickly smelling steam and smoke which was given off from the refuse while in the early process of combustion constituted the nuisance. The Commissioners of Sewers have been required to remedy the evil, which is, of course, self evident. The matter is simply quoted as affording a warning to local authorities desirous of adopting destructors, who may have lost sight of the advisability of having either a reverberatory arch or such combustion chamber for the gases as is suggested.

Crewkern, in Somerset, is not to be congratulated for the wisdom of its sanitary authority. Charles Hawkesley, C. E., having been called in to advise as to the cost of precipitating works for the sewage of the town, has estimated it at £4,200 for the northern outfall and £6,200 for the eastern. Further, that if the sewage is carried to one common point cost would be £13,500. Certain local experts and wiseacres have written the Local Board, in one case offering to cleanse the sewage at the rate of 2*s*. 3*d*. per head, the number of inhabitants being put at 6,000, while another offers to treat the sewage of the northern outfall for five years at £300 per annum. The intelligent gentry in whose hands is placed the sanitary authority of the district have invited the gentleman who offers to undertake the northern outfall at £300 per annum to meet them and go into the matter. Developments will be interesting.

AN ARCHITECTS AND ENGINEERS CONVENTION IN HAMBURG.

AMERICAN engineers in Europe this summer may be interested to know that the ninth meeting of the Union of German Architects and Engineers' Associations is to be held at Hamburg from the 24th to the 30th of August. Hamburg is a beautiful city and interesting to the engineer. Among the addresses to be delivered on the occasion may be mentioned "The Modern Tasks in the Construction of Streets in Great Towns with Regard to the Laying of Pipes, Etc.," by Dr. Hobrecht, Municipal Building Councilor, Berlin; "Recent Fast Steamers in the Mercantile Marine and Navy, and Their Motive Power," by Mr. Busley, Imperial Naval Engineer, Kiel; "The North Baltic Canal," by Privy Councilor Baensch; "Recent Wide-Span River Bridges," by Mr. Mehrtens, Railway Construction and Traffic Inspector, Bromberg. A number of inspections and excursions are to be undertaken, among which may be mentioned a walk through the new free haven district, a trip on a steamer to inspect the new docks, Elbe Bridge, etc., a trip to the outer Alster and the Alsterlust, a trip to the new transatlantic steamer "Columbia," of the Hamburg-American line, to the North Sea and Cuxhaven, a trip by railway to Kiel to inspect the dockyard and war ships, an inspection of the town of Lubeck and of the North-Baltic Canal.

THE CAUSE OF THE ACCIDENT TO THE "CITY OF PARIS."

THE Board of Trade Court of Inquiry, at London, which has been investigating the causes of the recent accident to the Inman Line steamer "City of Paris," made its report June 21. The Court attributes the casualty to the wearing of the propeller bearing.

In the judgment of the Court full provision was made to insure the vessel's safety as an ocean-going steamer, and safety was not sacrificed to speed. The propeller shafts, both inboard and outboard, appeared to have been sufficiently supported, and those of the port engines showed little or no signs of wearing.

The Court finds that the ship was properly constructed in all respects. The primary cause of the accident was the extraordinary wearing down of the ring in the bracket supporting the extreme end of the propeller shaft, whereby the end dropped from its proper position about seven inches, thus producing a bending effect on the shaft at its forward support coexistent with each revolution of the engine. This probably produced a rupture of the external surfaces, gradually extending inward, and finally a total fracture.

The cause of the water finding its way into the engine room and other compartments was that a large portion of the low-pressure cylinder fell, or was driven against the condenser, tearing away and thereby opening a large communication with the sea, through which the water rushed in such volume that before any of the inlets could be closed they became covered with water and out of reach. The water passed into the dynamo room and port engine room through the bulkheads, broken by the ruptured machinery, and into two compartments by injury to the valve box in the engine room. In conclusion the Court says:

> After the practically unanimous testimony of eminent authorities in the Board of Trade and the Lloyds and other experts upon the strength, completeness and efficiency in all respects of the ship for the service for which she was especially designed and built, the Court does not consider itself in a position to offer suggestion thereon. During the course of the inquiry we have had evidence that even if some of the forward compartments of the ship had been filled with water, in addition to those filled, she would still have had a fair amount of freeboard and been able to float.
>
> We are of the opinion that, having a fair regard for the trying ordeal through which she passed, the vessel proved to be one of the finest and safest vessels in the mercantile marine.

TEST OF BOILERS AT THE PAWTUCKET PUMPING STATION.

IN determining the influence of the steam jacket on the Pawtucket pumping engine, as described on page 74, Professor Denton found it necessary to determine separately the efficiency of the boilers and incidentally the economic value of different kinds of coal. Some of his conclusions on these points as given in a letter to Edwin Darling, Superintendent of the Pawtucket Water-Works, are contained in the following extracts:

I was enabled to make the experiments on the No. 1 Pawtucket Pumping Engine, under the following conditions. The engine having been overhauled as usual in March to prepare for the summer run, it should be taken in the condition it might be found, without any extra preparation except the insertion of wells in steam and water pipes for thermometers and valves for meter appliances; also that the usual coal which had been purchased for the season should be used in making the test, the idea being to have the engine tested under the conditions common to its regular daily work.

The experiments had for their special object the measurement of the steam consumed by the engine per horsepower under various conditions calculated to afford scientific data regarding the application of thermo-dynamic principles in engines of this type. This required the separation of the performance of the boiler from that of the engine. The engine had been several times previously tested without making this separation, the performance being stated in foot pounds of "duty," which expresses the combined economy of the engine and boiler. I had formed the opinion, during several years of acquaintance with the engine, that the high "duty" performed was gotten with a rather inferior efficiency on the part of the boilers, thereby making the probable efficiency of the engine abnormally high even for its type and conditions of special excellence. Having communicated this idea to friends interested in the applications of steam engines through their manufacture and otherwise, I succeeded in securing the subscription of sufficient funds to defray the expenses of the test, outside of the pipe-fitting and like labor, which you kindly volunteered to take upon yourself when assenting to my request to be allowed to make the experiments.

The results of the measurements do not confirm my idea regarding the unequal division of the economy between boiler and engine. The boiler is not of low efficiency, and the engine, while the most economical for its size, if not of any size, of which accounts have been published, does not reach the extraordinary figures I had been led to expect. The boiler evaporates 8.88 pounds of water from 104° Fahr. into steam of 127 pounds pressure with anthracite coal yielding 14 per cent. of ashes at 5 pounds rate of combustion, and 9.35 pounds of water from 104 degrees with Georges Creek bitumous coal yielding 10 per cent. of ashes at 5 pounds rate of combustion. The engine performs a horse-power of work in its steam cylinders with a consumption of 13.75[*] pounds of steam per hour. Taking into account the percentage of ashes, the performance of the boiler is practically the maximum economy to be expected or gotten from boilers, while the steam consumption of the engine is also unexcelled, as even the most improved marine engines of the triple expansion type using steam at 150 pounds pressure have yet to produce a record of steam consumption lower than 15 pounds of steam per hour per horse-power [†]

The combined efficiency of the boilers and engine gives a horse-power in the steam cylinders with 1.54 pounds of anthracite coal consumed per hour, and 1.48 pounds bituminous coal consumed per hour. Out of a horsepower produced in the steam cylinders 95 per cent. is available to force water, only about 5 per cent. being required to overcome the friction of the mechanism and operate the air pump, etc. In this respect also the engine is an extraordinary piece of apparatus.[‡] It results from all of the foregoing that the duty per 100 pounds of coal was for anthracite coal 124,750,000 foot pounds, and the duty per 100 pounds of coal was for bituminous coal 127,350,000 foot pounds. These figures are for the actual evaporation of the boilers as given above.

For the fictitious basis on the part of the builder of 10 pounds evaporation per pound of coal, the above figures for duty become 140 and 145 millions respectively. These figures for "duty" practically agree with those reported for the annual work of the engine in 1887 and 1888, when I understand the engine to have run without banking of fires for long periods of time, so that the effect of banking and starting fires in increasing the coal consumption was eliminated, as was the case in my experiments. Should the engine be worked days only, so that banking and starting of fires is required every 10 or 12 hours, then the reduction of duty should by my observation of the working of your station be about as follows:

To obtain a duty of 124 millions it is necessary that the coal consumption should average 200 pounds per hour, with 100 pounds every six hours for cleaning fires. Suppose the engine is run 12 hours daily, then at about half after the eleventh hour 200 pounds of coal is fired, and at the twelfth hour the 100 pounds of coal which would be used for cleaning, if the engine was not stopped, is used for banking. During the 11 hours that the fires are banked steam falls to about 80 pounds. To raise steam to running pressure requires 300 pounds of coal, and about 25 minutes after the engine is started 200 pounds more coal are used. At the end of the first hour and 25 minutes of running 200 pounds are again fired and there after the same amount is fired per hour.

To run the engine 12 hours, therefore, the consumption is as follows:

11 hours of steady firing, 2,200+200 for cleaning,	2,400 pounds.
Raising steam and first 25 minutes	500 "
Total	2,900 "

If the engine was running continuously there would have been required for the same 12 hours of work by the engine 12 times 200 plus 200 for cleaning, 2,600 pounds.

The banking therefore requires $\frac{29}{26} = 1.11$ times as much coal as continuous running.

Hence 124 millions duty for continuous running is consistent with $\frac{124}{1.11} = 110,000,000$ foot pounds "duty" for day service requiring banking.

The reverse of this is therefore also true, namely, that if, as appears from the reports of the engine, about 110 millions duty was performed during daily running and using banked fires, it is reasonable that about 124 millions should be performed during the continuous running in 1887–88.

* * * * * * *

Three boilers were used. The grate surface in each boiler was a circle 4⅓ feet in diameter and 15 square feet in area. Each boiler was a cylinder 14 feet long and 4 feet in diameter, suspended vertically in brickwork and having 48 3-inch tubes running from end to end. The total heating surface in the three boilers was 1,231 square feet in contact with water and 508 square feet of superheating surface.

The boiler flues had been swept clean about five days previous to the test. As soon as the fires were evenly ignited the fireman was limited to 200 lbs. of coal per hour, with an extra allowance of 100 lbs. for cleaning every six hours.

So nicely was the firing under control that the furnace doors were scarcely ever opened to look at the fires between the hours. As the hour approached, the allotted 200 lbs. were loaded upon a barrow and brought close to the furnace of one boiler. The damper of this boiler was then closed, the fire door opened and one-third of the barrow-load quickly but accurately distributed evenly over the grate, and the same operation was repeated with the other two boilers. Each fire door was open less than one minute.

When the fire was cleaned the engineer assisted the fireman, one using the slice-bar and the other withdrawing the clinkers. The cleaning, including the addition of one-third of the allotted 100 lbs. of extra coal, was accomplished in about three minutes for each fire. On several occasions the whole of the 100 lbs. of cleaning coal was not required.

The above refers to the 72-hours' test, during which the fuel was mainly stove anthracite. It is the practice of the station to screen this coal on a 1-inch square mesh, thereby freeing it of all small pieces of the size equivalent to nut coal. The small size, or that which falls through the screen, is used for banking the fires, while the larger or stove size is used for the bulk of the work. The small screenings were used for starting the fires.

The refuse of the anthracite coal collected in the ash pits was 752 lbs. This was screened through a ⅜-inch mesh and 110 lbs. of unburnt coal obtained. This coal was put on the fires during the last or 72d hour of the test, after the firing with fresh coal had ceased. The clinkers removed during the cleaning of fires amounted to 653 lbs. The contents of the grates at the end of the test amounted to 944 lbs.

The anthracite coal was therefore as follows:

Total coal fired	15,710 lbs	
Wood, taken as equivalent to 40 per cent. of coal	105	
Total fuel used		15,815 lbs.
Consumption per hour	219.5	
Incombustible from ash pits	641	
Incombustible clinkers	653	
Left in furnaces	944	
Total		2,238
Total combustible		13,577

Total refuse equals 14.3 per cent. of fuel.

The bituminous coal made no clinkers, and the fires were not cleaned during the entire 24 hours of its use. No separation of the ashes was made, the total refuse from ash pits and grates combined being 510 lbs.

The total consumption was:

Coal	5,200 lbs.
Wood	80 "
Total in the 24 hours	5,280

Consumption per hour, 218.6.

Ashes equal 9.6 per cent. of fuel.

I regard the above details of firing, etc., as worthy of note, from the fact that it is a matter of well founded opinion that a very sensible part of the performance of fuel depends upon the degree of skill displayed in the firing when the best results are obtained. Beyond doubt the extraordinary annual performance of the Pawtucket pumping engine is partly due to the high state of efficiency to which the routine firing and other details of management have been brought by Chief Engineer Walker's zeal and intelligence.

GOVERNMENT TESTS OF WOOD.

UNDER the above head the *Southern Lumberman* says: In compound columns care should be exercised in selecting the sticks which are to form the column. Of course it would be useless to place a poor with a strong stick, but it is best to place the good together and the inferior by themselves. To make the effects of knots in the resistance of short posts to compression more apparent, some columns, after having been tested and their resistance determined, were cut up and specimens of shorter length taken and tested; the difference in strength was very marked, as was to be expected. An oak column 168 inches long, which yielded at 4,953 pounds per square inch, showed in a specimen 52 inches long cut therefrom 8,450 pounds per square inch, and another 7,794 pounds per square inch, which then gave way at a knot. Another post 164 inches long failed at 3,432 pounds per square inch, but a piece 32 inches long was cut from it, which gave 6,230 pounds per square inch. A yellow pine post, 143 inches long, gave a resistance of 4,663 pounds per square inch, but a specimen 32 inches long was taken from it which had a resistance of 6,230 pounds per square inch. Pieces of smaller size could doubtless have been cut from each of these which would have shown still greater strength, as they might have been obtained more free from imperfections of all kinds. Knots of even small size, firm and sound, exercise an injurious effect upon timber. This was shown in a piece of spruce from which two samples were cut, one having a uniform, straight grain, the other two small knots; the strength of the former was 11 per cent. greater than the latter. When we come to determine the resistance of specimens having knots to forces of compression at right angles to fibers of the wood, we find the resistance much increased, and this increase should be taken into account when selections for this purpose are possible. The resistance of specimens of a given wood, as compared with others of its kind, is generally indicated by its specific gravity, but this does not always hold good. In yellow pines, some of those rich in turpentine have a high specific gravity, and yet are not the strongest. The rapidity of growth will sometimes give indications of the strength. A rapid growth in oak is apt to be accompanied by an increase of strength, while the reverse is often true in yellow pine.

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[*] Duplicate tests gave 13.64 pounds and 13.83 pounds, respectively.

[†] Tests of S. S. Meteor. Trans. Brit. Assoc. Mech. Engrs.

[‡] The principal features and dimensions of this engine are given on page 74. Its general arrangement is similar to that shown in the section of Pawtucket Pumping Station No. 3, on page 14, of Vol. XIX.

PROPOSED IMPROVEMENT OF SEWERAGE AND PAVING IN DULUTH.

THE Board of Public Works of Duluth, Minn., some months ago invited Rudolph Hering, of New York City, and Andrew Rosewater, of Omaha, Neb., to advise them in regard to the extension of their sewerage system, and also as to the pavements best adapted for the steep grades which are found in that place, and their report has just been published.

Duluth, with a population of over 20,000, is laid out for about six miles along the northwestern shore of Lake Superior, at its western extremity, but hardly averages a mile in width, and rises 500 feet or more in that distance, giving street grades in some cases as high as 32 per cent. These unusual conditions render both sewerage and paving problems of more than ordinary difficulty.

In 1883, when the population was about 5,000, and the expense of combined sewers could not be afforded, the sewerage of the city was commenced on the separate system in accordance with plans furnished by Mr. Hering. The aggregate length of sewers constructed to date is about 22 miles, over three-fourths of which are for foul water removal including roof water. The city has now so far developed that the underground removal of storm water has, according to the report, become necessary, or at least desirable in most cases, and the combined system is therefore recommended for certain parts of the city. In other places, however, it will be necessary to intercept the sewage at the water front and conduct it to a pumping station whence it can be forced out some distance into the lake while the storm water should be discharged as directly as possible, and here the separate system will be required. It may be a long while before it becomes necessary to pump the sewage, but the report states that even in the meantime the storm water should be excluded from the intercepters to prevent silting, except in the winter time, when, by a special device, the slight flow from the storm sewers may be thus discharged to prevent accumulation of ice on the flats at their outlets.

As the water supply of the city is taken from the lake the relative positions of the sewage outfall and the water intake become matters of much importance. In the large cities on the shores of the great lakes it has been found desirable to keep these points from six to ten miles apart, but a less distance is expected to suffice at Duluth, since its sewage seems to produce much less foulness in the lake than has been observed elsewhere. This is attributed to two causes, first the promptness with which, owing to the steep grades, the sewage is discharged, giving little opportunity for decomposition on its way, and reaching the lake comparatively fresh it is largely consumed as food by fishes, water fowl, etc., which are said to frequent the outfall, and, second, the coldness of the water even in summer, which retards decomposition even after the sewage is discharged and thus prevents foulness. As the current along shore is usually southwesterly, a location is suggested for the water intake about five miles northeast of the proposed sewage outfall.

In proportioning the size of storm sewers to run full it is recommended that a flow of two cubic feet of rain water per second per acre be allowed for in areas of less than two blocks, diminishing to one and a half cubic feet for 100 acres, and further gradually diminishing in accordance with Burkli-Ziegler's or McMath's formulæ. The

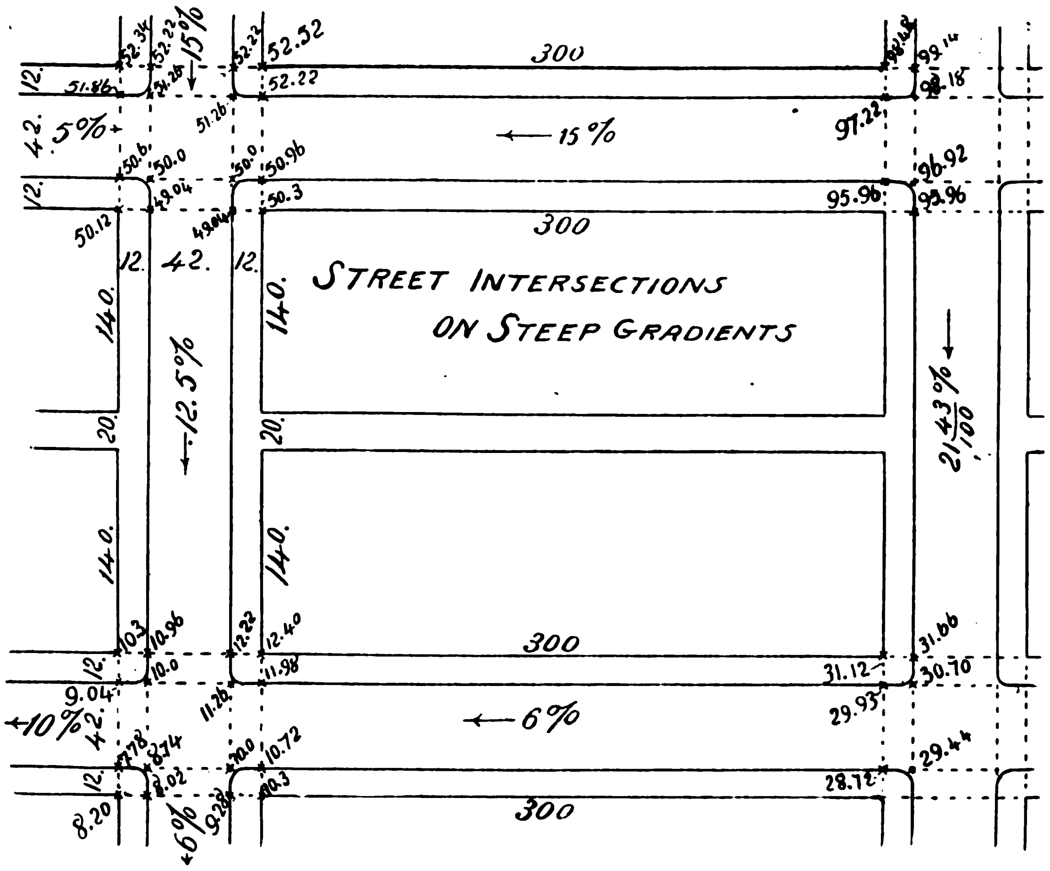
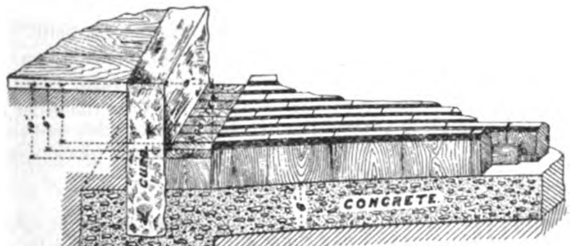
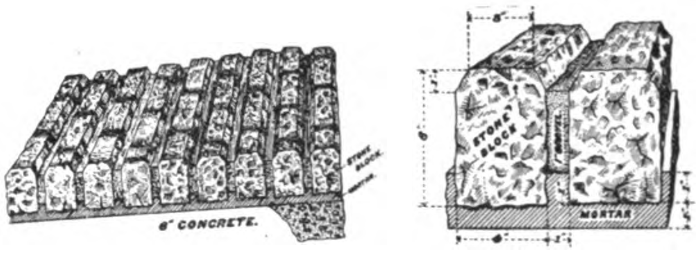


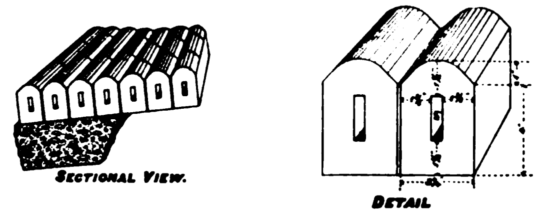
FIG. 3.



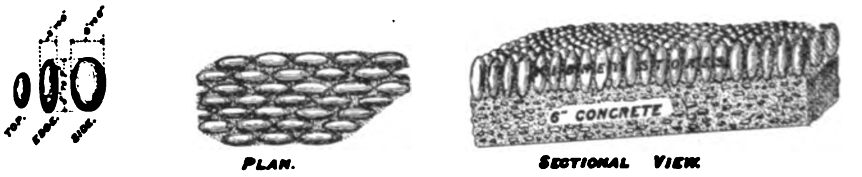
PERSPECTIVE OF CORRUGATED PAVEMENT AT CURB SHOWING BLOCK GUTTER.



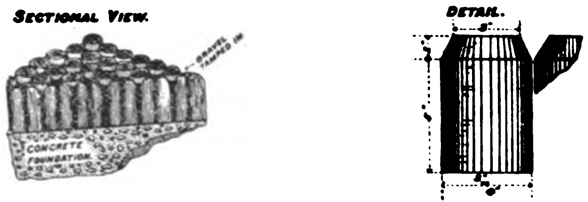
SECTIONAL VIEW OF CHAMFERED STONE BLOCK PAVEMENT. STONE BLOCKS.



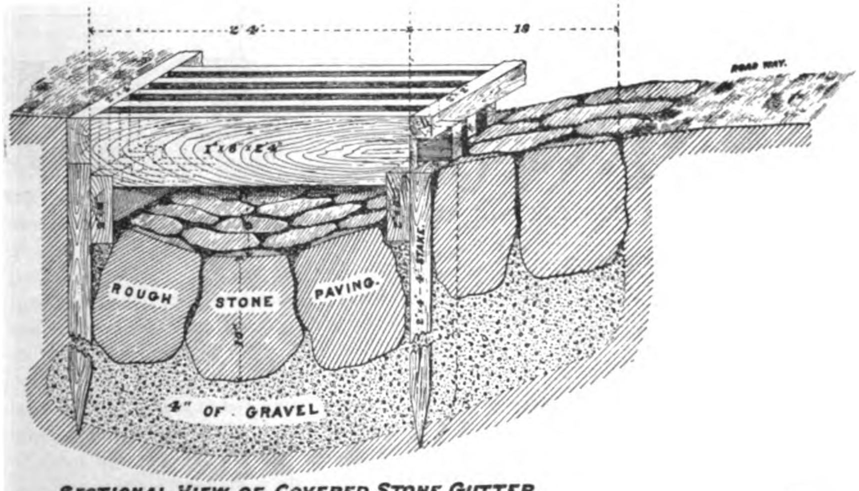
CORRUGATED BRICK PAVEMENT.



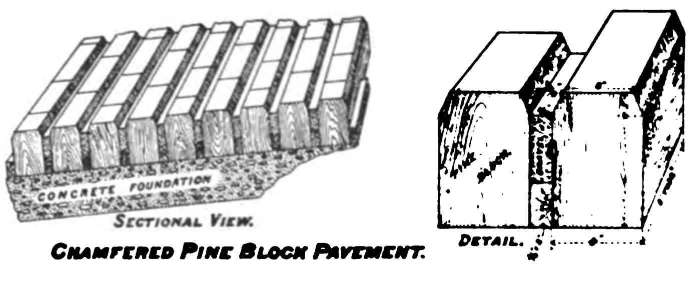
KIDNEY STONE PAVEMENT.



CHAMFERED CEDAR BLOCK PAVEMENT.



SECTIONAL VIEW OF COVERED STONE GUTTER.

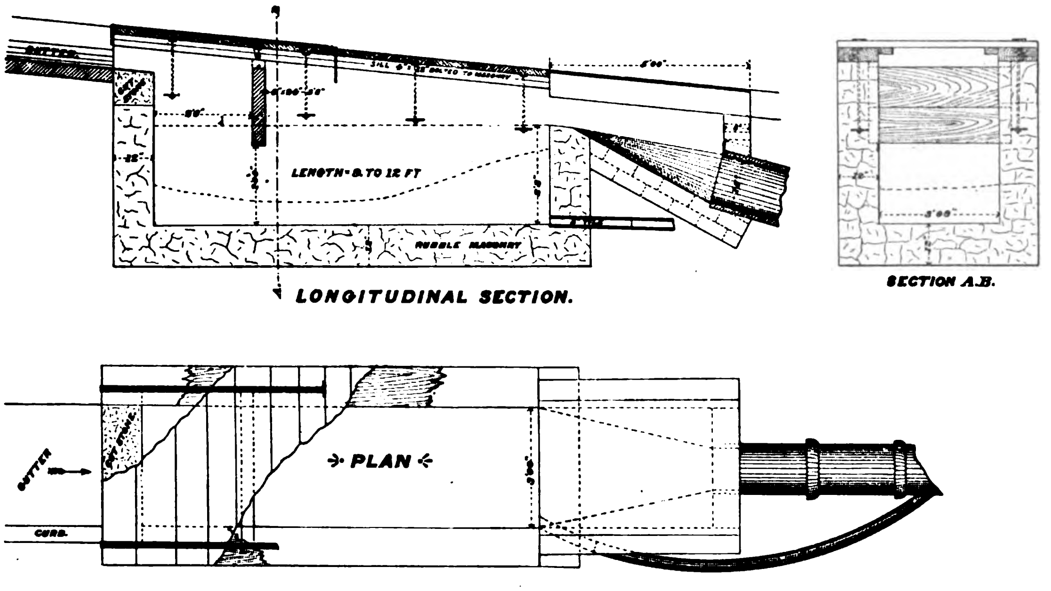


CHAMFERED PINE BLOCK PAVEMENT.

FIG. 1.

above is for the closely built up sections; for areas which will always remain residential three-fourths of the above are considered sufficient, with a still further reduction for park areas. As far as can be ascertained, the heaviest rainfalls in Duluth do not vary much from those in the northern portions of the Eastern and Middle States.

In view of the steep grades causing a more rapid flow it is assumed that one-half of the sewage will flow off in six hours instead of eight as is usually estimated. Roof water is to be admitted with the sewage to some extent even where the separate system is used, and provision is to be made for overflow into the storm sewers where necessary. Not only do the steep grades cause much sand and gravel to be washed into the sewers, but this, in connection with the high velocity of the flow, has already caused the sewers to show some signs of wear. To avoid this catch basins are recommended at street corners. They are to be of such capacity that the rate of flow through them will not exceed two feet per second and that the greatest amount of solid matter deposited by a single storm will not more than fill them. The accompanying illustration, Fig. 4, shows the construction proposed, in which a fender is placed to check the velocity of the inflow, sometimes over 20 feet per second, and a small drain leads from the bottom to keep the basin from standing full of water and to facilitate cleaning. At the upper end of graded avenues it may be found expedient to build specially large temporary catch basins of timber which, when the grading is extended, may be replaced by smaller ones of permanent construction.



LONGITUDINAL SECTION.

SECTION A.B.

→ PLAN ←

CATCH-BASIN

Fig. 4.

To keep out the larger refuse it is advised that the gutters of the graveled streets be covered by wooden gratings, as shown in Fig. 2 and in detail in Fig. 5, which are estimated to cost 15 to 25 cents per lineal foot. On steep streets not yet paved it is recommended that no crown be given, and by thus spreading the water from curb to curb its maximum depth and velocity, sometimes sufficient to carry stones eight inches in diameter, and consequent destructive effect will be much reduced.

No difficulty is apprehended from lack of ventilation; on the contrary, in winter, it becomes actually necessary to check the circulation of air as much as possible to prevent freezing in the sewers. Temporary wooden gates over the outfalls are recommended for this purpose.

In the construction of the sewers it is considered necessary, in order to ensure stability under such high velocities of flow, to have the sewers securely anchored into the body of the material in which they are laid by a substantial concrete bedding, with outward projections at suitable intervals. Inverts of granite slabs roughly hollowed or of granite blocks laid in cement are recommended for the storm sewers, to resist abrasion by the gravel, etc. Concrete sewers if of the best materials and well smoothed inside, and with anchor projections outside to prevent slipping, are considered suitable for either storm water or sewage. Existing sewers of Portland concrete have worn well, as have also those of clay pipe bedded in concrete. A storm sewer 40 to 48 inches in diameter built of brick with solid granite bottom on grades of 7½ to 12½ per cent. has given very good satisfaction.

In regard to street grades and the proper form for intersections, it is advised that no grades steeper than 16 per cent. be allowed, as they are practically useless for thoroughfares. If the difference of elevation between adjacent intersections would give a greater grade a retaining wall across the street is suggested, of sufficient height to reduce the grades on either side to reasonable limits. There would be stairs for pedestrians, but no thoroughfare for vehicles, which would have to reach the rear alleys from the nearest cross street. As a measure of economy the width of paving on such intercepted streets should be reduced from 42 to 30 feet with a corresponding increase in the width of the sidewalks.

In the business portions of the city it is recommended that wherever the grade exceeds 8 per cent. the curb should be broken at the street or property line, otherwise to be continuous and uniform between corners.

Figure 3 shows the arrangement of intersections on steep grades. From this it will be seen that at these intersections the grades are flattened to 3 per cent. for the width of the roadway of the intersecting streets, and that the grade of the curbs is flattened to 8 per cent. for the width of the intersecting sidewalks. Grades of less amount on roadway or sidewalk are continuous. The elevation of block corners is found by adding together the curb elevations at the points facing the block corner, and also the sum of the widths of the two sidewalks at the corner multiplied by 2½ per cent. and dividing the whole by 2. This gives an elevation equal to the average elevation of the curbs opposite the corner plus an average rise of 2½ per cent. across the width of the sidewalks.

On very steep grades it is recommended to reduce the alley width across sidewalks from 20 to 10 feet, and to flatten the sidewalk grade across that width to 10 per cent., so as to make it easier for vehicles to enter the alley, providing steps, if necessary, on either side to come again to the uniform grade of the street.

In considering the question of paving on steep grades much stress is laid on the importance of securing a good foundation for the wearing surface, preference being given to a concrete of broken stones and gravel in cement mortar, next, to a bed of compact layers of broken stone, then to gravel and last to sand, which is only suitable on the more level roads having a good natural bed. Where there is danger that moisture will penetrate the road-bed a line of blind drains is recommended laid below the curb and discharging into the corner inlets; while to keep the foundations from sliding on steep grades transverse bars or ribs of concrete, at suitable intervals, extending 6 to 12 inches into the soil are advised.

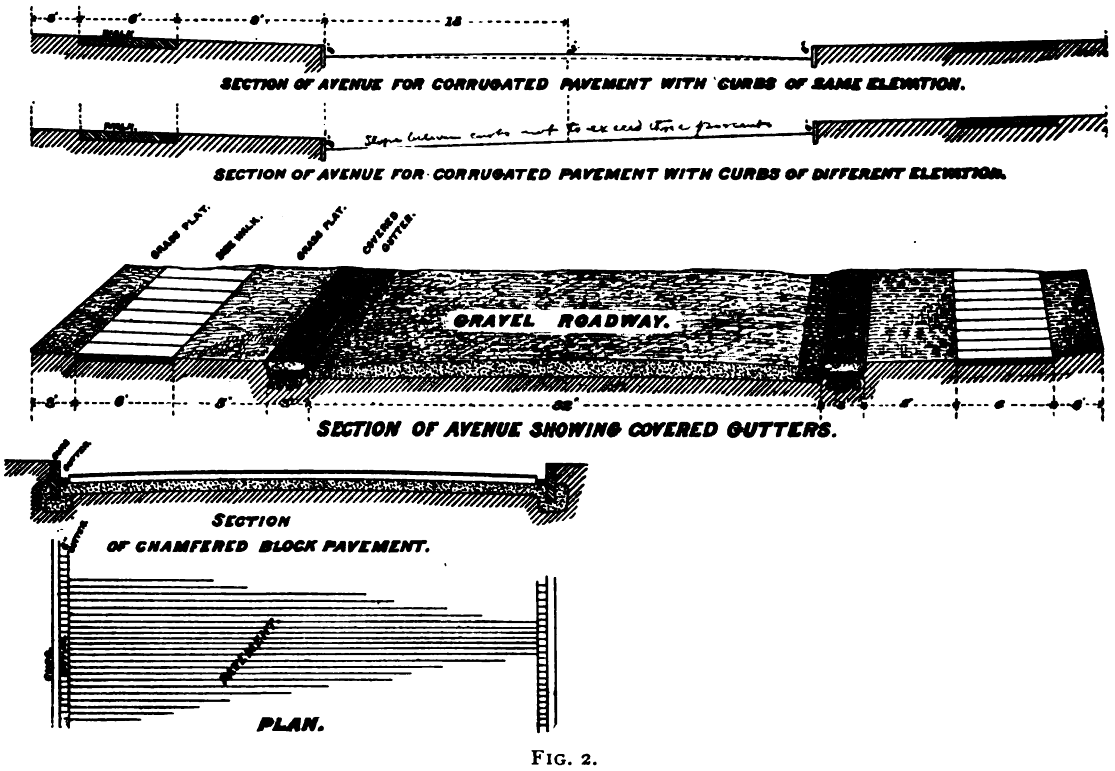
For ordinary grades the following pavements are recommended: For 10 per cent. or less, rectangular stone blocks with sand joints on concrete or broken stone foundation, costing $2 75 to $3.25 per square yard; for 6 per cent. or less, best paving brick laid on concrete, at $2.25 to $2.75 per square yard; ordinary round cedar blocks on concrete at $1.80 to $2 per square yard, or on broken stone and boards at $1.50 to $1.60; or rectangular pine blocks on concrete foundation at $2.25 to $2.40, and for less than 4 per cent. sheet asphaltum laid on concrete at $2.25 to $3 per square yard if maintained for five years, or $3 to $3.50 if maintained for ten years.

Macadam and Telford pavements are not recommended unless their upper layer is treated with coal tar, when it is believed that they may answer well for temporary pavements up to 16 per cent.

The pavements recommended for very steep grades are shown in Fig. 5. They are, first, for grades exceeding 10 per cent., rectangular stone blocks from 3½ to 4 inches in width and chamfered on the upper edges to give a foothold for the horses, estimated to cost on a broken stone foundation $2.75 to $3.25 per square yard, and on concrete $3 to $3.50, next, kidney or cobblestones of nearly equal size, not exceeding 3 inches in width, set in cement mortar on concrete foundation to cost $2 to $2.50 per square yard; and for grades exceeding 6 per cent. best paving brick of special form on concrete foundations at $2.50 to $3 or round cedar blocks 4 or 5 inches diameter chamfered to 3 inches at top, laid on concrete at $2 to $2.25 per square yard, or rectangular pine blocks either chamfered as shown in the drawing or plain 3 to 3½ inches wide, and set with 1 or 1¼-inch joints on concrete at a cost of $2.40 to $2.60 per square yard.

The pavements are recommended in the order named, and it is advised that the kidney, the brick and the cedar block pavements be tested by laying a block of each on some of the steeper avenues.

Statistics collected on the water-works at Greenville, Mich., by G. S. Williams, show that it actually cost less to buy and put in a 6-inch pipe to reach one block with a hydrant at the end of it, than it would to buy 2½ inch hose to reach the same block with a nozzle at the end of it.



SECTION OF AVENUE FOR CORRUGATED PAVEMENT WITH CURBS OF SAME ELEVATION.

SECTION OF AVENUE FOR CORRUGATED PAVEMENT WITH CURBS OF DIFFERENT ELEVATION.

SECTION OF AVENUE SHOWING COVERED GUTTERS.

SECTION OF CHAMFERED BLOCK PAVEMENT.

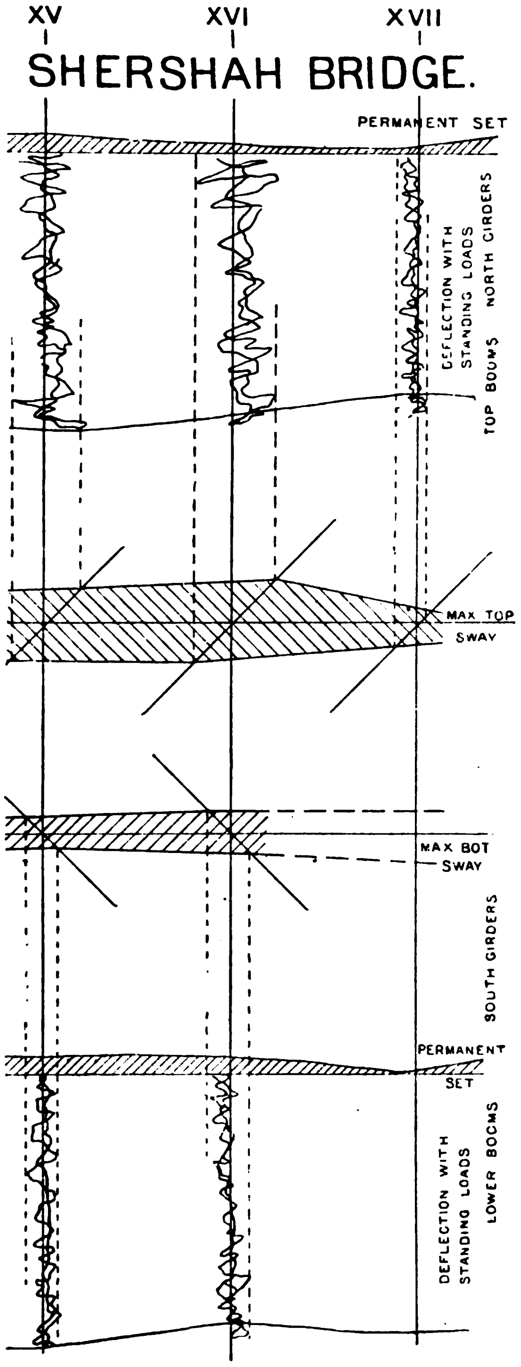
PLAN.

Fig. 2.

DEFLECTIONS OF THE RAILROAD BRIDGE AT SHER SHAH, INDIA.

THE bridge over the Chenab at Sher Shah, India, consists of 17 through spans of steel whipple trusses, 212 feet 6 inches between pier centers. The trusses are 20.6 feet deep, and the weight is about 220 tons per span. The bridge was built in 1888 and 1889, and was tested by trial loads in January, 1890.

The deflection tests were taken with two Kandahar Reserve (L. L.) engines, and a train weighing .85 tons per foot. The maximum deflection was 1 3/16 inches, of which 3/16 remains as permanent set. The maximum oscillation with the above train at between 25 and 30 miles an hour was ⅜ inch for the top and 3/16 inch for the bottom booms. The test diagrams are remarkably uniform and vary but little from the above maxima. One span tested for oscillation by running a crowd of men over it gave a deflection of 3/16 and sway of ⅛ inch on the cards.



With two L. class engines and tenders weighing 134 tons in all, hauling a train that weighs .873 tons per foot run, the maximum live load on any one cross girder is 21 tons; seven other cross girders carry an average live load of 15 tons each, and the rest of the train averages 9 tons per cross girder. The average uniform dead load is 11 tons per bay, and the maximum effects of the live loads above described approximate very close to those of a uniform distributed live load of 13 tons per bay, or 260 tons per span, and the maximum stresses on the main trusses are 6.5 tons in tension, and 6 tons in compression when a wind stress of 21 pounds per square foot is added to the loads stipulated above. A pressure of 21 pounds per foot is considered the highest under which traffic can ever be carried on. The wind bracing of the floor and the lateral connection of the top booms is effected through the cross girders—which are braced to the booms by horizontal gusset plates, and there are no horizontal diagonals whatever. The wind pressure on top booms is transmitted to the floor through the verticals.

The accompanying diagrams shows the deflection cards (natural vertical scale) taken at the 15th, 16th and 17th spans.

The facts given above are from an article in *Indian Engineering*, and the diagram is reproduced from the same publication.

DYNAMITE IN THE WET FOUNDATIONS OF THE LYONS FORTIFICATIONS.*

A BRIEF reference to this subject was made on page 685, Vol. XVI. The description here given from a different source will, it is believed, prove suggestive when similar or varying conditions are met with elsewhere.

Between the Rhone and the Marseilles line in France, the wall of the new Lyons fortifications traverses alluvial lands continually overflowed by the river. The soil is composed of fine clayey sand, very permeable and blackened by infiltrations of water charged with organic matter. Below this clayey bed, extending to an unknown depth, is a layer of round Rhone pebbles, the upper surface of which is in a practically horizontal plane and is covered to a depth of about 6½ feet by a sheet of water which dilutes the clay to a glutinous mud, very difficult to remove with a shovel.

For a proper foundation of the foot wall it was necessary to reach the gravel bed at a mean distance of about 6½ feet below the bottom of the trench.

In a 656 foot section of the foundation that was built by dredging in a closed coffer dam, where the mean depth of excavation was only 2.6 feet, the work took 80 days and cost about 12,000 francs. The principal difficulty was due to the fineness of the clay, which entered with the water through the cracks in the sheeting and refilled the excavation as fast as it could be made. It was, therefore, apparent that the method employed, suitable only for limited depths, would be impracticable for the remaining 426 feet, where the gravel was at a depth of from 5 to 7.25 feet.

To avoid long and costly operations it was determined to build the foundation on concrete arches, the supporting pillars of which should be founded by the dynamite method already used in dry soils, and the first pits were made in a simple and primitive manner to determine the practicability of the method. Experience justified the expectations, and showed that a nest of dynamite cartridge exploded in the midst of clayey mud with the following effect:

First.—To make smooth, walled pits, cylindrical, or slightly conical, truncated, which, for a 100-gramme nest of cartridges, attained a diameter of 3¼ to 5 feet, and a depth equal to the length of the cartridges, diminished about 15 per cent. by the earth falling back into the pit after the explosion.

Second.—To compress the clay so that the walls of the pit remained vertical and hold together long enough after the explosion to permit the entrance of laborers to clean it out.

Third.—To force the water in the clay to such a distance that it could not return for half an hour after the explosion.

From these results the following problems were solved:

First.—To find an easy, rapid process of making a hole to receive the cartridges.

Second.—To calculate the distance within which it would be unsafe to leave tools and platforms during the explosions.

Third.—After the explosions, to rapidly prepare a support for the walls of the pit, so as to permit work in the interior.

Fourth.—To clean out the earth which falls back after an explosion, and carry the bottom of the pit to the solid ground by hand work.

Fifth.—To place concrete in the excavations.

These problems were solved and the work conducted as follows: The cartridge holes were made by a special mine auger, consisting of a pointed iron cylinder 2 feet 9 inches in diameter, with tempered steel blades attached for about 8 inches from its extremity. This tube was fixed to tubular lengthening bars about 1¾ inches in diameter and 3 feet 3 inches long, connected by sleeves. Borings to the gravel bed were made in two or three minutes by four men, who withdrew the auger and inserted cartridges in the hole. The cartridges contained 100 grammes each of dynamite and were attached, about 5 inches apart, to a wooden rod. Materials and tools were removed about 16 feet before the explosion. The explosion produced very little spoil, the effect of the dynamite being to compress the circumference of the boring without detaching any material from it. At the top of the hole only, the resistance being less, the earth was torn off, thrown upwards, and portions of it fell back into the pit. This action produced a cylindro-conical hole, about 15 per cent. of the total depth of which was filled by the loose earth which fell back. The mean diameter of the pits was about 3 feet 7 inches.

Immediately after the explosion two men placed in the pit a cylindrical drum about 4 feet 6 inches long, 3 feet 7 inches in diameter, made of ⅛-inch sheet iron, furnished with holes in the upper part to receive the withdrawing handles. This drum was sunk and put in place by blows from an iron ram, and a man descended into the interior and rapidly removed the bed of mud above the gravel, two other men forcing the drum further down, while a fourth laborer removed the spoil from the top of the pit. The interior labor, slow on account of the consistency of the mud, only occupied about half an hour, during which time the water, forced back by the explosion to a considerable distance in the earth and there retained by the compression of the walls, did not interfere with the work. It did not even appear until the gravel bed was pierced, when a jet was produced that by its violence soon stopped the excavating; but by this time the gravel was laid bare, or if a little mud remained above it the amount was insignificant, and it could be removed by rapidly pumping out the water, which held it in suspension.

When the depth of the pit exceeded 5 feet the top was enlarged enough to prevent caving in, and the same length of drum used in the bottom In such case, after the drum was removed and the concrete had set, it was necessary to fill in the conical space around the top with gravel well consolidated with the adjacent earth. When the pits were finished the drums were filled half full of concrete, and removed after that had set.

The removal of the drums was at first difficult on account of the friction of the soil and adhesion of the beton, and while the concrete was being placed a trestle was put over the pit and from it the drum was raised by a three-ton tackle in stages of about 20 inches to permit the addition of successive layers of concrete.

The foundation pits were about 20 feet apart, and four skilled laborers could bore and fill five of them, each 6½ feet deep, in ten hours. The construction of the arches, although partly in water, was easy. Beton skew backs were made on the foundation pillars and connected by a concrete arch, laid on a well rammed bed of gravel and with gravel filling at the sides to receive any lime filtrations before the concrete set. Concrete foundations were thus made for a wall 427 feet long, 20 feet high and four feet wide at the base, with an external batter of 2 feet and weighing about 8,530 pounds per foot. Each concrete foundation pillar sustained a load of about 84 tons, and ten months after being constructed no settlements or cracks were visible.

Although the depth attained by the pits did not exceed about 7 feet the results indicate that a depth of 25 feet may be reached by this method, this being the limiting depth that the boring, the most difficult operation, can be effected by four or eight men with a mine auger. The sheet-iron drums can be made up to 20 feet in length by adding on short sections; beyond this length it is difficult to handle them.

Dynamite, in exploding, exerts a nearly uniform force in all directions, whatever the nature of the surrounding bodies. This is exemplified by the curious experiment of suspending a ¼-inch sheet-iron plate by a fine thread and exploding a 50-gramme cartridge upon it. A hole will be pierced through the plate without breaking the thread, or causing more than a slight oscillation of the plate.

The action of dynamite is twofold; a force due to the decomposition and violent separation of the elements of the nitro-glycerine, and the explosion of gas formed by new compounds. The first effect is the most important, and is the chief factor in making the pits; the second explosion tears the surface of the pits, especially near the top, and throws the material out vertically to fall back into the hole.

Exact calculations by M. Bonnefont have shown that the dynamite foundations of a mean depth of 50 feet cost 16.87 francs per meter (about $1.05 per lineal foot), as compared with a cost, under the parallel conditions, of 65.4 francs per meter, when cofferdams and dredging were used.

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* Translated from an article by M. Bonnefont, published in the *Revue du Genie* and reprinted in the *Revue Industrielle*.

A NEW METHOD OF CLEANING RESERVOIRS.

In The Engineering and Building Record of June 14. a brief reference was made to the arrangement which will be adopted to clear the reservoir at Denver, Col., from sediment in case of necessity. The bottom of the reservoir, as there stated, will be made to form several large pockets at the lowest points in which will be located blow-off valves through which water and any sediment which may have collected may be discharged to any convenient point.

The general arrangement of these pockets and valves is shown in the accompanying illustration, prepared from a photograph of one of the seven reservoirs at Florence, Neb., which supply water to the city of Omaha. The photograph and data were kindly furnished by Mr. W. A. Underwood, of the American Water-Works Company of New York, who in this instance, as well as in the case of Denver, carried out the work.

The formation of the pockets in the bed of the reservoir is clearly shown in the illustration and requires no explanation. The blow-off valves are of the disk pattern and are operated from small hydraulic cylinders arranged in the manner shown, the valve stems in each case being continuations of the piston rods worked from the cylinders. Water under pressure is supplied underneath the pistons by the pipes shown running along the reservoir bed, and the cylinders and pistons are so proportioned for the available pressure that when the water is admitted the total pressure under the pistons is sufficient to raise the blow-off valves from their seats and allow the escape of water and mud from the reservoir. From each blow-off valve opening a 24-inch pipe runs down vertically 15 feet, connecting with the main discharge pipe. The arrangement, it is understood, has been found to work in an altogether satisfactory manner. Where the entire contents of a reservoir are blown off in this way any remaining sludge may be washed off with a jet from a hose.

This hydraulic valve arrangement, according to Mr. Underwood, is in some places used by them on different points on delivery mains for shutting off the water supply when necessary, water under pressure in such a case being admitted to the top of the cylinder. Ordinary gate valves are in such cases employed, the advantages claimed being rapidity of closing and freedom from the danger of twisting the valve stems, incurred by lack of caution on the part of the men in working the shut-off valves in the ordinary way, there being generally a tendency to give the valve stem an extra, though unnecessary, turn, to make sure that a valve is tightly closed. With the hydraulic cylinder attachment the valve is closed by direct pressure, there being no turning of the valve stem, and the water to work the appliance may be taken directly from the delivery main at a point in front of the shut-off valve, the supply to the cylinder being controlled by a cock. Each hydraulic cylinder, it will be understood, is provided with proper discharge openings at top and bottom for the water after it has performed its work in opening or closing a valve.

BOOK NOTICES.

The Electric Railway of To-Day; by H. B. Prindle; 56 pages; published by E. B. Stillings & Co., Boston, Mass.; price 50 cents.

The author explains in the preface that his aim has been to describe the electric railroad system in such language that the reader, who is unfamiliar with technical terms, can readily understand the construction of the apparatus, and the functions of the various appliances used in the electrical propulsion of street cars. To this there is little to be added. The little book is eminently of a popular science character, but will, nevertheless, prove of interest to the engineering student also, giving, as it does, a brief, though necessarily incomplete, resumé of the subject. Several forms of dynamo and electric motor are shown, and illustrations are given of the customary forms of overhead construction. The storage battery system, however, comes in for but slight consideration, and might have been dealt with more fully to advantage.

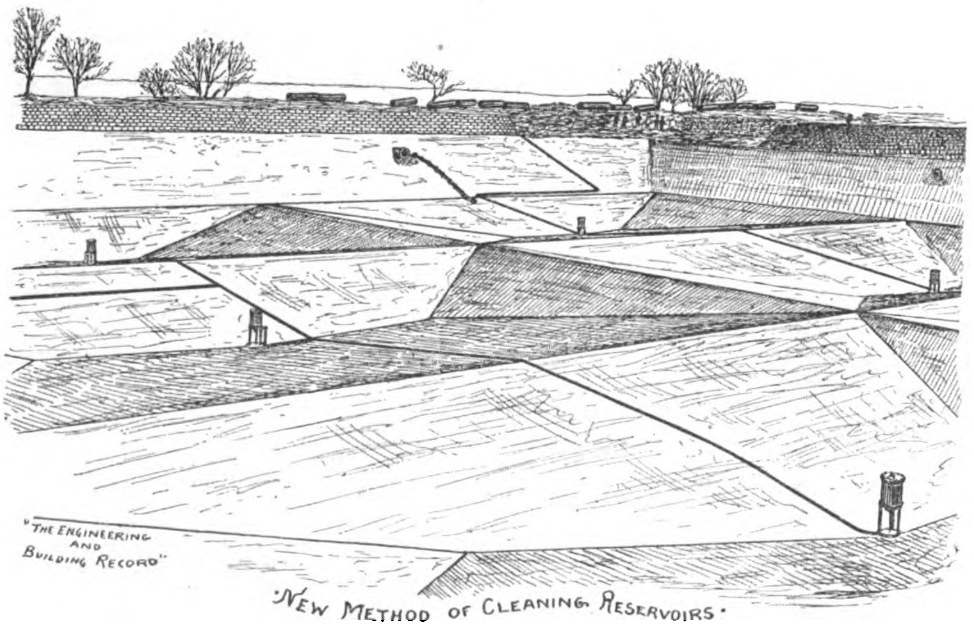
Report of the Board of Water Commissioners of the Town of Needham, Mass., on Water Supply; May, 1890.

On November 7, 1889, the town of Needham, Mass., voted to supply itself with water, and a board of water commissioners was elected. In the report just issued an account is given of what was done, with the view of contracting with one of several adjacent towns for a water supply, and the reasons are given for the conclusion to recommend an independent system of supply. The report of Louis E. Hawes, whose services as Engineer of the Water Board were secured, takes up the greater part of the pamphlet. Mr. Hawes in this report refers at length to the surveys and investigations made by him for the purpose of ascertaining a suitable source of supply, and submits a design for a proposed system of distribution and fire protection, together with estimate of cost and other details.

NEW PUMPING STATION AT BERCY, PARIS.*

The present notice deals with the pumping station from which the Montmartre reservoirs are supplied. The water is taken from the Seine by means of two syphons of cast-iron, which deliver it at the pumping station in wells whose floor is 13 feet 1½ inches below the normal river level. Provision is made for emptying and cleaning the syphons, and, by means of small pipes connecting the highest points of them to the pump barrels, all accumulation of air is prevented. The water is raised from these wells by vertical pumps to cisterns about the level of the highest floods of the Seine, and from these cisterns the horizontal pressure pumps are supplied. The head of water with mean river level is 184 feet in all. The capacity of the pumps in ordinary working is over 11,000,000 gallons per day. There are four sets of pumps, one vertical and one horizontal forming a set driven by one engine. Each engine is of 150 horse-power effective, and is of the Wheelock type with plane balanced sides. Each can act independently of or in combination with any other. The steam cylinder is of 31½ inches diameter. the horizontal plunger 16⅛ inches, the vertical piston 39¾ inches. The steam piston and horizontal plunger have a common stroke of 63 inches. The number of revolutions is 22½ per minute. The site being made on ground overlying peaty mud, the foundations were piled and a masonry floor 3 feet 3 inches thick laid over the whole site, in which the pile heads were buried. There are eight water tube boilers in four groups of two each. The tubes are 4⅜ inches in diameter and 15 feet long, with heating surface of 1,076 square feet, and grate 5 feet 5 inches by 4 feet 2 inches. The boilers work at 85 pounds, and can supply each 4,000 pounds of steam per hour. Six will supply the engines, leaving two for cleaning and repairs.

There are two pressure mains, each 23½ inches in diameter and about 3¾ miles in length. The cost of the works, not including land, was £36,000, or £60 per horse-power measured by water raised. The works were commenced in July, 1887, and the first engines started in May, 1889.


"The Engineering and Building Record"

New Method of Cleaning Reservoirs.

Correspondence.

Communications giving information or opinions on matters of general interest to the engineer, the architect, the contractor, or the municipal officer, will be welcomed in this column. Fairness will suggest that when communications are sent simultaneously to this and other journals we should be informed of it at the time. Anonymous letters will not be noticed.

REPAIRS TO MACADAM ROADS.

Essex County Engineer's Office,
Newark, N. J., June 20, 1890.

To the Editor of The Engineering and Building Record:

Sir: In the diffusion of valuable information on the road question by your paper there are one or two points on which I am at variance with the accepted methods in the way of road repairs, and on which it would seem proper to make a few remarks based on practical experience. The divergence is mainly on three points:

First.—I do not patch.

Second.—I do not use steam rollers.

Third.—I do not use screenings.

First.—On the advisability of patching. All treatises, books and articles written on roads lay it down as a fundamental principle that on the proper and systematic repair of roads a force of men should be continually kept at work patching up, filling holes and repairing bad spots in the roads. In my practice I have avoided this as much as possible. In the first place it is desirable to build your road at first so that it may wear down uniformly. If this is done patching is unnecessary, and when the road wants repairing or renewing, as undoubtedly it will, make the repairs in stretches of a mile or two miles at a time. If these repairs or renewals are thorough the process can be renewed at proper intervals, *ad infin.* To quote an old saying, a patch on the clothes is premeditated property, so patching roads is premeditated negligence or ignorance. Of course to achieve such a non-patching result proper care must be taken in the first construction, and still greater care in the subsequent renewals.

Second.—As to the use of steam rollers. The only real argument to be used in favor of a steam roller is that it is more economical to move a roller of 15 to 20 tons weight by steam than by horse power. This I freely grant, but at this point all comparisons cease. I think better results can be gained by running a horse roller over a stretch of newly-laid stone, weighing two tons, 15 times, than from a 15-ton roller twice, the hauling in these cases being the same, the constant trituration, if I may so call it, being of far more efficacy than the dead weight occasionally applied. The great objection to steam rollers is that they make a practical embargo on all travel during their use, and, while in the construction of new roads this may not be objectionable, in the repairs of roads it is, in the language of the vernacular, a tremendous nuisance. In addition to this the concentrated load of 300 pounds per square foot, which a steam roller occasions, is very trying and somewhat destructive to bridges, culverts and pipes, which of necessity must exist on long stretches of road.

Third.—As to screenings. While not condemning absolutely the use of such material, I consider it a luxury and not consistent with the economical maintenance of roads. If placed on a road in dry weather with heavy travel it lasts from four to six weeks and is then *non est.* In criticising these points it will probably be in order for me to state what substitutes I use in their place, and to do this I will briefly state the practice of road repairs as crystalized by my experience. In Essex County we have about 40 miles of county roads. These roads are arterial, being the main conduits of travel for a population of 250,000 people, excepting the pure intermural travel of the city of Newark. To keep these in repair the sum of $25,000 is annually appropriated; of this amount about $17,500 is spent in repairs of the pavement, the rest for gutters and sidewalks. This would place the cost of repairs of pavement at about $450 per mile, or nearly 4 cents per square yard, the pavements being 20 feet wide.

The practical working of the repair system is as follows: In the spring of the year bids are received from responsible, experienced men, for teams, carts and men per day, and the work is given out to these parties, and they are assigned to the different avenues.

Bids are also received for broken stone, 1½ inches in diameter, per long ton, delivered and dumped at the required spot on the avenue. These prices are for the year. The stone is delivered, the weigh bill punched, and the bill paid on the evidence of the punched weigh bill. When the stone is deposited the spreader spreads it uniformly along the surface of the road. One of the secrets of success in repairs depends on the ability of the spreader. He is like the poet, *nascitur non fit.* You may try a hundred men and only find one spreader, and when you find him, keep him. When the stone is spread it is rolled with a 2-ton horse roller, until the surface is fairly smooth. Then a coating or packing of loam or clay is put on, of a thickness of about ¾ inch to 1 inch This is then rolled for, say half a day, with the same roller, and the general travel allowed immediately to come upon it. The result is at first ruts and unevenness, but with careful watching and rolling, interspersed with occasional hand leveling, the surface, in about three days, will have come down to the desired uniformity and is then left to its fate. Occasionally, in very dry weather, more packing will have to be put on, or in very wet weather, more rolling and leveling will have to be done, but the whole manner of treatment has to be arranged according to the conditions of weather present and prospective and the class of travel coming on the road. No cast-iron rule can be observed, and successful results are only attained by good judgment and experience.

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* A paper by R. Andra in *Le Génie Civil*, abstracted in Excerpt Minutes of Proceedings of the Institution of Civil Engineers.

The only location whereon screenings are used is on the heavy grades down the mountains. It has been found that during the windy weather in the month of May, some protection has to be placed on the roads to keep them from breaking, so on the mountain slopes we place a layer of screenings, and on the rest of the roads, if their symptoms are bad, we sprinkle a light coat of loam to tide them over the dry, windy weather. This sprinkling of loam costs about $30 a mile, and I find it is impossible to get along without it and have good results. The coat of screening costs from $300 to $400; about as much as the average cost of renewals.

There are two points of special import that I wish to allude to, and that is for good, sound, economical results, broken stone of the size of 1½ inch is proper, and also that the Orange Mountain trap has better qualities for road making than any of the Bergen Hill or Palisade traps. This I do not state from prejudice, but from long experience in both kinds.

Feeling somewhat lonely in my experience on road repairs I have made occasional trips to New York City to observe their practice there, and after the observations I see no need to change my views. In the repairs of St. Nicholas Avenue I was much struck with the *modus operandi*. First a block of one-half the street is fenced off, into which the steam roller is corraled. Then two policemen are detailed to care for the fretful horses stirred up by the snorting and puffing of the steam, and occasionally a mounted policeman is detailed to help the others, and the roller puffs up and down its isolated block scrunching stone of sizes as big as your fist to that of a hickory nut, to a uniform surface and on top of which is spread a coating of screenings thick enough to stand alone. The whole process seemed to me barbarous and extravagant and certainly nothing that could be advantageously copied by any other community.

I then visited the Boulevard and found its condition hardly up to par. Humps and hollows existed in plenitude, and it was far from being a model road. So I returned to Jersey, feeling that even if isolated and at variance sufficient inducement had not yet been offered for me to mingle with the large army of road patchers.

JAMES OWEN.

[Discussions on practice and experience in road building and maintenance are always welcome in these columns, and we invite our readers to discuss the points made by Mr. Owen. Meanwhile we would say that from our experience the effect of the presence of a steam roller on horses is rather over-stated in Mr. Owen's communication. Horses get used to them as they do to other objects that, when strange, frighten them.]

Questions and Answers.

All questions relating to building construction, paving, sewerage, water supply, or kindred subjects, will be welcomed in this column provided they relate to matters of general interest and are not such as should properly be referred to a consulting engineer. Answers will be carefully prepared and a proof of both question and answer mailed to the inquirer as early as proper consideration will permit. They will be published for the benefit of other readers as soon as convenient. The full name and address should be given, not necessarily for publication, but as a guarantee of good faith, and to facilitate further correspondence in case the question is not sufficiently explicit.

Inquiries of the Editor, in order to secure prompt attention, should *not be written on the same piece of paper as a communication* to the *Publishing Department*. Letters renewing subscriptions are sent to a clerk in the publishing office, and matter for the Editor, if in the same enclosure, is likely to be overlooked unless it is on a separate piece of paper, so that it may be promptly sent to the Editor.

AUTOMATIC REGULATING VALVE FOR WATER MAINS.

"INQUIRER," St. Johns, N. Y., writes: "In a recent number of *Engineering* there is a brief reference to an automatic regulating valve to be used on water mains to reduce or regulate the pressure. It is the invention of an engineer, Mr. William Key. It is described as being worked in such a way that the pressure can be reduced to any desired extent, but in the event of a fire breaking out the pressure can immediately be raised to its full normal extent. Such a valve would doubtless be very useful in many cities. Could you kindly inform me if it has been adopted anywhere, and has it been a practical success?"

[In the copy of *Engineering* referred to, for January 31, 1890, no descriptive particulars of the valve are given, and we are not acquainted with its character. Regulating valves of various kinds, enabling the pressure in a pipe system to be quickly increased to any reasonable figure desired, are in current use, and, so far as we are aware, have practically demonstrated their value in fire-pipe systems. The reduction of pressure, to which our correspondent refers, is very probably effected by throttling the supply, the valve being opened wide when full pressure is wanted. We should be pleased to hear from any one who may know of the particular valve in question]

VENTILATING MANHOLES WITH CHARCOAL POCKET.

EDWARD MOHUN, of Vancouver, B. C., writes: "In your issue of the 31st of May, page 411, is an article, descriptive, as I understand it, of what is claimed to be a new design for the ventilation of sewer manholes.

The use of charcoal in a precisely similar manner to that explained in your paper is referred to, with explanatory drawings, on page 12 of Sir Robert Rawlinson's 'Suggestions,' revised and published in 1878.

I am not quite certain, speaking from memory, but think it is to Mr. Baldwin Latham that we are indebted for the spiral charcoal tray to be placed in manholes or ventilators for the attainment of the same object."

[We were aware that this idea of ventilating manholes was not new, but we believe the details of the device shown were of sufficient novelty to be noticed in our Novelty Column.]

OBSERVATIONS AND EXPERIENCES OF SUBSOIL WATERS.*

THESE observations were made in continuation of previous observations on the Bilin chalybeate springs, with a view to a knowledge of the nature of subsoil waters generally. Such waters, it is stated, are met with not only as underground lakes, but as running streams, which follow generally the laws applicable to all rivers and streams—the conditions being, however, in some respects distorted or modified, especially as regards frictional resistance and velocity. For although 6½ to 10 feet per second may not be regarded as an unusual velocity for rivers, it might take underground streams an hour to travel over the same distance, thus showing a velocity 3,600 times less; yet, on the other hand, subsoil waters are sometimes met with having a fall of 1 in 20, or 1 in 16—that is, considerably greater than that of rivers in general. And again, as regards backwaters, and the heading-up due to banks or weirs, these subsoil streams are subject to the same laws as rivers; but the most interesting property of subsoil waters in general is that there is no chemical homogeneity in them; the waters consisting, in fact, of separate filaments of different chemical composition due to outside influences. In this respect, however, similar results are to be observed in large rivers; for example, the flow of the river Inn into the Danube affects the character of the latter river for many miles; and the Moldau at Prague is another prominent instance, for the water of this river, at different points, is of different chemical composition, that along the right bank being much softer than that along the left bank, and the upper layers of water softer than those deeper down. Under the author's surperintendence a boring was made at Bilin through diluvium, chalk and gneiss down to a depth of 426 feet, when an abundance of good mineral water was obtained, the yield increasing with the depth. The rise of the water in the bore shaft was measured automatically, and its curve graphically shown—the time giving the abscissa, and the rise during that time the ordinate. This curve was a regular parabola, showing that the rise was uniform, and not affected by feeders under different pressures; between 380 and 426 feet of depth the curve was stationary, showing that no new springs had been met with. Wishing to tap this chalybeate spring, and to lead it to the sloping ground surface, a tunnel was being driven in the chalk towards the bore shaft, when fresh water was struck of a different chemical composition to the Bilin mineral water, and it was at the same time observed that the surface of the water in the bore shaft was steadily sinking, showing clearly a connection between the chalybeate water deep down in the gneiss and the subsoil stream in the chalk, flowing at a depth of only 15 to 20 feet below the ground surface, and also explaining why other wells that had been sunk above the trial boring showed different water levels. The results of the author's observations and experiences of subsoil waters generally led him to consider the question of the water supply of Prague, which is now very deficient, being restricted to house wells and the filtered water of the Moldau. A project has been under consideration for years past, and trial borings have been made, and the water levels in each well observed; these have shown a very great difference in the degrees of hardness of the water, though all the borings were apparently made in a connected subsoil area; and further experiments proved that the water at the left bank of the subsoil stream was considerably harder than towards the center. This hard water, it was thought, might be due to the supply coming through chalk strata, and the varying degree of hardness owing to the deposit of carbonate of lime in passage through the earth; but it is stated that the amount of hard water met with is entirely disproportionate to the amount of rainfall in the particular locality, and that the subsoil streams at Prague lie deep down in the earth, and are of different chemical composition. These considerations, it is stated, did not furnish much light on the question of deep boring at Teplitz, where there are subsoil warm springs, of volcanic origin, extending over a large and deep lying subsoil area, and where deep boring is of advantage, but the observations on the Bilin chalybeate springs prove that subsoil waters really play an important role in the province of medicinal waters, which has been hitherto ascribed to volcanic origin.

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* A paper by Prof. F. Steiner in *Wochenschrift des österreichischen Ingenieur und Architecten-Vereines*, abstracted in Excerpt Proceedings of the Institution of Civil Engineers.

DOMESTIC PLUMBING HEATING LIGHTING & VENTILATION ENGINEERING

CONVENTION OF THE NATIONAL ASSOCIATION OF MASTER PLUMBERS.

(From our Special Correspondent.)

DENVER, COL., June 19.

TUESDAY'S SESSION.

THE National Association of Master Plumbers of the United States opened its eighth annual convention in the Chamber of Commerce here at 2 o'clock P. M. Tuesday, June 17. President Hannan called the convention to order, and addresses of welcome were made by M. A. Dolan, President of the Denver Association of Plumbers, and Wolfe Londoner, Mayor of the city.

President Hannan responded in a few words, and announced that the first business in order was the appointment of a committee on credentials.

On motion of William Harkness, Jr., of Philadelphia, the chair appointed as such committee, William Harkness, Jr., of Philadelphia, James Foley, of Kansas, and Dan Shannon, of Boston, who, with Secretary Green and Secretary Sheehan, should examine and report on the credentials of the delegates.

The Secretary read the following telegram:

NORFOLK, June 17, 1890.

Virginia sends greeting, invokes harmony and much pleasure to all, ladies included. W. E. FOSTER.

After the reading of this telegram the convention took a recess to witness the operations of the Denver Fire Department.

On reassembling the Committee on Credentials submitted the following report:

Your Committee on Credentials present the following as their report: Number of States represented, 19; number of cities represented, 37; number of delegates as per credentials, 180; and we herewith attach a list of delegates. Respectfully submitted.

WILLIAM HARKNESS, Jr., *Chairman.*
JAMES FOLEY.
DANIEL SHANNON.

Baltimore, Md.—P. T. Barry, James Healy, William Drusnett, John Trainor, W. W. Rowles, Joseph C. Mitchell.

Boston, Mass.—I. J. Tute, William Lamb, Daniel G. Finnerty, Daniel Shannon, W. H. French, Henry W. Toombs, D. A. Hogan, Joseph H. Bagley, David Smith, J. F. Cronin, W. H. Mitchell, William McKenna.

Bridgeport, Conn.—H. B. Middlebrooks, Alfred Hopkins, L. H. Mills.

Brooklyn, N. Y.—George B. Lewis, William Fallon, George Cummings, H. H. Noble, T. W. Kelly, M. J. Lyons, Thomas Hudson, William J. Fitzpatrick, Theodore Radcliffe, John J. Keenan, Paul Ayres.

Buffalo, N. Y.—L. P. Beyer, Charles Geiger, Fred. Yuhl, C. H. Carey, Jacob Mensch.

Burlington, Iowa.—Henry Ewinger.

Chicago, Ill.—H. Watt, R. Griffith, D. Whiteford, J. H. De Veney, M. H. Reilly, C. J. Herbert, H. J. Kilrain, William Bowden, J. H. Roche, J. R. Alcock, C. J. Byrnes, C. C. Breyer, D. J. Rock, A. Young, T. F. Gay, J. J. Hamblin, J. G. Weber.

Cincinnati, O.—John A. Douglas, W. F. Wagner, Richard Murphy.

Cleveland, O.—C. C. Dewstoe, W. A. Kelley, J. Schneeberger.

Colorado Springs, Col.—E. S. Bunstead.

Columbus, O.—E. A. Futerer, C. A. Klie.

Decatur, Ill.—Philip Mueller.

Des Moines, Iowa.—Joseph Laing, John Burnside.

Duluth, Minn.—W. H. Dwyer.

Glenwood Springs, Col.—Joseph A. J. Clouden.

Indinnapolis, Ind.—John S. Farrell, Peter J. Gall.

Kansas City, Mo.—L. B. Cross, Alexander Gray, H. B. Farley, Dell Guay, R. B. Farley.

Kansas State Association.—James Foley, S. J. Stewart, Thomas Lloyd, C. J. Prescott, R. Wood.

Lowell, Mass.—Thomas Costillo.

Leadville, Col.—C. N. Priddy.

Minneapolis, Minn.—E. C. Couvet, A. W. Scott.

Milwaukee, Wis.—Charles Foleshek, W. E. Goodman, Herman Appell.

Nebraska State Association.—J. H. O'Neill, M. A. Free, N. B. Hussey.

New York City.—Joseph A. Macdonald, George D. Scott, J. N. Knight, William R. Brocken, H. G. Gabay, William P. Austin, F. Sullivan, James Gilroy, D. Mackay, Jr., I. J. Toumey, C. Fraser, P. J. Cummings, Frank Reynolds, William Young, E. J. Brady, W. H. Quick, J. W. O'Brien, D. W. Littell, George B. Brown, Philip Smith.

Philadelphia, Pa.—John E. Eyanson, William Harkness, Jr., Enoch Remick, William W. Wright, W. H. Doyle, F. P. Brown, J. J. Weaver, George F. Uber, A. G. Bond, William McCoach.

Portland, Ore.—I. J. Johnston, J. J. Owens, Alexander Muirhead.

Pueblo, Col.—E. P. Fish, C. Geiser.

Pittsburg, Pa.—J. J. Kennedy, B. F. Call, James McGinness, Frank McKnight, Leo McShane, Allen McFadden, George Sands.

Rochester, N. Y.—J. H. Howe, William Barr, I W. Ford, W. G. Reid.

Sioux City, Iowa.—D. W. Fitts, John F. Gearen.

Springfield, Mo.—W. W. Cronin, Harry Cooper.

St. Louis, Mo.—F. Abel, J. Sheehan, Joseph Funalty, William H. Graham, Joseph P. Gallagher, David Roden, Thomas Cantwell, Samuel S. Doony, Edward P. Rearden, P. C. Ring, M. J. Ward, Joseph A Stedger, William Morris, James A. Lynch.

St. Paul, Minn.—J. J. Dunnigan, J. P. Adamson, P. W. Hudner.

St. Joseph, Mo.—R. F. Connell, M. E. Herbert.

Syracuse, N. Y.—R. C. Maclure, Edward Jay, Alfred Tilley

Salt Lake, Utah.—J. J. Farrell, H. C. James.

Washington, D. C.—James Rogan, Edward J. Hannan, George A. Green, Joseph Lockhead, George Hutchins.

Wilmington, Del.—Alfred Gawthrop, Thomas Reilly.

Davenport, Iowa.—James Cameron.

Denver, Col.—N. A. Dolau, W. H. McCarthy, W. F. Brane, Daniel F. Frey, W. F. McCarthy, James Shannon.

Lowell, Mass.—Thomas Costello.

Bloomington, Ill.—Robert Landen.

Hornsburg, Pa.—John A. Kromer.

The report of the Committee on Credentials was adopted.

W. H. McCarthy, of Denver, was appointed sergeant-at-arms, and Henry G. Gabay, of New York, was appointed assistant secretary.

George Sands, Pittsburg; Henry W. Toombs, Boston, and Peter J. Gall, Indianapolis, were appointed auditing committee.

The following communications were read and the secretary instructed to acknowledge receipt:

FORT WAYNE, IND.

Sorry I could not attend, but wish you a harmonious and successful convention and pleasant time.

JAMES MADDEN.

CITY OF CHICAGO,
HEALTH DEPARTMENT.

This is to certify that I have appointed Mr. Andrew Young to represent the Health Department of Chicago at your convention.

SWAIN WICKERSHAM,
Commissioner of Health.

The convention then adjourned to 9 o'clock Wednesday morning.

In the evening a ball was given at the Chamber of Commerce in honor of the delegates and their ladies.

WEDNESDAY MORNING SESSION.

The convention was called to order at 9 o'clock Wednesday morning, and, in the absence of Secretary Green, W. H. Mitchell was chosen Secretary *pro tem.*

The report of the Essay Committee, A. W. Murray, Chairman, was read as follows:

CHICAGO, June 14, 1890.

The accompanying printed report explains the work of your Essay Committee, and hoping for the continued prosperity of the organization, we beg to subscribe ourselves your obedient servants,

ALEXANDER W. MURRAY,
M. L. MANDABLE,
C. J. BROOKS,
FRANK E. RUH,
P. J. LOUGHLIN.

CHICAGO, ILL., February 25, 1890.

E. J. HANNAN, Esq., *President of the National Association of Master Plumbers, Washington, D. C.*

Your committee on announcing subjects for essays for the Denver convention, beg leave to report as follows:

1. The exhibition of plumbing materials and workmanship at the World's Fair in 1892. What method can be adopted to make it an attractive feature and of general benefit to the plumbing interests.
2. Electricity in the plumbing trade. (*a*) Applications. (*b*) Dangers to workmen from electric wires.
3. Automatic flushing apparatus, and their application to plumbing fixtures.
4. Air currents in the interior of a building. (*a*) Motive power causing them. (*b*) In what manner contaminated. (*c*) Their influence on the seals of traps.
5. The proper system for controlling the water supply of buildings in cold climates.
6. The best system of preventing back-water from sewers entering buildings during severe rain storms.
7. Management of a plumbing establishment. (*a*) The office. (*b*) The salesroom. (*c*) The workshop. (*d*) Arrangement of stock.
8. Water-backs for heating water. (*a*) What metal is the best for its manufacture. (*b*) Care necessary to prevent explosion. (*c*) Cause of explosions.
9. Inspection of plumbing and house drainage. (*a*) Benefits to householder. (*b*) Benefits to plumbing interests.
10. Water filters. (*a*) What is the best for domestic use. (*b*) Quality and kind of filtering material generally used.
11. Progress of sanitary legislation. (*a*) Method to adopt in obtaining favorable laws from legislative bodies. (*b*) Example of a proper law.
12. Traps, and what is known of them as at present used in the plumbing trade.
13. How to promote larger attendance at local association meetings,
14. The principles of natural philosophy in the sanitary appliances of a building. (*a*) Is there any other business where the practical use of these principles is in greater demand than in household sanitation?
15. Is competition in plumbing to the best interests of the householder?

All of which is respectfully submitted.

ALEXANDER W. MURRAY,
M. L. MANDABLE,
C. J. BROOKS,
FRANK E. RUH,
P. J. LOUGHLIN.

NATIONAL ASSOCIATION OF MASTER
PLUMBERS OF THE UNITED STATES.
OFFICE, 517 ELEVENTH STREET., N. W.,
WASHINGTON, D. C.

To the Master Plumbers of the United States, in affiliation with the National Association, greeting.

The Committee on Essays having selected the inclosed subject for essays, to be prepared for our coming convention, which will be held in Denver, Col., June 17, 18 and 19 next, and believing that it is better that each subject be assigned to a local association, we therefore request the co-operation of the presidents by the appointment of members to write upon the subject assigned to their association, selecting the best and having the same printed and retained until read before the convention, and afterwards distributed. We wish it understood, however, that while we assign each subject to a particular association, members of other associations are not debarred from writing upon the same subject, but their contributions are invited.

First—To Chicago Association.
Second—To New York Association.
Third—To Buffalo Association.
Fourth—To Milwaukee Association.
Fifth—To St. Paul Association.
Sixth—To St. Louis Association.
Seventh—To Omaha Association.
Eighth—To Baltimore Association.
Ninth—To Philadelphia Association.
Tenth—To Brooklyn Association.
Eleventh—To Boston Association.
Twelfth—To Kansas City Association.
Thirteenth—To Kansas State Association.
Fourteenth—To Cincinnati Association.
Fifteenth—To Colorado State Association.

Very truly yours,
EDWARD J. HANNAN, *President.*
GEORGE A. GREEN, *Secretary.*

The report of the committee was unanimously adopted.

The Apprentice Committee submitted the following report, which, after a spirited debate, was adopted:

The apprentice question of to-day is one of the most important that we have to discuss at our annual conventions. What the foundation is to the building, what seed grain is to the farmer, the apprentice is to the plumbing profession.

The trade has in the past employed boys to learn the business without regard to their mechanical ability or tastes; the result has been that 50 per cent. of them quit work or were laid off in one or two years, being entirely unfit for the trade, and only 25 per cent. of the total number employed became first-class plumbers. We must put better material into our shops in the future if we expect to make perfect plumbers.

A few years ago apprentices in England and other European countries were required to serve seven years, and then often had to pay for the privilege. When they got through they were finished mechanics, if not artists. Many of them, coming to this country, could shape anything out of lead.

The average time for an apprentice in this country has been five years. Very often boys break through their obligations and quit work, and proclaim to those who employ them that they are journeymen. It does not take long to prove their assertion false; and the result is provoking and expensive, as it frequently happens that they are put on first-class work, which has to be done over. And the trade unions allow these men to select the class or grade of work for themselves, without any regard to their experience or ability, which is a great imposition and outrage on the business. We all have this experience sooner or later. Boys become restless as the end of their apprenticeship approaches, and often demand wages they are not entitled to. They become filled with their own importance, and give a great deal of trouble, often acquiring expensive habits which their limited wages will not keep up.

A case of this kind came up in St. Louis. The boy quit work, and, after several weeks' wandering, found a man who wanted a plumber. He hired as a journeyman, but after a short trial his employer told him he was not a journeyman. The young man acknowledged he was not, and admitted the deception. His employer then made arrangements to employ him for a year under instructions at a small advance over his former wages, and the boy went to work for him. His former employer had some circulars printed, informing the members of the organization that this boy had not finished his apprenticeship, as agreed, and also referring to an article in the by-laws which prohibited any member from employing an apprentice who worked with another member, without his consent. The young man was laid off, and could not get work in any first-class shop in the city. He could go back and finish his apprenticeship, but he got stubborn and refused to do so. He tried to get work under an assumed name, and did get some work in a few small shops, but finally had to leave the city.

He brought suit for $5,000 damages, which was demurred to and the demurrer sustained. Then he amended his petition and sued for $2,500, and his employer set up a demurrer to that also, and it was sustained. The boy's attorney then took it to the Court of Appeals, where they ordered the case to go to trial.

In the meantime, the judge who sustained the demurrer on the two occasions failed to be re-elected and a new judge tried the case. Both parties fought the case zealously, but there was a good common jury trying the case and they gave a verdict against the apprentice and in favor of the employer.

Then the Knights of Labor and other labor organizations raised a howl, claiming to have elected the judge, and that he had made pledges and promises to them. They were furious because the boy lost the case, and were going to have a special law passed in Jefferson City protecting workingmen, etc.

The boy's attorney applied for a new trial; and, after two months' waiting, the judge granted it on the sole ground that the verdict was not in accordance with the evidence.

The employer then took a change of venue, declaring he could not get justice in that court; that he had fairly won the case and it should have gone up to a higher court on its merits. It was assigned to an associate judge of the one before whom it had been tried, who was elected on the same ticket and indorsed by the labor party. This time 10 of the 12 jurors were young men employees, and when they were sworn in we knew the case was lost. The case was discussed by them for two days and they finally brought in a verdict for the boy for a portion of the amount claimed.

The case was appealed. The Court of Appeals confirmed the verdict on the ground that the boy was not indentured according to the law of the State of Missouri, which says that an apprentice must be taken before the Probate Court, accompanied by his parents or guardian and two witnesses, and have a notary certify the papers. It was proved that five years was the customary time for a boy to serve at the business, learning the trade. The court ruled that when there was a written law governing the case custom could not prevail. The boy had been well treated, was paid his wages promptly, and had no other ground for complaint but that he was not legally apprenticed.

An effort was made to take the case to the Supreme Court on constitutional grounds, but the amount sued for limited it to the Court of Appeals. This was the first case of the kind ever tried in the State of Missouri, and it was commented on by the daily press as a case of great interest to employer and employee.

The lesson learned is to take no apprentice unless properly protected by papers. No employer wants to educate a boy and then when he is able to do anything have him quit work, often when he needs his services most. What our trade wants as apprentices is young men about 16 years of age, strong and sound, physically and mentally; boys who are not afraid of work. Reading, writing and arithmetic is all the education they need, with a decided taste for mechanics. If they have not this taste or talent all the education in the universe will not make mechanics of them. Too much education unfits a boy for a trade. It makes him feel that work is degrading, and he wants some work that will not soil his hands.

The trade schools are very popular in New York and Philadelphia. In about three months a boy gets his diploma, and can make a joint, bend a pipe in all sorts of shapes, and solder ends of lead together; all of which does not make a finished workmen by a great deal. If a boy does not work in a shop, in addition to the trade school lessons, the result is superficial and is only a veneering. The promiscuous education of boys, without regard to their talents or tastes for mechanical pursuits, is pernicious, and often ruinous to the boy's future. A boy whom nature intended for a minister or a merchant can never be made a mechanic.

We are not in favor of short methods of education. They are not durable. Nature takes the usual time to perform her work, and it is done well. The earth takes the same time to perform its revolutions. The sun, the stars and the various planets revolve in their endless orbits, and have done so for thousands and thousands of years; they have no short route over which to travel; they go over the same old beaten path. What would the public think if Yale, Harvard and Princeton College were to announce that instead of four years' study, as of old, you could get all the degrees in three months, under the direction and care of old experienced teachers? The people would be astonished and would think it impossible. Does our trade school enthusiast think to overcome the laws of nature by cramming into a boy's brain in three months what it usually takes as many years to accomplish? We admit that as preliminary training for a boy, before going to learn his trade, it is splendid; but of itself alone it will do much harm. "A little learning is a dangerous thing."

Euclid, the world-renowned mathematician was asked by the king to reveal his knowledge to his son, without the drudgery and labor of years' studying to acquire it. The king offered him a large sum of money if he would comply with his request. Euclid said: "Sire, I would do so with pleasure were it not impossible. There is no royal road to knowledge. Your son must study and learn like all the other boys in your dominion."

The same great truth holds good to-day. Look at our successful men in their various pursuits. They were poor boys, who, by untiring exertions, won fame and fortune. Ericsson, Edison, Morse, Carnegie, Fulton and Stephenson—we want a few boys like these in the plumbing business to elevate and ennoble it. Andrew Carnegie says he began in an office using a broom. All boys should begin low and aim high; avoid gambling, drink and other bad habits; and an industrious, persevering boy with good habits can, and does work his way to the head of his profession.

Your committee recommends the trade schools in connection with actual work, as an apprenticeship in a plumbing shop, experience in the shop and technical instruction in the training school combined will make a first-class mechanic of a boy, but trade-school instruction alone will fail to make a finished mechanic.

We request every city and town where there is a plumbers' association to establish and maintain a trade school in connection with their shops, where their apprentices can be instructed in the science of the trade one or two evenings a week, by a committee appointed for that purpose, and to establish a reading room in the same building, if possible. In this way the trade will be kept in its proper channel and diplomas given by veterans in the business to finished plumbers only.

William H. Graham,
James A. Lynch,
Thomas Cantwell,
Committee.

The reports of several State vice-presidents were submitted, after which the convention adjourned until 1.30 P. M.

WEDNESDAY AFTERNOON SESSION.

On reassembling in the afternoon the first business was the address of President Hannan, which was as follows:

Gentlemen: It now becomes my pleasant duty to render an account of my stewardship for the past year. I am happy to inform you that a misunderstanding which existed between a manufacturer and one of our local associations when I was elected has been investigated by a committee of three State vice-presidents appointed by me. After receiving their report, which unanimously sustained our members, the case was amicably settled. Entire harmony prevails between the better class of manufacturers and dealers and the trade. Where there are any violations of our protective resolutions they are on the part of the small, mean tricksters who are compelled to resort to all manner of devices to secure trade. They are engaged in an illegitimate pursuit, pretending to be doing a wholesale business while, in reality, they are retailing. I must confess that in a great many cases the plumber is to blame, for such dealers could not exist long if they depended on their illegitimate trade. Names of those so engaged and details will be given in executive session.

It cannot be denied that to a certain extent we have continued to carry out the objects for which we organize; our special objects being for sanitary, commercial and social purposes. The States and cities having sanitary laws are about equal to the number of associations represented here to-day, which is proof that we have attained the object for which we are banded together, as far as the sanitary feature is concerned. The sanitary laws which are in effect, as well as the vast improvement in the class of work being done at the present time, have been secured through the efforts of our members.

Need I say anything about the social feature? The banquets, balls, excursions and picnics of the past year. which have served to bring our members together, speak for themselves.

We should now turn our attention to the commercial feature, for we have not improved financially in proportion to our advancement in other directions. This is due to the fact that in every community unscrupulous men, who, without mechanical skill or technical ability, are conducting a business and come into competition with respectable, intelligent members of the craft. They receive all the advantages of trade discounts and the benefits of organization, although not affiliated with any association for protective measures. The remedy seems to be found in urging the passage of State sanitary laws to prevent any but competent persons from engaging in the business.

Thanks are due Colonel Richard Auchmutty for inaugurating trade schools, for they are doing an excellent work throughout the country, and they should continue to receive the indorsement of every good and patriotic citizen. Educating the young men, technically and practically, will solve the question of competency.

During the year I traveled about 7,800 miles in the interest of our association. I visited Milwaukee, St. Paul, Minneapolis, Sioux City, Omaha, Chicago, New York, Albany, Rochester and Buffalo. The increase in membership here to day furnish a proof as to whether the time and money were well spent. The receptions given and the treatment received on those occasions more than paid me for the time spent in the interests of our association.

While in Chicago I had the pleasure of meeting the Hon. DeWitt C. Creiger, Mayor of the city, and extending to him the thanks of this association, as passed by vote at the last convention, for appointing our honored Ex-President, Andrew Young, to the position of Chief Sanitary Inspector for Chicago. By so doing he honored our trade and proved our argument that practical men should be appointed on all health boards and as inspectors.

During the year we have organized and received into the National Association eight associations, as follows: Memphis, Tenn.; Duluth, Minn.; Indianapolis, Ind.; Watertown, N. Y.; Birmingham, Ala.; Erie, Pa.; La Crosse, Wis., and Salt Lake City, Utah. In addition, we have received individual members as follows: Texarkana, Ark.; Jacksonville, Fla.; Fargo, N. D.; Barre, Vt.; Portsmouth, N. H., and Huron, S. D. By referring to the Secretary's Report, it will be seen that our membership has increased each year.

The plan of employing an executive clerk I found to be an excellent one, for by so doing I was enabled to answer all correspondence promptly, as well as to send our personal letters to gentlemen in our business who were not members, urging them to organize. If I did not succeed in all cases in getting them to organize and unite with us, I think I have sown seed which may take root and grow under a future administration.

I would urge upon all associations in affiliation with the National the necessity of living up to our constitution and by-laws, and platform of principles, as adopted at Pittsburg.

The success of, and good example set by our association, has been followed by all the building trades, in organizing associations, and the forming of Builders' Exchanges. But we must not let them excel us; neither can they take the place of our organization. I would recommend that our local associations in cities which have no statutes governing plumbing, continue to agitate the question until such laws are enacted; not only for the benefits which they will derive from such legislation, but for the good of the public health.

I know it would be a great tax for my successor to visit our local associations, but much good can be accomplished by a personal visit, especially where differences exist. A visit to the localities which are unorganized would be productive of better results than a year's correspondence.

The national association is not an organization separate from the individual societies—it is an amalgamation of them all. Its direct object is to build up and strengthen every association which enjoys its membership, thereby strengthening itself. New York State by herself would be a small and insignificant nation. Rhode Island would be of less importance still, but as parts of the great American commonwealth each obtains a new power and majesty and acquires a voice in deciding the destinies of the world.

It is very important to know at all times who our members are, and when we receive new ones or any drop out it should be made known either through the trade papers or by circular.

There are a few traitors in our camp who must be sought out and driven from the ranks when found. The time has come when the Executive Committee should be empowered to weed out all such, and to take away the certificate of membership from any association violating our constitution or rules.

I congratulate all the local associations on their progress during the past year. It seems as though all had adopted the motto "Excelsior." I wish to thank the officers of the several associations for their promptness in answering all communications, and their willingness to co-operate with me in advancing the good work of our organization. I also tender my heartfelt thanks to the trade press for the assistance rendered by the willingness to publish all matters of importance.

In conclusion, I desire to thank my colleagues of the Executive Committee for the good advice and assistance rendered me during the year, the successful termination of which has been due to the good will manifested at all times; and I bespeak for my successor that same good will and co-operation on the part of all, in order that his administration may be as successful and his relations as pleasant as mine has been.

Secretary Green submitted his annual report, as follows:

Gentlemen: In submitting my report for the year ending with this convention, I desire to state that the duties of the office have been performed with dispatch and all the correspondence promptly attended to.

I presented a copy of the proceedings of each annual convention to the library of Congress and received therefrom a letter accepting the gift.

During the year there were about 475 personal letters written, 350 circular letters hectographed and sent out, and about 2,000 circulars and 1,800 copies of proceedings of the seventh annual convention distributed.

A few remarks on the growth of our organization might not be out of place at this time. By referring to previous reports of the Financial Secretary it will be seen that in 1884 we had 1,315 members in good standing; 1885, 1,148 members; 1886, 1,188; members; 1887, 1,360 members; 1888, 1,456 members; 1889, 1,526 members, and in 1890, 1,700 members.

I take pleasure in reporting the following additions to our membership during the year:

Memphis, Tenn.—Twelve members, namely: J. A. Bailey & Co., J. W. X. Browne, Bruce Rutledge, Hartie & Scheid, Woods & McGrath, John Hopkins, Rhodes Brothers, Massa Brothers, Leech & McClain, P. Callahan, Lagomarsino & Zanoni, and Latting & Bailey.

Duluth, Minn.—Seven members, namely: William McMillen & Co., Duluth Plumbing Company, N. C. Harvey & Co., P. V. Dwyer & Brothers, Joseph Neil, John P. Wray, and Farrel & Sullivan.

Indianapolis, Ind.—Sixteen members, namely: Freaney Brothers, Charles W. Meihel, Healy & O'Brien, Kalb & Ayers, Anashansel & Strong, Foley Brothers & Co., Dewald & Gall, J. S. Farrell & Co., George W. Keyser, Henry T. Hudson, John C Dunn, Smith & Haslinger, Kirkhoff & Meyer, James McGauley, Schmidt & Gunn, and Peck & Toon.

Watertown, N. Y.—Eight members, namely: D. A. Wait, L. A. Howard, Harbottle & Sons, Beffrey & Mowe, F. B. Devendorf, Howard & Arthur, Bragger & Son, and Wicks, Hughes & Griffith.

Erie, Pa.—Eight members, namely: R. T. Williams & Co., William J. Butler, Miller Brothers, Porsch Brothers, Carey & Campbell, Karch Brothers, Kelly & Baker and James Lumbard.

La Crosse, Wis—Four members, namely: James A. Trane, F. C. Healey, C. A. Krebaum and W. P. Powers & Son.

Birmingham, Ala.—Six members, namely: Robert Knauff, R. W. Gayle, W. H. Franklin, E. C. Worms, C. E. Eckerle and P. Schenssler.

Salt Lake City, Utah.—Ten members, namely: Heesch & Ellerbeck, David James & Co., James J. Farrell & Co., L. H. Dale, A. J. Bomdette & Co., James Fenwick, P. J. Morgan, J. W. Farrell & Co., Salt Lake Construction Company and R. Morrison.

Jacksonville, Fla.—One member, John Eirig.

Texarkana, Ark.—One member, T. E. Walters.

Fargo, N. Dak.—One member, William D. Allen.

Barre, Vt.—One member, L. J. Griffin.

Portsmouth, N. H.—Two members, Robert J. Donnelly and John P. Sweetser.

Huron, S. Dak.—One member, H. D. Brach.

Bridgeport, Conn.—Seventy-eight new members.

Colorado Springs, Col.—Three members, E. S. Burnstead, W. H. D. Morrill and William Scott.

Glenwood Springs, Col.—One member, J. A. I. Claridon.

Leadville, Col.—One member, C. N. Priddy.

Minneapolis, Minn.—Twenty-five members.

Pueblo, Col.—Three members, J. H. Bennett & Co., Morgan Geiser and C. F. Fish & Co.

Making a grand total of 112 new members to date.

In surrendering the office of Secretary, I desire to tender my thanks to all for the kindness of which I was the recipient. Respectfully submitted.

George A. Green, Secretary.

Andrew Young, ex-President of the association, now chief Plumbing Inspector at Chicago, made a report as delegate to the Brooklyn meeting of the American Public Health Association as follows:

Gentlemen: I have the honor to submit to your national convention, assembled at Denver, Col., June 17, 1890, my report as your delegate to the seventeenth annual meeting of the American Public Health Association, convened at Brooklyn, N. Y., October 22, 23, 24 and 25, 1889.

It was gratifying to me to be able to meet this gathering of representative, liberal, public-spirited men, laboring with some sacrifices and encouraging and inspiring enthusiasm in the great cause of public health—engaged in promoting the highest interest of the human race this side the common heritage of us all. We can point to no sublimer incident in all the history of our great country than this assemblage of men gathered together, with no thought of pecuniary reward, to enhance the common welfare of man; to present and discuss the best means of preventing the ravages of disease with its resulting misery and woe. The love of liberty and the blessings of self-government have made patriots of our people, and opportunities have made heroes of our patriots; but here is an association of men loyal to the highest interest of mankind, who have made their own opportunities to serve their fellow men. Their profession has made them philanthropists, and their love for mankind has made them benefactors.

The influence that grows out of this association is extensive, for its membership embraces every section and part of the country. It can be said that in these meetings the United States centers its expert thought, investigations and discoveries; and from this center go out to all parts of the States the aid, strength, moral force, and the collected experience and wisdom of organization. This is a great school of hygiene, and its pupils returned as teachers to our cities, villages and rural districts to continue and further extend the great lessons of preventive medicine. The result is, from this center radiate the influences which become severally potential in the education of the people to a higher plane and a better understanding of the importance and value of hygienic laws. Not only this; the association is annually making most valuable additions to the literature of public medicine, the advancing science of sanitation, and through the limitless circulation of the press this literature is dropped at the cottage and the mansion and along the highways and byways throughout the land. The great need in the progress of sanitary reform is the proper education of the people. They have not yet been educated up to the necessities of hygienic laws. They have not been taught the value of sanitation and the importance of its practical application. But education is progressing in this direction, and while this association has not yet accomplished this great end, it, with similar agencies, is making gratifying progress in this direction.

I found at this meeting an attempt made in the way of sanitary exhibits. It was a rather meager display, yet it is a step in the right direction. There is no greater educator in this work than an exhibition of sanitary appliances. It not only serves as an object lesson to impress important principles in the proper sanitation of dwellings, but it is one of the strongest incentives to improvement and invention that can be given. In this feature I found great room for improvement, but I can see no reason why it cannot be made a most valuable part of the work of the American Public Health Association. I am casting no reflection on the members of this association when I state that they in general are not familiar with the commonest sanitary appliances which are such important quantities in the great problem of sanitation. Their work and knowledge lie in another direction, yet no effort will prove wholly efficient without these sanitary appliances, which not only guard the security of the home but stand as sentinels upon the outer walls of communities. Herein we find the field for the plumber, co-extensive with mankind, enriched and adorned with the fruits of genius, and filled with boundless possibilities. As the hearthstone is the origin of the great thoughts that have revolutionized the world and founded empires and republics, so is the home the birthplace and nursery of that science out of which is to flow the beauty and strength, the happiness and health of a new Eden with its sweet air, glorious sunshine, and pure, refreshing waters. Give us healthful homes and we will give you a nation of strong men and fair women.

This leads me to suggest to you a great service which we, as plumbers, can render the cause of sanitation in its more rapid and effective advancement. We stand nearer the health of the home and the sanitation of man's abode than any others. It is our business to provide the mechanical and scientific agencies to secure the healthfulness of human habitations. We are familiar with all the sanitary appliances that science and genius have produced, and are acquainted with the offices they are designed to fill. No men are so well qualified to give a perfect exhibition of these appliances as the plumbers are, and I offer the suggestion that such an exhibition be made a prominent feature of our annual conventions; and as a means to this end I would recommend that this convention, when the place is selected for holding the next convention, authorize the local association of that place to take charge of such exhibition, and proceed with such arrangements as will result in an exhibition which will be an honor to the association and a benefit to the whole country. Each local association can be instructed to give its aid, and I am sure manufacturers will gladly take part in such an exhibition as it is possible and practical for us to give. The value of such an exhibition has been indorsed by high authority and experience, and we possess the means and qualifications to give the greatest exposition of sanitary appliances the country can afford.

It gives me pleasure to state that I was received by the American Public Health Association most cordially as the representative of the master plumbers, and I was assured of the high value placed upon the plumbing fraternity as an important aid in the advancement of sanitary science. During my stay my observations led me into a comparison of the sanatory and the sanitary sciences, and more particularly of the practicing physician and the plumber. The aim of the one is to cure diseases, that of the other to prevent them. The physician drives to the residence in broadcloth, silk hat and gloves, enters the first door, is shown into the parlor or conducted to the sick chamber, is treated with great consideration and served with the utmost courtesy. Every aid or service that can be commanded is rendered him—all that money can purchase or love and sympathy inspire is placed at the service of the physician. Every effort of the family, of relatives and friends, and even of strangers is given to aid the doctor to soothe and comfort the patient and rebuke the disease. There is nothing in the range of human possibilities ever denied the physician in his efforts to heal the unfortunate sick. How is it with the plumber? He walks to the residence dressed in his greasy overalls and blouse, carrying his bag of tools; he enters at the basement or the servants' room; he receives no welcome, no courtesy, no aid. No part of the resources of the family or friends is given him. The family that stood sympathizingly by the doctor in the luxurious chamber are now in the parlor or at the matinee, while the plumber is in the basement fighting with his skill and scientific knowledge the disease germs invading and threatening the life of the household. And what is the difference between the two? The doctor is called in to cure probably the same disease that the plumber could have prevented; yet the plumber is in a dirty, neglected basement or water closet, and for a meager and grudgingly paid renumeration prevents the sickness and suffering which the doctor seeks to cure for a royal and liberally paid consideration.

But they tell us that the plumber is only a mechanic. If he is a mechanic he has that advantage over the physician, who is not. But is he only a mechanic? He may put in a system of plumbing mechanically perfect in every respect, and yet it would annihilate a family in six months. He could employ only his mechanical skill and ruin the health and destroy the life of a whole city. It is his scientific knowledge that is of value. It is that knowledge which not only makes the healthful home but contributes so largely to the advancement of sanitary intelligence. The physician spends one, two, or at most, three years, probably six months out of each, in the study of his profession, and sets out a full fledged doctor, while the apprentice at plumbing must serve five or seven years. The plumber could acquire the mechanical skill of his trade in a short time, but to gain the scientific knowledge of his profession he must devote two or three times the amount of time in which the doctor is required to gain his knowledge.

They tell us the work of the doctor is intellectual. I cannot reflect in the least on the learning and intellectuality of the noble profession of physicians; but who can stand in the presence of some of our great public buildings and private mansions and say that the agent that planned them, hung their drainage and placed their sanitary fixtures was not intellectual? It is not only the hands but the head of the plumber that places about the home its sanitary safeguards. The plumber is not a machine. He is of necessity an intellectual being with a brain as big as that which directs any art, science or profession we have. Recently I had a talk with the managing editor of the *Sanitary News*, whose correspondence and contributions embrace this whole country and parts of others, and he informed me that of the contributions to his journal, and, as he believed, to the general literature of sanitary science, those from plumbers were superior, and the most important means for the promulgation of sanitary knowledge.

Encouragement in our work comes from every hand, as we have much cause to continue our efforts and advance our cause. Let us continue to make healthful homes and public health will follow. In this broad, bounding, youthful land of ours there 6,000,000 homes. Let us make these homes healthful and happy and we will make a nation of 60,000,000 healthful and happy people, and coming generations will say of us then in the words of our motto, "They builded better than they knew."

ANDREW YOUNG.

The convention then went into executive session after which it adjourned until 9 o'clock in the evening.

WEDNESDAY EVENING SESSION.

The evening session was not largely attended, and was devoted to the reading of papers. John J. Weaver, of Philadelphia, read an essay on "The Inspection of Plumbing and House Drainage," followed by a paper by Joseph P. Gallagher, of St. Louis, on "The Best Method of Keeping out Back Water." A paper by J. J. Wade, of Chicago, on "The Exhibition of Plumbing Materials and Workmanship at the World's Fair" was read by J. R. Alcock, and an essay by J. D. Adamson, of St. Paul, Minn., on "The Best Means of Controlling the Water Supply of Buildings in a Cold Climate," was read by Mr. Weaver. The last paper of the session, "Traps, and What is Known of Them as at Present Used in the Plumbing Trade," by D. M. Quay, of Kansas City, Mo., was also read by Mr. Weaver. The thanks of the convention was voted to the authors, and provision was made for printing the papers.

THURSDAY MORNING SESSION.

The convention met at 9:30 o'clock. The report of the Treasurer showing receipts of $4,700.14: expenditures of $2,883.88, and a balance on hand of $1,123.88 was read and referred to the Auditing Committee.

Mr. Kennedy, of Pittsburg, presented a communication which had been received by the Secretary of the Master Plumbers' of Pittsburg and Allegheny on the apprentice question, as follows:

> At a meeting of the Twin City Association No. 4, of Journeymen Plumbers and Gas Fitters, it was decided that after the first of May no member of the association should receive less than $3 a day; also, that the association register all apprentices, and that the term of apprentices be five years, three years to be served as helping, and two years to be at the employer's disposal.

This was referred to the Apprentice Committee.

State Vice President J. R. Alcock, of Chicago, introduced the following resolution, which was adopted:

> That this national body appoint each association in the United States a day of exhibit at the World's Fair, the State Committee to commence action at once, said association in each State to be controlled by a chairman, who shall be appointed at this convention, and who shall direct the display, the State chairman to be the State vice-president.

The convention then adjourned until 2.30 o'clock in the afternoon.

THURSDAY AFTERNOON SESSION.

The election of officers was the first business, and Messrs. Horgan, Pollasheck, Tumly, Noble and Fitts were appointed tellers.

On motion of Mr. Gabay, of New York, seconded by Mr. Murphy, of Cincinnati, and Mr. Finnerty, of Boston, Robert Griffith, of Chicago, was unanimously chosen as president of the association for the ensuing year.

For vice-president Jeremiah Sheehan, of St. Louis, and Joseph A. McDonald, of New York, were nominated. A ballot gave McDonald 105, Sheehan 53, Mitchell 1 and Hussey 1, and Mr. McDonald was declared elected.

For treasurer Mortimer J. Lyons, of Brooklyn, and W. F. McCarthy, of Denver, were nominated, and the ballot gave Lyons 81 and McCarthy 70, and Mr. Lyons was declared elected.

J. R. Alcock was nominated by President Griffith and unanimously elected as secretary.

J. J. Hamblin, of Chicago, was elected financial secretary.

W. F. McCarthy, of Denver, William Mitchell, of Boston, N. D. Hussey, of Omaha, W. G. Reed, of Rochester, L. B. Cross, of Kansas City, were chosen Executive Committee.

The following State vice-presidents were then chosen:

Colorado.—M. A. Dolan, Denver.
Connecticut.—L. B. Mills, Bridgeport.
District of Columbia.—James Lockhead.
Delaware.—Alfred Gawthrop, Wilmington.
Florida.—William Clark, Jacksonville.
Illinois.—David Whiteford, Chicago.
Indiana.—J. Madden, Fort Wayne.
Iowa.—William Ellomund, Sioux City.
Kansas.—Thomas Lloyd, Kansas City.
Kentucky —Simon Shulhafer, Louisville.
Maryland.—William Drummett, Baltimore.
Michigan.—Edward Sterner, Flint.
Minnesota.—S. H. Rothwell, Duluth.
Missouri.—David M. Quay Kansas City.
Maine.—G. L. Learned, Waterville.
Massachusetts.—Daniel Shannon, Boston.
Nebraska.—James H. O'Neill, Lincoln.
New Jersey.—J. F. Blackshaw, Jersey City.
New York.—Martin Fallon, Brooklyn.
Ohio.—Richard Murphy, Cincinnati.
Pennsylvania.—B. F. Call, Pittsburg.
Rhode Island.- W. L. Whipple, Providence.
South Carolina.—R. L. Long, Charleston.
Tennessee.—T. J Mooney, Nashville.
Texas.—George W. Kite, Fort Worth.
Virginia.—W. E. Foster, Norfolk.
Vermont.--P. L. Lyons, Montpelier.
Wisconsin.—E. T. Doyn, Milwaukee.
Utah.—J. J. Farrell, Salt Lake.
Oregon.—J J. Owens, Portland.

Cincinnati was chosen as the place for holding the next national convention.

The customary resolutions of thanks were passed.

A resolution recommending that the association name a candidate for sanitary superintendent of the World's Fair was referred to the Executive Committee, after which the convention adjourned.

STEAM PIPES OF THE NEW YORK STEAM COMPANY.

THE largest pipes procurable when the work of construction on the plant of the New York Steam Company was commenced were 15 inches outside diameter. These were ordered ¼-inch thick, making the inside diameter 14½ inches. Several miles of this pipe were laid, principally for supply mains and on Broadway. At a later date pipes 16 inches outside diameter were obtained, and a length of nearly a mile of this size was put in. A small length of pipe, 13 inches outside diameter, and a larger quantity, 11 inches outside diameter, also were used for distributing mains. The thickness of the latter was 0.21 inch, and all larger sizes were uniformly ¼-inch. These larger pipes were secured in flanges by a process of rolling somewhat similar to that used to secure boiler tubes. The end of the tube, however, abutted against a turned shoulder, and the seat against which the metal was forced by the rollers was expanded towards the end of the pipe so as to make a dovetail joint. The backs of the flanges of all pipes used as steam mains are provided with a recess about ¼-inch wide and 1 inch deep around the pipe, to receive calking material in case of leakage. It was at first intended to bore this recess and insert a wrought iron calking ring. The joints, however, of all kinds proved so satisfactory that, to give additional stiffness, the recess was merely filled with rust joint material, which could be readily cut out in case of leakage.

Screwed pipe, of good quality, was adopted for steam mains less than 8 inches inside diameter. The smaller, long mains were of 6-inch pipe, but 4-inch was used in some cases for short distances. The flanges were all put on the pipe by machinery in the shop. Service pipes are generally 3 inches in diameter, though occasionally 2-inch pipe is used for small consumers.

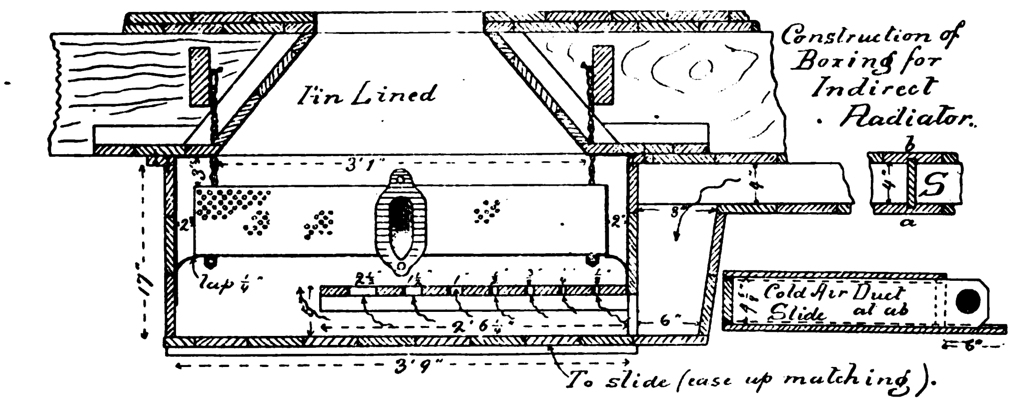
THE attempt of the London County Council to have the special assessment, there called the "betterment," principle applied in improving the Strand has failed. The committee of the House of Commons which had the bill in charge decided that the proposed application of the principle would not be proper, but did not pass upon the principle itself.

BOXING FOR AN INDIRECT RADIATOR.

W. F. **Porter** & Co., designers and contractors for hot-water and steam heating, at Minneapolis, Minn., have adopted and used the method of boxing indirect radiators shown in the accompanying illustration, which practically explains itself.

The interior of the casing is tin-lined, the heavy black line designating the tin protection. In the bottom of the casing one or more of the boards may be arranged free to slide by easing up the matching, thus affording an additional air supply to that coming through the regular cold air duct S if desired. The duct S, as shown, is fitted with a slide placed near the opening, a section of the duct at this point being shown in the smaller engraving. The grooves in which the slide works are ⅜ inch deep. Within the radiator box, and underneath the radiator, is a "spreader," consisting simply of a partition with variously sized openings, as marked in the sketch, the sizes of the openings increasing with their distance from the junction with the cold air duct. This "spreader" tends to equalize the flow of air over the radiator in a manner readily understood.

The style of boxing shown Messrs. Porter & Co. consider the best for the northwestern climate, claiming that with galvanized iron casings the severe cold is liable to chill the cellar to an uncomfortable degree.


Construction of Boxing for Indirect Radiator.
Tin Lined
3'1"
3"
2"
2"
8"
4"
lap ¼"
2½"
1½"
1"
2'6¼"
6"
17"
3'9"
b
S
a
Cold Air Duct Slide at ab
6"
To slide (ease up matching).

Notes and Queries

on Domestic Engineering.

Communications relating to the practical details of plumbing, heating, lighting and ventilation will be welcomed in this column. The writer's true name and address must always be given, but an assumed name may be used for publication if preferred.

AMMONIA REFRIGERATION.

John W. Archer, Pawtucket, R. I., writes: "Would like to learn if there is a rule for calculating the heat required to convert ammonia into vapor, anhydrous, I believe it is called, used in cold storage plants and ice-making machinery, and the amount or measurement of ammonia needed for a given area to be cooled. Does the continual application of heat cause a continual increase in pressure, or is it governed by increase of heat? What would be the result if ammonia was subjected to 212 degrees boiling water? Would that cause vaporization to any extent, or does it need a higher degree of heat to be effective?"

[Bearing on this inquiry the De La Vergne Refrigerating Machine Company, of New York, to whom we submitted it, writes:

"Regarding the answering of this question we would say that the conditions under which the cooling of rooms is to be effected varies so much that it is absolutely impossible to give any rule about it. The whole question is one of practical experience, and we might even go as far as to say a question of individual experience. Of course we have general rules by which we estimate the capacity of a refrigerating machine as needed for a special purpose, but to give such a rule to anybody not experienced in these matters would be totally useless. Even experts in our business sometimes find it very difficult to establish the basis for refrigeration. It depends on climate, on insulation of the rooms, on the manner in which the rooms are to be used, on the kind of goods that are to be stored, on the number of persons that work in the rooms, and whether warm goods are brought into the rooms, what they consist of, what their temperature is when they go in, and a great many other items that it is impossible to figure on by any general rule.

Regarding your correspondent's inquiry all we are able to answer is this: The amount of heat that is necessary to convert one pound of anhydrous ammonia into vapor is about 560 thermal units, but to figure on the quantity of ammonia that it is necessary to evaporate to cool certain rooms is, as we have just now explained, a matter of individual experience and judgment. What the result would be if the ammonia was subjected to a temperature of 212 degrees we are not able to state. The table of pressures that we have at our disposal only goes up 104° Fahr., and the pressure at this temperature is 213 pounds per square inch. If heated to a temperature of 212 degrees the pressure would very likely go up to 600 or 700 pounds."

To the above we would add that according to a table of temperatures and pressures based on Regnault's observations, and which extends to 179.1 degrees, the pressure of anhydrous ammonia (which is the pure, dry gas, an aqueous solution being sometimes used for refrigerating purposes), is 623.47 pounds per square inch. At the temperature of boiling water, or 212 degrees, the pressure would, of course, be still greater since, according to the laws governing the behavior of gases, an increase of heat or temperature will always cause either an increase of volume or of pressure. As to the vaporization of anhydrous ammonia it should be stated that the gaseous state is maintained at ordinary temperatures and pressures.

As to the amount of ammonia needed to cool a given volume, the communication from the De La Vergne Refrigerating Machine Company explains, in a measure, the difficulties encountered in attempting to give a precise answer. It may be interesting, however, to follow, in connection with this, the different steps in an ammonia refrigerating process. Cooling, or expansion, coils are, of course, used. The ammonia gas is drawn from these coils by pumps at a pressure varying from 10 to 15 pounds above that of the atmosphere, and is then forced into condensers where a pressure of from 125 to 175 pounds per square inch usually exists. There liquefaction takes place, and the resulting liquefied gas is allowed to flow to a stop cock having a minute opening, which separates the compression from the expansion side of the plant.

Heat is absorbed by the expanding gas in the cooling coils, the latter being connected to the suction or low-pressure side of the apparatus from which the pumps are continually drawing the gas, thereby reducing the pressure to the above mentioned figures—10 to 15 pounds. The liquefied ammonia in again assuming a gaseous condition, owing to its expansion, reabsorbs a quantity of heat equal in amount to that originally held, and given up by it during liquefaction, the latter being termed the latent heat of evaporation. The liquefied gas, in entering the cooling coils, is suddenly relieved from a great part of the pressure and begins to boil, passing into the gaseous state at the same time. The heat necessary for this can be supplied only from the substances surrounding the cooling coils, and these are, therefore, reduced in temperature. The quantity of heat taken up by the gas is the same as that which was expelled from it during its compression and liquefaction in the condensers.

To illustrate this numerically we will refer to some figures given in a paper on a test of a refrigerating plant presented by Prof. De Volson Wood at the Cincinnati meeting of the American Society of Mechanical Engineers. In the case there taken the liquid ammonia reached the expansion coils at a temperature of 67.4° Fahr. On passing the valve on the expansion coil the pressure fell to 28.88 pounds absolute, the corresponding temperature being — 2 degrees. Hence the fall of temperature was 69.4 degrees, during which operation heat is given out by the ammonia, the amount being $69.4 \times 1.08 = 74.95$ thermal units. The factor 1.08 is the specific heat of the liquid ammonia at the temperature — 2 degrees. Passing along the coils the liquid absorbed heat until it was evaporated at the temperature — 2 degrees, after which the temperature of the vapor was increased to 35.9 degrees. The latent heat of ammonia at — 2 degrees is 565.6 thermal units. The specific heat of ammonia gas being 0.50836 the heat absorbed in raising the temperature of the vapor 37.9 degrees will be $37.9 \times 0.50836 = 19.27$ thermal units.

The heat removed from the cold room per pound of ammonia hence will be, $565.6 + 19.27 - 74.95 = 509.92$ thermal units. Taking 142 thermal units as the latent heat of fusion of ice, we have for each pound of ammonia used an ice-melting capacity of

$$\frac{509.92}{142} = 3.591 \text{ pounds.}$$

If it be desired to cool air for ventilating purposes, for example, we may proceed as follows: Suppose we supply 2,000 cubic feet of fresh air per person per hour, the air being initially at 80° Fahr. The density of this air will be .0736, and the total weight of the air supply per person per hour will be $.0736 \times 2{,}000 = 147.2$ pounds. To cool this amount, say 10 degrees from 80 to 70, we must remember that the specific heat of air is .238, and there must, accordingly, be abstracted $147.2 \times 10 \times .238 =$ about 350 heat units per hour. This means, the latent heat of ice being 142.8, that there will be melted and must be supplied $\frac{350}{142.8 + 38} =$ about 2 pounds of ice per hour for each person. For each 1,000 persons, then, the ice consumption for a decrease of temperature of the air supply equal to 10° Fahr., will be about one ton of ice per hour. The capacity of an ice machine, based on such calculation, may then be chosen.

Should our correspondent contemplate cooling of any kind, however, we would suggest that consultation with a reliable maker of refrigerating machinery would probably prove most satisfactory in the end.]

"SHOOTING" A WATER WELL.

At the pumping station at Ford, England, of the Herne Bay Water-Works Company, the process of "shooting" a well was recently successfully carried out. According to the London *Engineer* the well, although carried 576 feet below the surface, yielded little or no water. Under these circumstances the firing of several heavy charges of an explosive at intervals in the bore hole, from the bottom upwards, was tried with the view of breaking into a fissure and thus striking water. The explosive adopted was roburite, fired by electricity. The first charge consisted of 27 pounds of roburite, at the bottom of the boring; the second charge weighed 25 pounds, and was lowered to a point 50 feet above the place where the first was exploded. The second shot was so successful that it was considered unnecessary to proceed further. A large volume of water at once made its appearance at the mouth of the bore pipe, and has since continued to rise.

PUBLICATIONS RECEIVED.

Annual Report of the Board of Public Works of the City of Milwaukee, for the year ending December 31, 1889; pp. 349.

Annual Report of the City Engineer of the City of St. Paul [Minn.], for the year ending December 31, 1889.

A Popular Treatise on the Electric Railway; by H. B. Prindle; pp. 56; Boston, Mass.; E. B. Stillings & Co.; 50 cents.

TRADE PUBLICATIONS.

STEAMED FILTER WELLS.

The advantages of the steamed filter wells of the National Water Supply Company, of Cincinnati, O., are set forth at length in a recently issued catalogue. A description is given of the method of sinking these wells, and a number of testimonials are published from places where they are in use.

STEAM AND HOT WATER RADIATORS.

The Exeter Machine Works, Exeter, N. H., have issued a new illustrated catalogue, devoted to their steam and hot water radiators. Several designs are shown and particulars of trade interest are given. Illustrations are shown also of the Exeter Manifolds and the Exeter Low Pressure Damper Regulator.

THE BOYNTON HOT-WATER HEATER.

A pamphlet bearing the above title and devoted mainly to the interests of the Boynton boiler for hot-water heating, though giving also an outline of recent advances in the heating of public buildings, dwellings, churches, schools and apartment houses, has been brought out by the Boynton Furnace Company, of New York and Chicago. Illustrations and descriptions are given of the Boynton boiler, explaining its design and construction, and tables of sizes and prices are added. The pamphlet further contains interesting extracts from reports of the Hatch Experimental Station of the Massachusetts Agricultural College, headed "Steam Heat *vs.* Hot Water," and a short chapter on the hot-water system of heating.

CONTRACTING NEWS DEPARTMENT.

A WEEKLY RECORD

OF SPECIAL INTEREST TO CONTRACTORS, BUILDERS AND MANUFACTURERS OF ENGINEERING AND BUILDING SUPPLIES.

CONTRACTING INTELLIGENCE

Our readers will oblige us by notes, clippings, or any information which will put us in the way of obtaining early and reliable news for our "Contracting Intelligence." *Information of importance sent to us exclusively, and not elsewhere published will be liberally paid for.*

Persons who make any use of the information they find in these columns we trust will not omit to mention THE ENGINEERING & BUILDING RECORD as the source

For works for which proposals are requested see also the "Proposal Columns," pages i-ii-x-64.

WATER.

For Additional Water Items see Proposal Columns.

NORMA, NEB.—A proposition to expend the sum of $3,000 on a system of water-works for this place is receiving the attention of the public officials.

BRINKLEY, ARK.—The Brinkley Water-Works, Electric Light and Power Company will sink additional artesian wells at this place to improve the water supply.

HUNTER VILLAGE, N. Y.—It is reported that a system of water-works is to be established at this place at an early date.

PHILLIPSBURG, KAN.—Reports say that the sum of $20,000 has been appropriated for the purpose of establishing a system of water-works at this place.

SILVER CITY, N. M.—There is considerable talk of establishing a system of water-works at this place.

GLENDALE, MASS.—A system of water-works is talked of for this place.

ST. LOUIS, MO.—The Board of Public Improvements, on June 20, declared the contract of O'Donnell & Brothers, for the construction of section "A," of the water-works conduit forfeited, and a new letting will be advertised.

SHELBYVILLE, KY.—An election is to be held here at an early date to decide the question of establishing a system of water-works. For particulars address L. C. Willis, as above.

MERIDEN, CONN.—Engineer Bishop, who has been investigating various sites for the purpose of procuring an additional water supply, has submitted his report to Mayor Page and the Aldermen, and it is expected that important steps in the desired direction will soon be taken.

WEST RUTLAND, VT.—Dr. J. D. Hanrahan and others are interested in the proposed organization of a stock company to provide this place with water-works. A company is to be organized with a capital of $25,000.

ELKINS, W. VA.—The Ohio Valley Improvement Company has been incorporated here by H. G. Davis, S. B. Elkins and others, with the privilege of building water-works, gas-works, bridges, etc. The capital stock is $20,000.

WASHINGTON, D. C.—A stand-pipe will be erected at the Freedmen's Hospital and Asylum. Hon. J. W. Noble will furnish particulars.

GREENVILLE, ALA.—Reports say that a Philadelphia, Pa., firm has made a proposition to establish a system of water-works at this place.

JACKSON, TENN.—Extensions will be made to the local water-works plant. Address the Mayor for information.

PARKERSBURG, W. VA.—Reports say that this city will probably put in new boilers at the pumping station. Address the Mayor for details.

STOCKBRIDGE, MASS.—It is proposed to expend the sum of $150,000 on a new system of water-works for this place.

SANDY CREEK, N. Y.—The people of this place are discussing the water-works question. Estimates made give the probable cost of a suitable system at $18,000. Engineer E. D. Smalley can furnish particulars.

BERLIN, N. Y.—The Berlin Water Company has been incorporated at this place with a cash capital of $5,000. For particulars address William F. Fay, as above.

YOAKUM, TEX.—Reports say that the officials of this place desire to have a water-works plant established by outside parties, and operated on the franchise plan.

PALMYRA, MO.—This place has decided in favor of establishing a system of water-works. Address Frank Sosey for particulars.

OLYMPIA, WASH.—The Olympia Water-Works Company has been incorporated at this place, with a capital stock of $150,000.

MACUNGIE, PA.—The taxpayers of this place are discussing the question of establishing a system of water works.

EDGERTON, O.—The water-works question is receiving the attention of the citizens and officials of this place.

PINE PLAINS, N. Y.—The question of expending the sum of $20,000 on establishing a system of water-works is being considered by the taxpayers of this place.

SHELTON, WASH.—Reports say that this place is to establish a system of water-works.

GOSHEN, IND.—The authorities of this place are considering plans for the improvement of the local water-works plant.

FREEHOLD, N. J.—The people of this place have voted to establish a water-works plant, and to own it themselves.

GRAND FORKS, DAK.—The Grand Forks Water, Light and Power Company has been incorporated at this place with a capital stock of $100,000.

LANCASTER, PA.—As a temporary relief to the citizens of the West End, who complain of a scarcity of water, it is proposed to lay a 20-inch water main, in connection with the stand-pipe, to that portion of the city. As soon as possible permanent measures will be taken. Address Mayor Clark for details.

AMERICUS, GA.—The people of this place will hold a public election July 10 to decide whether or not to issue bonds in the sum of $25,000 for the purpose of extending the local water-works system. Address the Mayor for particulars.

TRENTON, N. J.—Governor Abbett, June 20, signed Senator Pfeiffer's repealer of the act which gave Camden power to issue $1,000,000 of bonds for an improved water supply.

WELLSTON, O.—It is proposed to build water-works here.

MANCHESTER, N. H.—The Board of Commissioners of this place are considering plans for an extension of the water supply and for the building of a new reservoir.

EUSTIS, FLA.—City Clerk Arthur G. Smith writes: "The city have granted exclusive franchise to A. D. Wright and J. De V. Hazzard, of Eustis, who propose to lay about 11 miles of mains for the purpose of irrigation, principally, incidentally furnishing water for household uses and fire protection for the city of Eustis, Fla.

PROVIDENCE, R. I.—It has been ascertained that the necessary repairs to Fruit Hill Reservoir will cost $75,000. The matter is in the hands of the Committee on Highways.

SPRINGFIELD, MASS.—The City Council has finally passed the measure to issue bonds in the sum of $125,000 for the purpose of making necessary improvements to Ludlow Reservoir.

GALESBURG, ILL.—The time for opening bids for the water-works at this place has been postponed until July 8. See our Proposal Columns.

EDSON, WASH.—A system of water-works is to be established at this place by the Samish Water Supply Company.

ZANESVILLE, O.—The water-works have been authorized to issue $50,000 worth of bonds to build a stand-pipe and lay a 30-inch main over a mile in length. There will also be an additional 12-inch main 2 miles in length.

MILWAUKEE, WIS.—The following proposals for the construction of a water-works tunnel were opened by the Board of Public Works, June 20. The work is divided in six parts, as follows: 1, shore tunnel, per lineal foot, including distributing well with connections, and the gate well copings, etc., 260 feet long; 2, shore shaft, complete, per lineal foot, with coping and cover, and all connections, 153½ feet deep; 3, lake tunnel, per lineal foot, including extensions on opposite sides of each shaft, 3,157 feet long; 4, lake shaft, complete, per lineal foot, including iron cylinders with connections, 140 feet deep, 5, furnishing and putting in place the crib, complete; 6, rock excavation per cubic yard, 120 yards. The following are the names of the bidders, with the figures given for each part of the work in their respective positions: John O'Niel, Milwaukee, Wis., $33, $234, $33, $435, $28,400, $7; total, $238,820. Wm. Forristal, Milwaukee, Wis., $30, $50, $30, $225, $43,000, $10; total, $185,885. J. J. Crilley, Milwaukee, Wis., $25, $400, $25, $400, $120,000, $7; total, $323,665. The bids were considered too high and rejected. The work is advertised and new proposals will be received until June 30.

ROCHESTER, N. Y.—At a meeting of the Executive Board held June 20, the following contracts were awarded: For furnishing cast-iron water pipe in the following quantities: Donaldson Iron Company, of Emaus, Pa., for $13,435.63. Forty tons 12-inch, 168 tons 10-inch, 56 tons 8-inch, 215 tons 6-inch, 42 tons 4-inch, 25,000 pounds special castings. The contract price is $13,435.63. The contract for as many water meters as the city deems advisable to procure was awarded to the American Frost Meter Company of Boston, at the following figures: ½-inch meters, $13 each; 1-inch, $28.50; 2-inch, $72; 4-inch, $290; ¾-inch, $21.50; 1½-inch, $52; 3-inch, $145. The Board awarded the contract for pumping machinery for the Gates well to the Holly Manufacturing Company, of Lockport, N. Y., at the following figures: A No. 5 Gaskill duplex compound condensing engine, guaranteed capacity 1,500,000 gallons per 24 hours, $4,950; 5x16 boiler, $1,200; 70-foot smoke stack, $240, making a total of $6,390.

MADISON, IND.—This place is agitating the question of water-works.

GRAND FORKS, N. D.—The City Council has repealed the ordinance passed at the last session giving Ordway & Rogers, of St. Paul, exclusive franchise for thirty years for electric lighting and water-works systems.

LOS ANGELES, CAL.—The city of Los Angeles is agitating the question of owning and constructing her own water-works. The water would have to be taken out of the river about five miles above the city. The expense of the works would be about $150,000,000.

EAST CHATTANOOGA, TENN.—Regarding the project for water-works at this place B. Thompson writes: "Definite plans have not yet been formulated; will be soon.

PERTH AMBOY, N. J.—The people of this place are becoming more urgent in their demand for a new water supply. At a recent meeting of the Taxpayers' Association the entire session was devoted to a discussion of the subject, and Mr. Convery proposed the collection and publication of all facts bearing on the water supply. The president, secretary and Mr. Buel were appointed a committee to ascertain the probable cost of a supply from Millbrook, five miles distant.

GLEN ELLEN, CAL.—The construction of a system of water-works at the Home for the Feeble Minded at this place is to be commenced immediately. The site for a 200,000-gallon reservoir has been selected, at an elevation of 150 feet above the building.

STOCKTON, CAL.—The sum of $35,000 has been appropriated for the completion of the water-works system at this place.

WATER-WORKS.—See our Proposal Columns for information regarding water-works and water-works furnishings at the following places: Ogden, Utah; Galesburg, Ill.; Key West, Fla; Brooklyn Village, O.; Toronto, Ont.; Binghamton, N. Y.; Des Moines, Iowa; Glenville, O.; Canton, O.; Washington, D. C.; Fargo, Dak.; St. Louis, Mo.; Atlanta, Ga.

SEWERAGE.

For Additional Sewerage Items see Proposal Columns

SACO, ME.—The sum of $10,000 has been appropriated at this place for the continuation of the Woodbury brick sewer extension.

BRUNSWICK, GA.—Reports say that at a recent election the people of this place voted the sum of $300,000 for the purpose of doing additional sewerage work.

TROY, N. Y.—The Common Council has authorized the construction of numerous additional sewers. Address the Public Improvement Commission for details.

HARTFORD, CONN.—It is proposed to construct a main sewer on Pearl street, this city. The City Clerk can furnish particulars.

KNOXVILLE, TENN.—City Clerk S. B. Kennedy writes: "The city has appropriated $2,500 to pay for survey and plans for a system of sewerage. That work is now in progress, and when completed and estimates of probable cost made, the proposition to issue bonds for the construction of sewers will probably be submitted to a vote of the people."

COLUMBUS, O.—Our correspondent writes: "George E. Waring, C. E., is here to investigate the plans of a main intercepting sewer, eight miles long, and intended to convey the sewage of the city about four miles south of the same, where it is discharged into the Sciote River."

GARDNER, MASS.—McClintock & Woodfall, C. E., Boston, Mass., have been engaged as engineers in charge on construction of sewers in this place.

REVERE, MASS.—McClintock & Woodfall, C. E., Boston, are working over a system of sewers for this place. Some action is expected from this town soon.

READERS of **THE ENGINEERING AND BUILDING RECORD** interested in the Contracting News Department of that paper are respectfully requested to examine those columns every week, and advise the Editor of any item which they may find that, in their judgment, is of no value to any one other than the person mentioned.

ST. STEPHEN, N. B.—McClintock & Woodfall, C. E., Boston, are making surveys for a partial system of sewers for this place.

PASSAIC, N. J.—Passaic some time ago concluded to build a sewer, the outlet being into the Passaic River. The City of Newark objected to this on the ground that the discharge of the sewage would pollute the water which Newark used for domestic purposes. An injunction was obtained from the Chancellor restraining Passaic from going on with the work of constructing the sewer. The Chancellor dissolved the injunction, deciding that Passaic had the right to use the river as a sewer, and that this right was superior to Newark's right to use the river for a supply of water for domestic purposes. An appeal followed, and now the highest tribunal in the State sustains the Court of Chancery.

STOCKTON, CAL.—The sum of $85,000 has been voted by the taxpayers of this place for the purpose of establishing a system of main sewers.

DAVENPORT, IOWA.—Gordon H. Nott, C. E., of Chicago, Ill., has submitted his report regarding the proposed system of sewers for this city, and it is probable that he will be engaged to prepare working plans with necessary details for its construction.

Calais, Mass.—McClintock & Woodfall, C. E., Boston, are making surveys for a system of sewers for Calais.

Hoboken, N. J.—The following resolution has been passed by the Mayor and Council of this city: "Resolved, That City Surveyor Thomas H. McCann is instructed to prepare, in co operation with A. Fteley, Chief Engineer of the New York Aqueduct Commission, a general sewerage plan of the city, to be presented to this Board with their report as soon as possible."

BRIDGES AND IRON STRUCTURES.

For Additional Bridge Items see Proposal Columns.

Ottawa, Ill.—It is proposed to erect a new bridge over the Fox River, in this city. Address Alderman Armstrong for particulars.

Knoxville, Tenn.—The Board of Public Works has presented the city engineers report on the location of the West Fifth Avenue bridge, which will be erected at a cost of $14,626. The report was adopted.

Rye Neck, N. Y.—A new bridge will soon be constructed over the Mamaroneck River at Barry Avenue.

Toronto, Ont.—The construction of a high level bridge over the Don at King Street, at a cost of $150,000, was recommended by the engineer at a meeting of the Board of works, held June 18, upon receipt of a petition from the property owners interested and benefited by the construction of this bridge. The report was referred to the Sub-committee on the Don Improvement.

Franklin, Pa.—The following bids for four single-span iron bridges were received by Venango County Commissioners June 19:

Bidders.	36-foot span. Price per Lineal foot.	42-foot span.	64-foot span	57-foot span.
Groton Bridge Co., Groton, N. Y	$17 33	$16.88	$18.23	$18.23
Nelson & Buchanan, Elmira, N. Y	17 50	16.50	17.50	17.50
Smith Bridge Co., Toledo, O.*	16.90	15.85	16.95	16.95
Columbus Bridge Co., Columbus, O	17.50	16.75	17.56	17.56
Milwaukee Bridge and Iron Co., Milwaukee, Wis	17.50	16.40	18.00	18.00
Mt. Vernon Bridge Co., Mt. Vernon, O	17.20	16.60	17.43	17 43
Variety Iron Works, Cleveland, O	18.20	16 75	18.20	17.60
Penn Bridge Co., Beaver Falls, Pa	17.63	17.50	17.63	17.63
King Bridge Co., Cleveland, O	17.10	17.40	17.25	17 25
Youngstown Bridge Co., Youngstown, O	17.20	16.50	17.30	17.20
Champion Bridge Co., Wilmington, O	17.48	16.47	18.00	18.00
Berlin Bridge Co., East Berlin, Conn	18.00	17.00	18 98	18.08
Wrought Iron Bridge Co., Canton, O	17.80	16.90	18.00	17.20

* Awarded contract for all four bridges.

Elizabeth, N. J.—A committee has been appointed by the Board of Freeholders to report upon the advisability of constructing two bridges in Plainfield, one over Cedar Brook and the other on Prospect Avenue. Mr. Vanderbeek, of the Board, can furnish particulars.

Asheville, N. C.—Reports say that Richmond Pearson contemplates building an iron bridge across the French Broad River at this place.

Montreal, Can.—The following appropriations for bridge work have been recommended by the city officials: St. Catherine's Street Bridge over the C. P. R. tracks, $90,000; Ontario Street subway, $80,000; Mountain Street Bridge, $160,000; Wellington Street Tunnel, $32,000.

Fairhaven, Wash.—The following bids for the construction of a single-track iron drawbridge over Nooksack River, weight 335,000 pounds, were received by J. J. Donovan, Chief Engineer F. & S. R. R., May 13: New Jersey Steel and Iron Company, Trenton, N. J., 4$\frac{7}{10}$ cents per pound, f. o. b. Chicago, $15,745; Elmira Bridge Company, New York, 4$\frac{4}{10}$ cents per pound, f. o. b. Chicago, $14,740; Detroit Bridge and Iron Works, Detroit, Mich., 4$\frac{1}{4}$ cents per pound, f. o. b. Chicago, $14,237.50; Passaic Rolling Mill Company, New York, 4$\frac{4}{10}$ cents per pound, f. o. b. Chicago, $14,740. Contract awarded to Detroit Bridge and Iron Company, Detroit, Mich.

Stockton, Cal.—The people of this city have voted the sum of $25,000 for the construction of bridges.

Columbus, O.—The City Civil Engineer has been directed to prepare plans and estimate for the construction of a viaduct over the railroad track crossing, at High Street.

Dayton, Ore.—The contract for a steel bridge over the Yamhill River was let June 16 to Hoffman & Bates for $14,000. Tubular piers 63 feet high; length of span about 340 feet.

Minneapolis, Minn.—The County Commissioners have awarded the contract for the Cedar Avenue bridge across the Minnesota River. The contract for the stone work was let to W. D. Van Norman on the following terms: The County to pay $9.40 a yard for stone, Red Wing limestone being used; $50 a yard for granite and $22 a thousand for lumber; piling above the cut-off, 15 cents per foot; below, 30 cents per foot; oak piling, 31 cents. The contract for the superstructure was let to the Smith Iron Bridge Company.

Newark, N. J.—Reports say that the residents of this city are agitating for a new bridge across the Passaic River, from the lower end of the city to East Newark.

Pueblo, Col.—The sum of $10,000 is to be expended on an iron bridge to be erected here.

Bridges.—See our Proposal Columns for information regarding bridge construction at the following places: Columbus, O.; Mitchell, Dak; Foreman, N. Dak.; Dalton, Ga.; Mount Vernon, O.; Albany, N. Y.; Salinas City, Cal.; Pembina, N. Dak.; Ritchie, W. Va.

NEW DEPOTS.

Binghamton, N. Y.—A new depot is to be built by the D., L. & W. Railroad Company. The plans and specifications are all ready and the arrangements are nearly completed.

THE Editor of THE ENGINEERING AND BUILDING RECORD is always glad to receive items of news for the Contracting News Department. But such items are not considered news except when the prices and particulars of the award of a contract are given. The announcement that ——— has sold ——— to ——— without giving the *prices* and particulars concerns only the buyer and seller. Such notices are always excluded, except in the case where a certain firm is stated to have taken a certain contract, the execution of which would require that they should buy certain materials. Such an item would be used if deemed of more than local interest, because it would suggest to some readers the possibility of their making a sale or securing a subcontract.

STREET-WORK AND PAVING.

Concord, N. H.—McClintock & Woodfall, C. E., Boston, are to do considerable street work here.

Newark, N. J.—The street paving bill has become a law through Governor Abbett's signature, and $2,000,000 can be spent for that purpose. This year a sum of $1,000,000 will be appropriated in the tax levy for a beginning of the work.

Elizabeth, N. J.—The contract for the improvement of Westfield Avenue has been awarded to E. M. Lynch, of this city, to pave with Telford at 83 cents per yard.

Brooklyn, N. Y.—City Works Commissioner Adams has decided to repave numerous streets with granite blocks.

Stockton, Cal.—The sum of $50;000 has been voted for doing necessary work on the public streets.

North Plainfield, N. J.—The Borough Council has authorized the construction of numerous macadamized roads.

Columbus, O.—The bids for laying new pavements in the State House yard have been rejected, and the Adjutant General has been instructed to readvertise for new bids, to be opened July 14.

Rutherford, N. J.—The people of this place propose to issue bonds in a sufficient amount to undertake extensive road improvement.

GAS AND ELECTRIC-LIGHTING.

Dubuque, Iowa.—A system of tower lighting is proposed for the public streets of this place

Oregon, Ill.—The Oregon Electric Light Company will establish a plant at this place.

Brookline, Mass.—At the recent town meeting called for the consideration of public lighting by electricity, it was voted that the Selectmen be required to look into the subject, and the sum of $35,000 was appropriated for the erection of a town plant.

Elgin, Ill.—Reports say that the Elgin Watch Company will put in a complete electric lighting plant.

Seattle, Wash. — The Seattle Electric Light Company has been reorganized with a capital stock of $500,000, and will proceed to erect an additional plant. Messrs. T. H. Tyndall, James A. McWilliams and others are interested.

Keokuk, Iowa.—This place wants proposals for public lighting, either with gas or electricity.

Webb City, Mo.—The Jasper County Electric Power Company will establish a plant here.

Port Huron, Mich.—A gas plant is to be established at this place.

Austin, Tex.—The Austin Gas Light and Coal Company will add new machinery and 4,000 feet of 3-inch pipe.

Rahway, N. J.—Articles of incorporation have been filed by the Rahway Electric Light and Power Company, whose capital is $50,000. The incorporators and stockholders are John B. Simonson, of New York City, Welles P. Ayer, of Boston, Mass., and others. The company's plant will be located here, where it will compete for lighting the city with electricity.

Brandon, Man.—The Brandon Electric Light Company contemplate the following additions to its plant: 85 horse-power engine, 2 dynamos, and 1,200 lights.

Osage City, Kan.—The Councils of this city have authorized Charles Stackhouse and others to erect an electric light and power plant here.

Chatham, N. Y.—The Board of Trustees of the local electric light company has voted to increase the capacity of the plant, and will enlarge the building and add machinery.

Passaic, N. J.—The Electric Light Company will increase the facilities of its plant, and add new machinery. Two engines, 125-horse power and 100 horse-power, 80 horse-power generator and 1,300 lights, are among the contemplated additions.

Johnson City, Tenn.—Architect R. W. Hill, of Waterbury, Conn., is preparing plans for an electric light plant to be built at this place, under the direction of A. M. Young, electrical engineer, also of Waterbury. The plant includes a fire-proof brick building one story high, 97x64, with wing 17x37. A 600 horse-power engine will be put in.

Paterson, N. J.—The following proposals for public lighting have been opened here: Paterson Electric Light Company, $135.75 a light for three years, and $128.50 for five years; the Universal Electric Light Company, of New York, for $170 a light; the Edison Company, $140 for three years and $135 for five years; while the gas company's bid was $20 per lamp.

Rushville, Ill.—The electric light question is being discussed at this place.

Aberdeen, Wash.—The Aberdeen Electric Light Company has increased its capital stock to $25,000, and will expend $10,000 in extending the system.

Tampa, Fla.—The Florida Electric Company has been incorporated here, with a capital stock of $50,000. J. R. Ritter, Howard C. Levis, S. Giglio and others are interested.

Palmyra, Mo.—An electric light plant is to be established at this place.

Cartersville, Ga.—The Georgia and Tennessee Construction Company of this place has been incorporated by H. M. Smith and G. H. Aubrey. It is privileged to develop mineral and timber lands, build and operate electric light, gas and water works, factories, etc. The capital stock is $50,000.

Quincy, Ill.—Reports say that a number of Chicago capitalists have formed a joint stock company, with a capital stock of $400,000, to put up an electric light and gaslight and fuel plant in this city. The company binds itself to lighting gas, for the next five years, at $1.50 per 1,000 cubic feet, and fuel gas at $1 per 1,000 cubic feet for the same length of time After five years the price will be $1 for lighting gas and 90 cents for fuel gas. The company proposes to make corresponding reductions in electric lighting.

Camden, N. J.—The following proposals for lighting the streets for the ensuing year were opened June 23 by the Lighting Committee of the Common Council: Camden Heat and Lighting Company, electric arc lights, 40 cents per night; incandescent lights, $29 per year; Ball Electric Light Company, of New York, 200 arc lights, $100 per year each; Fort Wayne Electric Light Company, arc lights of 2,000 candle power, 30 cents per night. The foreign companies bids were all contingent that the city must grant them the right and franchise of erecting wires. The Camden Gas Light Company were awarded the contract for lighting the gas lamps at $10.75 per lamp per year. The Pennsylvania Globe and Gas Light Company were awarded the contract for furnishing oil lamps at $22 per lamp. The awards for electric street lighting were not made.

Electric Railways.—New electric railways will be established and improvements will be made to those already built, at the following places: Paducah, Ky.; Westfield, Mass.; Baltimore, Md.; Greenville, S. C.; Marion, N. C.; Little Rock, Ark.

BIDS OPENED.

Port Townsend, Ore.—The contract for the erection of the Custom House at this place has been awarded to Ritterhard & Martell, of Seattle, Wash., at $72,000.

Lowell, Mass.—The plans of the Middlesex Machine Company, of this city, for warming and ventilating the new City Hall at Dover, N. H., have been accepted. The estimated cost of the work is $10,000.

GOVERNMENT WORK.

Washington, D. C.—The following proposals for a new boiler house, etc.; also four horizontal steam boilers, etc., for the Winder Building, U. S. Treasury Department, were opened by the Supervising Architect of the Treasury Department, June 24. The first figures given are for the boiler house, and the last ones for labor, etc., to fix complete, boilers. Bidders, all Washington, D. C.: Bright & Humphreys, $5,973, $7,837; Howarth & Yates, $6,979, $7,019; John Lyon, $5,380, $6,094.75; W. E. Spen & Co., $5,838, $4,581.53; Peter Hepburn, $6,060; James L. Parsons, $7,550, $5,969; Pettit & Dupps, $6,495-35, $7,815; William Rothwell, $5,200, $8,600.

NEW CORPORATIONS.

Holyoke, Mass.—The Holyoke Hydrant and Iron Company has been incorporated here. Capital, $40,000. President, C. E. Torrance; Secretary, C. F. Smith.

INDUSTRIAL.

Jackson, Tenn.—A convention is to be held at this place at an early day to consider the feasibility of cutting a canal to connect the Tennessee and Mississippi Rivers, *via* Jackson.

New York City.—The Third Avenue Street Railway Company has been granted a franchise to operate its line by cable power instead of horses, which are now in use. Specifications have been prepared for the work necessary to make the change, and bids will be wanted at an early date. The company's headquarters are at Third Avenue and Sixty-fifth Street this city.

Niagara Falls, N. Y.—See our Proposal Columns for information regarding the construction of an 8,000-foot tunnel by the Cataract Construction Company of this place.

Pelhamville, N. Y.—The streets are being staked out in a 176-acre tract of land to be known as Pelham Heights, adjoining the N. Y., N. H. and H. R. R., at this station. Grading operations will be begun as soon as the profiles and estimates are made. The owners intend to macadamize the roadways, put in sewers, water and gas, and start building operations as soon as possible. For further information address the engineers in charge, John F. Fairchild, Mt. Vernon, N. Y., or F. Carles Merry, 83 Fulton Street, New York City.

PROPOSALS.

(Continued from page x.)

NOTICE TO CONTRACTORS.

OFFICE OF SUPERINTENDENT OF PUBLIC Works, Albany, June 26, 1890. Sealed proposals will be received by the Superintendent of Public Works until TUESDAY, July 8, 1890, at twelve o'clock noon of that day, for building a **WROUGHT-IRON BRIDGE** over the Erie Canal at FULTONVILLE, N. Y. The substructure and superstructure will be bid for and let separately. Plans and specifications may be seen for five days prior to the date of letting, at the office of the Superintendent of Public Works at Albany. All proposals must be accompanied by sight drafts on some good banking institution of the City of New York or Albany, payable to the Superintendent of Public Works for the following amounts: For substructure of bridge, $400; for superstructure of bridge, $500. Proposals must be indorsed "Proposal for Bridge ———." The right is reserved to reject any or all bids.

EDWARD HANNAN,
5 Sup't of Public Works

TUNNEL, St. Louis, Mo.—Proposals are wanted until September 1, for the construction of about 3,000 yards of tunnel. Address McCormick & O'Meara, 904 Olive Street, as above.

PAVING, Chattanooga, Tenn.—Proposals are wanted until July 10, for paving about 6 miles of streets. Address L. S. Walker, Chairman Board of Public Works, as above.

SEWERS, Marion, O.—Proposals are wanted until July 18, for constructing about 17,300 feet of 18-inch outfall sewer. Address H. S. Jones, City Engineer, as above.

PIER, New York City.—Proposals are wanted until July 9, for building a new wooden pier, with appurtenances, including sewer boxes and a dumping board, at the foot of East One Hundred and Tenth Street, Harlem River. Address the Department of Docks, Pier A, North River, as above.

GRANITE STONES, New York City.—Proposals are wanted until July 2, for furnishing a quantity of granite stones for bulkead on river wall. Address the Department of Docks, Pier A, North River, as above.

BRIDGE, Ritchie, W. Va.—Proposals are wanted until July 12, for the construction of a steel road bridge over Hughes River. Address the County Clerk of Ritch e County, as above.

SEWERS, La Salle, Ill.—Proposals are wanted until July 1, for the construction of about 15,000 feet of sewers. Address Mayor F. W. Matthiessen, as above.

CEMENT, Washington, D. C.—Proposals are wanted until July 10, for furnishing a quantity of cement. Address J. W. Douglass, Commissioner, as above.

HYDRANTS, Washington, D. C.—Proposals are wanted until une 30, for furnishing 75 fire hydrants and 50 street hydrants. Address J. W. Douglass, Commissioner, as above.

SEWERS Canton, O.—Proposals are wanted until July 5, for the construction of certain sewers. Address H. G. Schaub, City Clerk, as above.

SEWERS, Key West, Fla.—Proposals are wanted until September 1, for the construction of an underground system of sewers, also for paving and laying water mains. Address William L. Lavey, City Clerk, as above.

PAVING, Glenville, O.—Proposals are wanted until July 9, for paving certain streets. Address Charles B. Cook, Village Clerk, as above.

DIKE, Philadelphia, Pa.—Proposals are wanted until July 7, for the construction of a p le and stone dike at Bulkhead Bar. Address C. A. Raymond, Major of Engineers, U. S. A., as above.

BUILDING, South Macon, Ga.—Proposals are wanted until July 5, for the erection of a public school building. Address R. W. Cubbedge, No. 467 Second Street, us above.

SEWERS, Athens, Ga.—Proposals are wanted until July 20, for building 4,000 feet of separate system sewer; Address R. L. Bloomfield, Sewer Commissioner, as above.

STREET WORK, Racine, Wis.—Proposals are wanted until July 7, for the improvement of certain streets. Address L. H. Coleman, City Clerk, as above.

WATER PIPE, Washington, D. C.—Proposals are wanted until July 5, for furnishing a quantity of cast-iron water pipe. Address J. W. Douglass, Commissioner, as above.

STREET WORK, Canton, O.—Proposals are wanted until July 7, for paving and otherwise improving certain streets. Address H. G. Schaub, City Clerk, as above.

STREET WORK, McKeesport, Pa.—Proposals are wanted until July 1, for paving, etc., certain streets. Address G. B. Heuick, Borough Clerk, as above.

PAVING, Pittsburg, Pa.—Proposals are wanted until July 2, for paving certain streets. Address E. M. Bigelow, Chief of Department of Public Works, as above.

HEATING APPARATUS, Cleveland, O.—Bids will be received by the Cleveland Board of Education until July 7, for materials and labor for heating by warm air or steam and ventilating the Central High School addition on Arlington Street, 18 rooms; the South Case Building, corner Case and Garden, 24 rooms; Giddings' Building, Giddings Avenue, near Cedar, 16 rooms. By order of the Board. Harry Dixon, Clerk.

BRIDGE, Seattle, Wash.—Proposals are wanted until July 7, for the erection of a bridge over Green River. Address the Kings County Commissioners, as above.

Building Intelligence.

We solicit from each and every one of our readers information relating to projected buildings in their locality, and should be glad to receive newspaper clippings and other items of interest.

ABBREVIATIONS.—*b s*, brown stone; *br*, brick; *br st*, brick store; *b s dwell*, brown-stone dwelling; *apart house*, apartment-house; *ten*, tenement; *e*, each; *o*, owner; *a*, architect; *b*, builder; *fr*, frame.

NEW YORK.

S e cor 5th av and 59th st, bk hotel; cost, $500,000; o, P H Duryea and F Wagner; a, R S Townsend.

25th st, 375 w 6th av, br flats; cost, $18,000; o, E Steinwentz; a, H H Cader.

713 Fifth st, br flats; cost, $22,000; o, F Sieghardt; a, F Baylies.

38–42 Scammel st, br factory; cost, $30,000; o, J Wallace; D Burgess.

79–83 Crosby st, 2 br stores; cost, $160,000 all; o and a, A J Horgan and V J Slattery.

149–53 Leonard st, br stores; cost, $142,500; o, Catherine Garich; a, as above.

N s 77th st, 100 w Columbus av, 9 br dwells; cost, $162,000 all; o, E Martin; a, H L Harris.

S w cor 8th av and 29th st, br flats; cost, $15,000; o, Mary A Beggs; a, J W Cole.

308 E 82d st, br flats; cost, $15,000; o, W E Deitz; a, C Stegmayer.

Morningside av and 116th st, br flats, cost, $30,000; o, Kate Gallagher; a, Andrew Spence.

46 Pike st, br flats; cost, $18,000; o, J Ennich, Jr; a, A J Tinkel.

W s 85th st, 155 w 9th av, 8 br flats; cost, $128,000 all; o, D W James; a, J G Prague.

341 W 86th st, br dwell; cost, $45,000; o, H A Sanderson; a C A Eidlitz.

S s, 80th st, 250 e Amsterdam av, 5 br dwells; cost, $100,000 all; o, G J Cohen; a, G A Schillinger

128 and 130 Bleecker st, 2 br stores; cost, $80,000 all; o, G R Read; a, O Wirz.

219–23 E 32d st, 3 br flats; cost, $54,000 all; o, J Schmidt; a, C Rentz.

643 Lexington av, br flat; cost, $11,000; o, Regnia Grossmayer; a, A B Ogden & Son.

N w cor 129th st and 7th av, br church; cost, $25,000; o, Calvary M E Church; a, S D Hatch.

88 Cortlandt st, br hotel; cost, $12,000; o, P Wilkens; a, J Kastner.

27 W 20th st, br dwell; cost, $10,000; o, C H Marshall; a, J B Lord.

34 W 37th st, br dwell; cost, $13,000; o, Isabel M. Phelps; a, L Watson.

554–62 W 25th st, br factory; cost, $10,000; o, J W Felter; a, not given.

296 Broome st, br, s and terra cotta flat cost, $23,000; o, J L Buttenwieser; a, R L Pollock; m and c, J W Campbell.

129th st, s s, 35 e Madison av, br and s flat; cost, $25,000; o, S Lovejoy; a, G Robinson, Jr.

153d st, n s, 194 e 10th av, br and s dwell; cost, $15,000; o, M F Disbrow; a and c, W Baker.

ALTERATIONS—NEW YORK.

89 Columbia st, extension; cost, $11,000; o, S Rosenthal; a, H Horenburger.

Park row, n e cor Pearl st, new marble floor, doors and windows changed; cost, $7,000; lessee, E Maher; c, J Diamond.

BROOKLYN.

Atlantic av, n e cor Williams av; 3 fr stores and dwells; cost, $16,000; o, F H Reed; a, A J Warren.

Pennsylvania av, n e cor Liberty av, 1 fr church; cost, $7,000; o, Francis H Miller; a, Coy & McLean; b, not selected.

Park pl, s s, 300 e Carlton av, 1 brown s dwell; cost, $8,000; o, J Konvalinka; a, R Dixon; b, J Brophy.

N w cor 7th av and 12th st, 3 br dwells; cost, $23,000 all; o, J H Doherty & Bro; a, W M Coots.

S w cor Patchen av and Quincy st, br dwell; cost, $15,000; o, J McQuaid; a, Th Engelhardt.

S s Bergen st, 100 e Buffalo av, 7 fr dwells; cost, $10,500 all; o, G Sickels; a, F W Ames.

N s 14th st, 285 w 9th av, 3 br dwells; cost, $14,250 all; o, C C Firth; a, W O Tait.

BUILDING INTELLIGENCE.

BROOKLYN—Continued

S w cor 4th av and 33d st, 2 fr dwells; cost, $8,000 all; o, J J Edwards; a, H L Spicer & Son.

N s Union st, 260 e Van Brunt st, 3 br dwells; cost, $27,000 all; o, D Ferry; a, not given.

S s Green av, 27 w Sumner av, 4 br dwells; cost, $20,000 all; o, T B Bryant; a, I D Reynolds & Son.

S e cor Nevins and Union sts, br dwell; cost, $7,000; o, J Farrell; a, not selected.

S s Greenpoint av, 451 w Manhattan av, br stable; cost, $10,000; o, G Treher; a, C Dunkhase.

N s Wallabout st, 100 w Marcy av, 4 fr dwells; cost, $16,800 all; o, J Bossert; a, J Platte.

112 Front st, br factory; cost, $8,000; o, J Bowie; a, Carl & Eisenach.

N s 11th st, 20 e 6th av, 7 br dwells; cost, $34,000 all; o, J Jack; a, R Dixon.

N w cor Fulton av and Warwick st, br dwell; cost, $7,000; o, F Herchenroesher; a, C Meins.

120 1st pl, br dwell; cost, $11,000; o, J Finlay; a, J J Kierst.

THE CONTRACTING NEWS DEPARTMENT of **THE ENGINEERING AND BUILDING RECORD** is edited with a view of giving space to no item that does not indicate where professional services or supplies may be needed in the near future, the prices bid for work or supplies, and the correction of false or misleading reports in some papers, that may subject readers to needless trouble and expense in going after something that does not exist.

MISCELLANEOUS.

BRAINTREE, MASS.—Pond st, addition to a fr school house, heating, ventilating and sanitary closets; cost, $9,700; o, Town; a, Blackall; contract not awarded.

CANTON, O.—Nothing over $7,000 to report this week.

DENNISON O.—Nothing over $7,000 in value to report.

GENEVA, N. Y.—Nothing over $7,000 in value to report.

HARRISBURG, PA.—Nothing over $7,000 in value to report.

HOLYOKE, MASS.—4-story br block.

LANCASTER, PA.—Nothing over $7,000 in value to report.

LOS ANGELES, CAL.—The people of Los Angeles County have voted to issue $300,000 worth of bonds to complete the court house.

MILWAUKEE, WIS.—Westwater and Cedar, business block; cost, $24,000; o, Geo Brumder; a, F Velguth; b, Siebert & Son.

Broadway and Martin, schoolhouse; cost, $30,000; o, Mrs F L Vogel; a, Crane & Barkhausen; b, L Buestrin.

Third nr Wells st, business block; cost, $20,000; o, Pabst Brewing Co; a, J E Peege; b, Chas Luenzmann.

SPRINGFIELD, O.—Boiler shop, cost, $25,000; o, Brettendorf Metal Wheel Co; a, C A Cregar.

Flack block, stock br business block; cost, $12,000; o, Flack heirs; a, same as last.

PLYMOUTH, MASS.—This place has voted to erect a new high school building, at a cost of $40,000.

POTTSTOWN, PA.—Nothing over $7,000 in value to report.

POTTSVILLE, PA.—Nothing over $7,000 in value to report.

ROCHESTER, N. Y.—A hotel to cost $20,000 is to be erected here from plans by Architect William C. Walker, of this place.

BUILDING INTELLIGENCE.

ST. LOUIS, MO.—Forest Park Boulevard and King's Highway, br dwell; cost, $11,000; o, William L L Hull; b, S M Ross.

7th and Poplar sts, br warehouse; cost, $180,000; o, Sam'l Cupples R E Co; b, J H Bright.

4th and Morgan sts, br bank; cost, $10,000; o, Fairene Bank; b, F Stottemeyer.

Main st and Chouteau av, br shop; cost, $12,000; o, St Louis Iron and Mach Co; b, Klesto & Hildebrand.

Westmoreland Place and King's Highway, br dwell; cost, $25,000, o, W L Herse, b, F S Greene.

Longfellow and Grand avs, br dwell; cost, $11,300; o, F W Tinker; b, Matthers & Schneider.

S w cor Hickory st and Mississippi av, br flats; cost, $22,000; o, Mrs E Schneider; b, Mier & Merz.

Washington and Vandeventer avs, br dwell; cost, $7,500; o, L B Valiant; b, T H Busey & Co.

Lucas and Channing avs, br dwell; cost, $12,000; o, Abner Cooper; b, A Cooper.

12th st and Cass av, br dwell; cost, $10,000; o, G V Brecht.

Forest Park, br dwell; cost, $11,000; o, Mrs L L Hull.

Poplar, bet 8th and 9th, br bldg; cost, $180,000; o, Samuel Cupples Real Estate Co.

Fairlin Park, br bldg; cost, $10,000.

Chont av, br bldg; cost, $12,000; o, St Louis Iron and Machine Co.

Taylor av, br bldg; cost, $11,000; o, T H Russell.

WILKES BARRE, PA.—Nothing to report this week over $7,000 in value.

WORCESTER, MASS.—Main st, br apart house; cost, $15,000; o and b, Geo Pierce; a, W H Harvey.

John st, fr dwell; cost, $5,000; o, F E Estabrook; a, J B Woodworth; b, Geo M Hubbard.

Marston way, fr dwell; cost, $6,000; o, H E Estabrook; a and b, same as above.

YORK, PA.—Nothing over $7,000 in value to report.

ZANESVILLE, O.—The city will advertise for bids for the construction of a new hose house; cost not to exceed $12,000.

WALLACE A. BARTLETT,
Principal Examiner U. S. Patent Office, 1875-1883.
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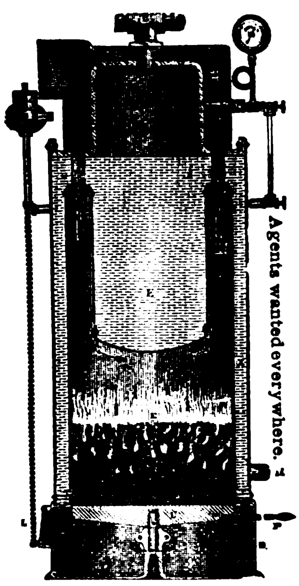

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THE NEW YORK CHAMBER OF COMMERCE AND THE MISSISSIPPI FLOODS.

THE recent widespread and most disastrous floods on the Mississippi River have been made the subject of a memorial addressed to the Chamber of Commerce of New York by a number of prominent citizens of that place, setting forth the great loss and suffering in the district immediately affected and the injury caused thereby to interests in all parts of the country. The memorial goes on to show the importance of completing the Mississippi levee system at the earliest possible date and by the general government, which alone can and should be expected to undertake a work of such magnitude and far-reaching benefit, and concludes by requesting the Chamber to take suitable action in furtherance of these objects.

In compliance with this request the Chamber adopted resolutions to the effect that the continued overflows of the Mississippi were a national disaster, that the President be requested to bring the matter to the attention of Congress, and that that body be urged to adopt such measures and make such appropriations as might be necessary to prevent such overflows in future, that concerted action by similar bodies in other cities be invited and that a committee be appointed to personally lay the matter before the President and Congress.

The committee appointed in pursuance of this resolution has visited Washington, and as a result of their appeal the Senate has added to the House bill for the improvement of Rivers and Harbors the sum of $3,500,000 for the prosecution of the work on the Mississippi levees, and it is hoped that the House will concur in this action.

As we have more than once had occasion to comment on the short-sighted policy pursued by some of the New York dailies in opposing without discrimination appropriations for river and harbor improvements in other parts of the country, it is refreshing to note such action as the above initiated by leading citizens of New York, and promptly seconded by its most influential commercial organization. We have no doubt that it will bear good fruit, not merely in securing the desired appropriations but in promoting a better feeling between different parts of the country.

ENGINEERING CONVENTIONS OUTSIDE LARGE CITIES.

THE success of the annual convention of the American Society of Civil Engineers, which met at Cresson Springs, Pa., from June 26 to 30, a report of which will be found elsewhere in this issue, thoroughly demonstrated the wisdom of the policy of the society in selecting a summer resort hotel as a place of meeting rather than a large city. All the visitors and their lady friends, of which there were a goodly number, were housed under one roof and thus kept together, acquaintanceship and social intercourse, so pleasant and essential a feature of such occasions, being greatly facilitated.

It was found that when cities were selected as a place of meeting the programme necessarily included numerous trips and visits to industrial establishments. This, besides fatiguing the visitors, seriously interfered with the discussion of papers. Moreover, it frequently happened that the local committee felt called upon to secure large subscriptions to defray entertaining expenses. This has resulted in extravagant entertainments and a feeling of obligation by the visitors, distasteful under the circumstances.

This feature was entirely absent at Cresson, as it has been from several of the recent conventions of the American Society of Civil Engineers. We notice the Railway Master Mechanics' Association have just held their convention at Fort Monroe, and we anticipate the policy of avoiding large cities as places for holding engineering conventions will be more generally adopted.

HEIGHT OF FACTORY CHIMNEYS.

AN item, now going the rounds, gives particulars of a new factory chimney in Germany which will rise to a height of considerably more than 400 feet. This, as well as several other remarkably tall chimneys frequently mentioned of late, calls to mind the fact that a large number of chimneys now in existence are of much greater height than is necessary for their purpose if the latter be simply to produce draught for boiler plants. Where chimneys are designed for carrying off noxious vapors from chemical works, as in the cases of several of the widely noticed stacks at Glasgow and one or two other cities of Scotland, there is some method in providing for unusual height, since the aim there is to insure as complete as possible a diffusion of the gases or vapors, and prevent their mingling with the air of the lower strata. With boiler plants chimneys, however, unusual height is rarely based upon a good reason.

The prevailing notion that the greater the height the greater in direct proportion the draught producing power of the chimney, is a natural error on the part of many, and has been responsible for much unnecessary outlay in chimney construction. As a matter of fact the draught-producing capacities of chimneys, having flues of the same size, are in proportion to the square roots of their heights, so that if one were to have double the power, if we may so call it, of the other, it would have to be four times as high. Attention has been directed more than once to the circumstance that beauty of design, from an architectural point of view, has had much to do with the unnecessarily great heights so frequently encountered, a much-favored rule being to make the height of the chimney equal to about 25 times the diameter of the flue. A little consideration will show that strict adherence to this ratio would bring about some rather peculiar results, as chimneys for small plants would turn out to be much lower, and those for large plants much higher, than is necessary.

The area of cross-section of chimney flues should in all cases be made to depend upon the combined areas of the boiler flues, and this, with a chimney height of about 100 feet, shown by long experience to be a very satisfactory figure, will in most cases furnish ample draught to burn any of the commonly used fuels. Applying the 25 to 1 ratio to two plants of, say two and ten boilers, respectively, all of the same size, and proportioning the flue areas of the chimneys in the way just indicated, will afford a striking illustration of the shortcomings of the rule. One hundred and fifty feet represent what has on good authority been given as the maximum height of chimney necessary in any case for producing the requisite draught, always providing, however, that the flue area has been properly proportioned. Proprietors of steam plants boasting of chimneys which much exceed this height may indulge in some profitable reflections as to the money needlessly spent in erecting such structures.

WORCESTER'S NEW SEWERAGE SYSTEM.

THE new sewerage system at Worcester, Mass., involving chemical precipitation, was put in operation last week, and experiments are being made to determine what precipitants are best. Lime and alumina have been used, both separately and together, but, because of the varying chemical nature of the sewage itself, the results with either or both are not the same from day to day. The intention is to determine what precipitant is best upon the whole by repeated trials.

SCHOLARSHIPS IN TECHNICAL SCHOOLS.

AT the recent twenty-third annual meeting of the American Railway Master Mechanics' Association, at Old Point Comfort, Va., the following resolution was unanimously adopted:

> *Resolved*, By the American Railway Master Mechanics' Association in convention assembled, that a committee of three members, consisting of J. N. Lauder, John N. Barr and Angus Sinclair, be and are hereby appointed, empowered and directed to confer with the trustees or other proper officers of the Massachusetts School of Technology of Boston, the Cornell University of Ithaca, N. Y., and the Stevens Institute of Technology, and arrange and report a plan at our next annual meeting for the investment of the principal and interest of the Boston Fund of this association in one or more scholarships in one or more of these institutions, and submit the same for approval of the association. The benefits of said scholarships to be for such time as may be directed by the association, as a prize to the sons of members who shall exhibit the most valuable attainments and skill in the development of locomotive mechanics.
>
> And be it further *Resolved*, That notice is hereby given that a vote will be taken at our twenty-fourth annual meeting to so appropriate said fund.

A previous report had shown the total amount of the fund to be at present about $6,678.

SHOOTING WELLS.

BEARING on the subject of shooting wells, George F. Chace recently remarked before the New England Water Works Association that the effect of the explosion about one time in three is to increase the water, but sometimes the supply is diminished. With respect to this H. G. Holden said:

"I have blasted several wells, and all of them but one resulted in giving more water; I never knew of a case of its being less. I blasted one on the Hudson River, a well about 1,000 feet deep, for a paper mill, where they wanted to get a large supply of pure water for making note paper. The supply was very small indeed. I put in three charges of nitro-glycerine, 25 pounds to a charge, and it was successful, as I think they have since had all the water they needed. This depends a good deal however upon whether there are any water-bearing veins anywhere in the vicinity. If there are, a heavy explosive will sometimes open the veins so as to get a great deal more water. But I don't understand how the effect would be to close anything up so as not to get as much, unless the well caved in. It might do that if it was in very soft material but, ordinarily, it makes a large chamber wherever the explosive lies."

THE AMERICAN BOILER MAKERS' ASSOCIATION.

THE American Boiler Makers' Association held its second annual meeting at New York City this week. The sessions extended over three days, with about 75 members in attendance.

The objects of the association, which was formed at Pittsburg in April, 1889, are given as follows:

To establish such standard for materials and workmanship as will insure uniform excellence of construction of all American boilers, and thus secure safety to the lives and property of all communities where boilers are used, and to procure the passage of laws making the manufacture, sale, or use of inferior materials criminal offenses.

To concert such measures and take such action as shall be for the interest and advantage of its members especially.

To procure and furnish to its members statistics of the trade, domestic and foreign, and

To take such action as shall from time to time be deemed advisable regarding the regulation of prices and production.

PASSAGE OF SPORES THROUGH CLOTH USED FOR AIR FILTERS.

IN an article on the above subject in the *Zeitschrift für Hygiene*, abstracted in Excerpts of Proceedings of the British Institution of Civil Engineers, Dr. Karl Moeller points out that air filters are of two kinds. For "germ-proof filters" he employs an ante-filter and ten layers of a specially thick, closely woven, and very much roughened material; for "dust-proof filters" only one thickness of a much less closely-woven fabric is used. Filters of the latter kind, though capable of excluding very large proportions of germs, are obviously not germ-proof. By Dr. Moeller's arrangement of the filter in the form of a series of pockets, the cloth, moreover, is used in a direction very oblique to the air current, forming an angle with it of from three degrees to five degrees, whereas in some earlier tests the cloth was at right angles to the air current. By reference to enlarged sections of the fabric, the vast difference in the degree of permeability due to this change in the direction of the movement of germs is explained. Dr. Moeller asserts that a woolly surface is one capable of entangling large numbers of germs, and that in some earlier tests the obvious precaution of sterilizing the cloth before the commencement of the experiments was neglected. A vast number of germs were thus regarded, no doubt, as having passed through the cloth, which, as a matter of fact, had been simply blown off its surface by the air current.

SEWAGE DISPOSAL AN EVANGELIZING AGENT.

A correspondent sends us the following humorous item which, it is alleged, came near appearing in a Liverpool paper. According to the story a reporter had to attend a meeting at a Wesleyan Chapel for the conversion of the Hebrews to Christianity, after which he reported the addresses given by the late General H. Y. D. Scott to the Polytechnic Society on the conversion of sewage into lime and cement. In the printer's hands the folios got mixed up, and the report read:

"The Chairman, after the meeting had been opened with prayer, explained that the conversion of the Jews was one of the greatest works that could engage the attention of our sanitary authorities. Filtration was the most perfect method that could be adopted for purification, but a filter had its limits. There was a popular notion that the sewage contained a vast amount of wealth, but the sludge must be taken out of it for purposes of irrigation, as it otherwise choked the pores of the land, and they were a wandering race spread over the whole face of the habitable globe. They were denied the inimitable blessings of Christianity, which might be counted by thousands of tons per annum allowed to run to waste, when by a judicious admixture of lime and clay, the benighted Hebrews who sat in darkness might easily be converted into lime and cement for building purposes, and if thus deodorized, after being first dried and burned in a kiln, this ancient race would once more take its proud position among the nations of the world."

"Subscriptions were earnestly solicited for the purpose, though he (the speaker) disclaimed any idea of making a profit out of the process, and, in conclusion, he urged increased efforts in the good work, showing that, thus deodorized by a very novel process of evangelization in large tanks constructed for the purpose, the grateful Hebrews might flow over the land without injury to vegetation, while the expense of conversion, which was progressing as rapidly as the best friends of Christianity could wish, would be more than repaid by the sale of the phosphate of lime and valuable cement for building purposes."

A GRAND JURY in New York City has made a presentment in regard to street pipes and subways which tells the familiar story of the evil in vigorous language, and suggests, as remedies, that no more permits for laying steam and gas pipes be given for streets already overcrowded, and that ultimately a non-political commission be created to consider "a new system by which the benefits of steam, gas, water, electricity and sewage can be had more safely, and with less official obstructions."

NOTES.

ABOUT 40 members of the Architectural League of New York went to Tuxedo Park on June 25, as guests of Bruce Price.

THE Secretary of the Permanent State Road Association of Illinois reports that there were nearly 200 iron bridges erected and nearly 2,000 miles of gravel or macadam roads made in Illinois last year, and that the figures will be larger for this year.

"SCHISEOPHONE" is the name of an electrical instrument recently tested at the Ermont Works on the Northern Railway of France, its object being to indicate the exact spot where interior flaws exist in iron or steel rails. It is stated that the result of fracturing rails to prove the indications of the instrument showed it to be reliable.

THE Federal Senate has passed the bill incorporating the North River Bridge Company, before passed by the House. This represents what is known as the "Lindenthal" project, from the name of the engineer who designed the bridge between New York and New Jersey. Another bill is being urged upon Congress, authorizing the New York and New Jersey Bridge Companies, chartered in New York and New Jersey, to build the projected structure across the Hudson. This represents the "Greene" scheme, and is reported to be pushed with the agreement that more than one bridge will be necessary.

A FAILURE in the water supply of Nashville, Tenn., June 27, compelled the sudden drawing of fires under boilers and the consequence was that all electric cars were stopped without warning wherever they happened to be and that factories had to shut down. A fire in the old pumping station had disabled a part of the machinery and a leak in the suction pipe of one of the pumps still running compelled stopping for repairs and so reduced the water supply as to cause the inconvenience mentioned. The water-works of both Nashville and Cincinnati are now in very unsatisfactory condition, furnishing a scant supply at best and under such circumstances that a single accident to machinery might easily prove a grave disaster to the city.

OBITUARY.

JOHN PAGE, Chief Engineer of the Canadian Government railways and canals, died suddenly at Ottawa, Ont., Wednesday. He was 74 years old. He came from Scotland to the United States in 1838 and worked in the construction of the Erie Canal, after which he went to Canada. He directed the construction of the St. Lawrence Canal system, and prepared the plans for the canal now being built at Sault Ste. Marie, Ont.

EDWARD FRY, Chief Mechanical Engineer of Brooklyn, N. Y., died recently. He had been in charge of the pumping engines of the Brooklyn Water-works 12 years.

CHARLES R. ARMSTRONG, aged 23 years, was drowned in the Delaware River, Tuesday, while bathing. He was a draughtsman at the Edgemoor Bridge Works, and lived in Auburn, N. Y.

FREDERICK F. WELD, City Engineer of Waterbury, Conn., died of typhoid fever June 28 at the age of 40 years. He had been City Engineer of Waterbury since 1884 and had served as a member of the Board of Health. His illness is reported to have been due to the use of impure milk, and one of his daughters is critically sick, apparently from the same cause.

PERSONAL.

HENRY C. MEYER, Editor and Proprietor of THE ENGINEERING AND BUILDING RECORD, sails on the steamer Umbria to-day for his annual European vacation trip. He will return about the middle of August.

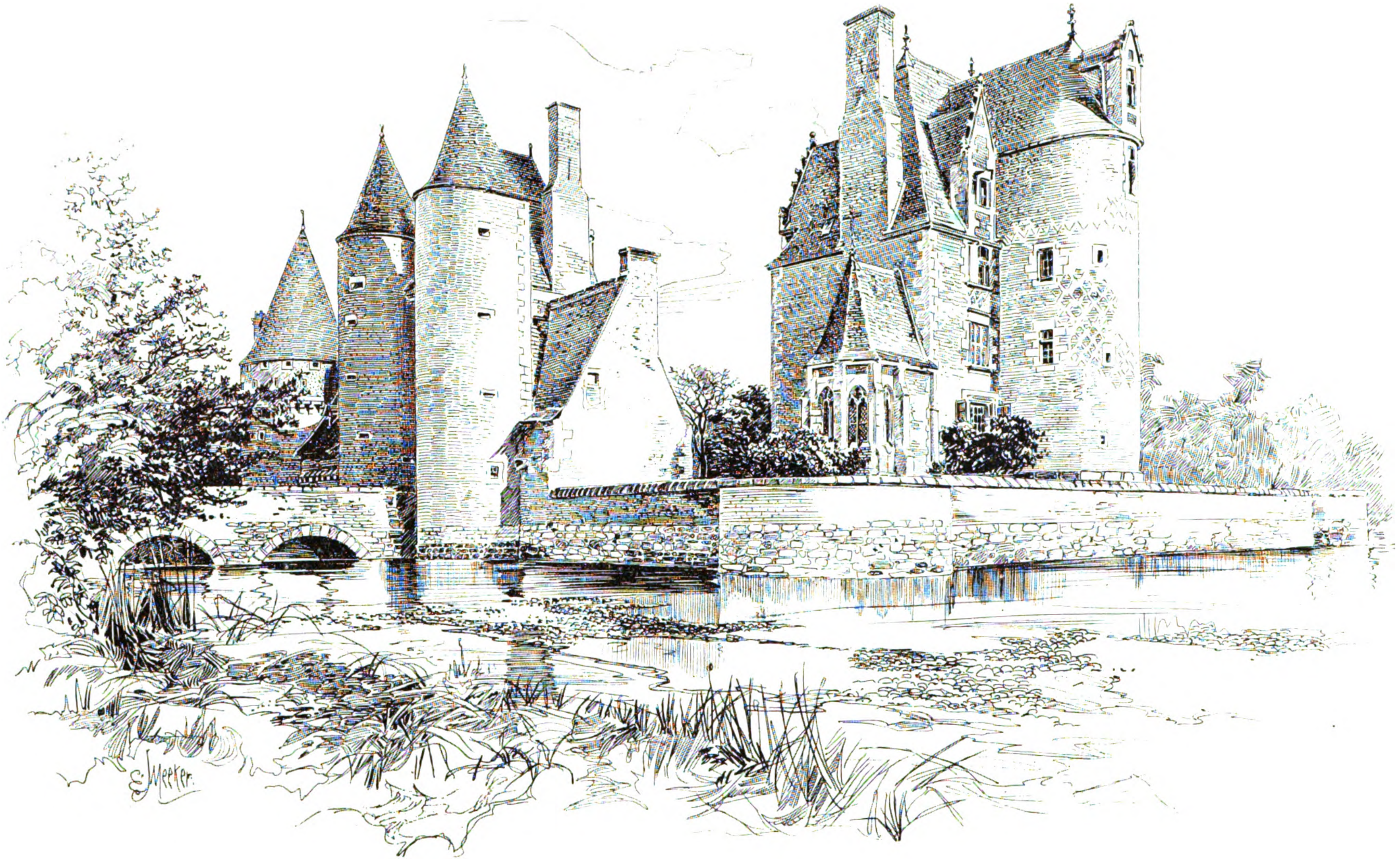
GEORGE PARKER has been appointed Engineer and Superintendent of the Water-Works at Galveston, Tex.

CHARLES PAINE, Past-President Am. Soc. C. E., has formed a partnership with two of his sons, with the name of Charles Paine & Sons, and the firm has opened an office in New York City as consulting engineers.

OUR ARCHITECTURAL ILLUSTRATIONS.

CHATEAU DU MOULIN, LOIR AND CHER, FRANCE.

JOHN K. MARTIN'S HOUSE, BRIDGETON, ME.
STEVENS & COBB, ARCHITECTS.



THE ENGINEERING AND BUILDING RECORD ILLUSTRATED SERIES.

CHATEAU DU MOULIN, LOIR AND CHER, FRANCE.

NEW YORK, VOLUME XXII.

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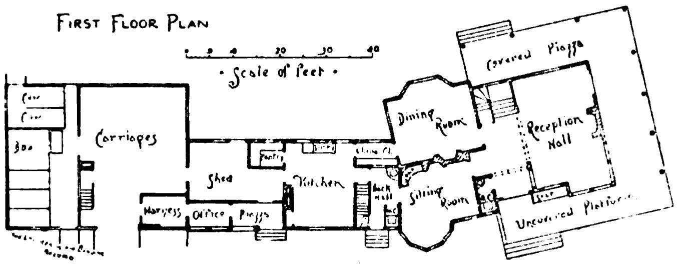
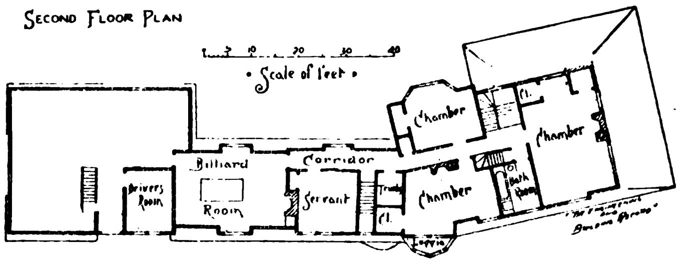
ANNUAL REPORTS.

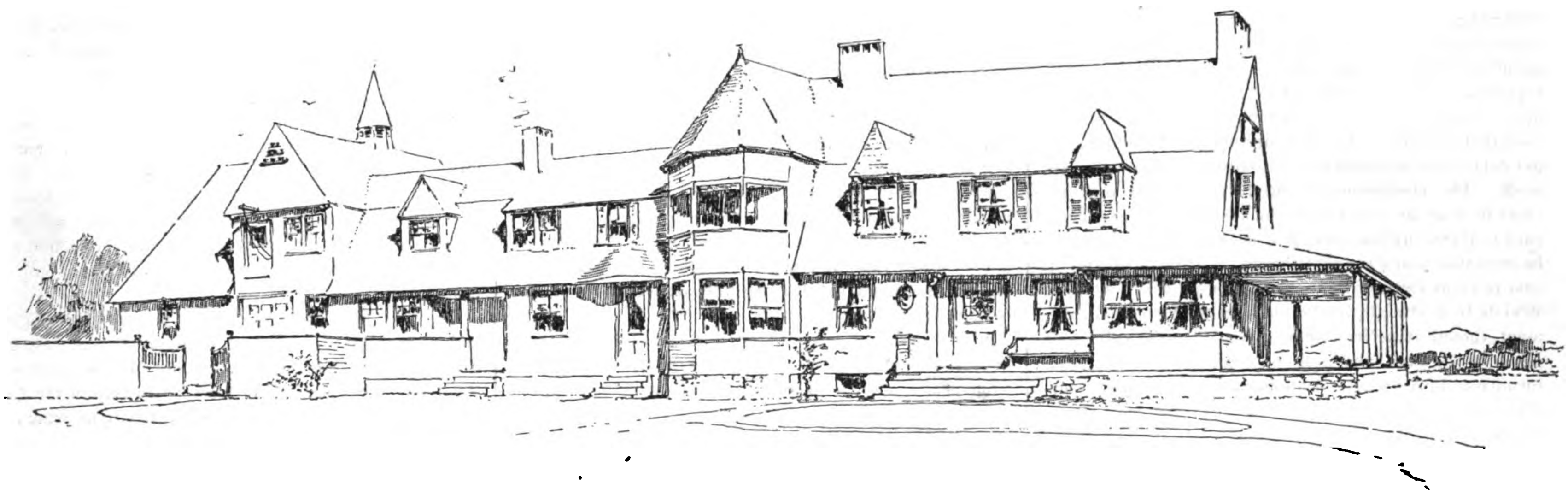
Third Annual Report of the Board of Public Works of Duluth, Minn., for the year ending February 28, 1890; William B. Fuller, City Engineer.

In their last annual report the Board of Public Works of Duluth note that the city has in a number of cases been sued for damages caused by the encroachment upon private property of the cuts and fills necessary in grading the streets. They also call attention to the inequitable method of levying assessments, especially for sewers, by which one man has been made to pay $429 for the same improvement that another man gets for $61. Reference is also made to the reports of Rudolph Hering and Andrew Rosewater on a proposed system of sewerage and sewage disposal, and of A. P. Boller on a proposed drawbridge over the ship canal at Minnesota Point, which will be noted separately.

Street improvements to the amount of $279,137 were contracted for and nearly completed. Six storm sewers were completed, at a cost of $34,083, or $5,500 less than the engineer's estimate, and eight sanitary sewers, at a cost of $57,888.







JOHN K. MARTIN'S HOUSE, BRIDGETON, ME.—STEVENS & COBB, ARCHITECTS.

The following are some of the contract prices: Excavation, per cubic yard, earth, highest, 40c., lowest, 20c., average, 28c.; rock, $4.50, 50c., and $1.66; borrow, per cubic yard, 45c., 1c., 31c.; gravel and rolling, per cubic yard, $1, 50c., 78c.; loam, per cubic yard, 55c, 40c., 48c.; paving, per square yard, cedar block, $1.19, 93c., $1.07; pine block, average, $1.32; Telford macadam, average, 90c.; rough stone for gutters, $1.28, 50c., 83c.; rough stone in Portland cement, $1.60, $1.25, $1.43; B. M. timber in place, per M., $20, $15, $17.46; curbing, per lineal foot 18-inch granite, average, $1.40; 18-inch Berea sandstone, 93c., 83c., 88c.; 20-inch Berea sandstone, average, 70c.; excavation in sewer, per cubic yard earth, 80c., 35c., 49c.; rock, $4.50, 50c., $2.61; sewer pipe laid in concrete, per lineal feet, 24-inch, $2.50, $2, $2.30; 21-inch, $2.30, $2, $2.18; 20-inch, $1.95, $1.60; $1.82; 18-inch, $1.90, $1.30, $1.57; 15-inch, $1.35, $1.05, $1.23; 12-inch, $1.25, $1.10, $1.18; sewer pipe laid in sand, per lineal foot, 18-inch, $1.20, 80c., 97c.; 15-inch, 75c., 55c., 63c.; 12-inch, 75c., 50c., 58c.; 10-inch, 60c., 16c., 44c.; 9-inch, 62c., 30c., 38c.; 8-inch, 40c., 25c., 29c.; 6-inch, 25c., 10c, 18c.; brick sewer, with granite block bottom, per lineal foot, 39-inch, average, $4; Portland concrete sewer, per lineal foot, 36-inch, average, $5; 28 inch, $3.50, $3.40, $3.45; 26-inch, average, $4; sewer brick, per M., $20, $17, $17.75; masonry, per cubic yard cut stone, $25, $15, $21.75; mortar rubble, $4.50, 80c., $3.08; piled rock slope, per cubic yard, average, $1.25; peen hammered work, per square foot, 40c., 25c., 33c., catch-basins, each, $55, $30, $42.95; manholes, each, $95, $38, $51.76; automatic flush tanks, each, $125, $85, $100.31; lampholes, each, average, $18; inlets, ⅛ bends, each, $3, 90c., $1.40; cast iron, per pound, 4c., 3c, 3½c.; removing and relaying sidewalks, per lineal foot, 10c., 5c., 7⅙c. The contract price for plank sidewalk was about four cents per square foot, and for one piece of sandstone sidewalk, 12 feet wide, and including curb and filling, it was $7.92 per lineal foot.

The city has been lighted since May 4, 1889, by from 121 to 183 arc lamps of 2,000 candle-power each, at a total cost of $15,793. The price per night for the first 100 lamps was 35 cents and 33⅓ cents for each additional lamp. The total expenditure for public buildings was $60,698, and plans for a jail and police station, to cost about $25,000, are under consideration.

Water is supplied by the Duluth Gas and Water Company, who, during the last year, constructed and put in operation a 4,000,000-gallon reservoir 280 feet above the lake. Over 10½ miles of water mains were laid during the year, making 28 miles in all. Of hydrants 56 were set, making 199 in use, and of services 239 were put in, making 1,059 in all

The water is taken from Lake Superior and the works have a capacity of 5,000,000 gallons per day. The total pumpage was 683,117,002 gallons or 1,871,553 per day, giving 124 gallons a day to each of an estimated population of 15,000 supplied.

The company is required to extend its gas and water mains whenever an annual income of 50 cents per lineal foot of mains is guaranteed.

Three block plans are given showing methods of apportioning special assessments for street improvements.

The cost, for engineering, of investigation and report on petitions for improvements was 0.29 per cent. of the estimated cost of the proposed improvements, aggregating $814,596. The cost of engineering on $522,011 of work done was 2.01 per cent. and the cost of inspection was 1.03 per cent.

Brick and stone gutters have been used on new graveled avenues at about half the cost of the wooden gutters heretofore used and are considered much superior. Their annual cost of maintenance will, however, be greater, except when the wooden gutters have to be renewed.

Nearly 50,000 square yards of paving were laid. On a street where there is 1,200 feet on a grade of 12 to 13 per cent. a pavement of rectangular pine blocks was adopted. They were 4 inches wide and set on end in rows 1 inch apart on a 2-inch plank foundation, the space between the blocks being filled with tar. As an experiment, 150 feet of this street on a 13 per cent. grade was paved with cedar blocks without tar, and some on a 10 per cent. grade with cedar blocks with tar; no blocks exceeding 6 inches in diameter. Over 15 miles of sidewalk were laid altogether.

A two horse street sweeper was purchased from the Abbott Downing Company, of Concord, N. H., which has given good satisfaction. Of sewers, 3.7 miles of sanitary, and 2.9 miles of storm water have been constructed, making the totals in use 15.9 and 6 miles respectively. One 36-inch storm-water sewer drops 22 feet on a reverse vertical curve, at the same time changing its horizontal direction 90 degrees in a length of 87 feet. The grades of each end are 2½ per cent., and at the steepest point 37 per cent. It is made of a concrete of crushed granite and best Portland cement.

Borings to a depth of 118 feet were made at the site of the proposed bridge over the ship canal by the following method:

"Two-inch wrought-iron pipe was sunk by means of a hydraulic jack, gravel, shale or similar material being in advance of the pipe, by a drill, and the sediment and other loose material removed by flushing with water forced to the bottom of the well through a ½-inch pipe placed inside the larger one. In soft material the water jet was used simultaneously with the hydraulic jack."

The intention of the University of Pennsylvania to establish a school of architecture is announced.

ANNUAL CONVENTION OF THE AMERICAN SOCIETY OF CIVIL ENGINEERS.

(From our Staff Correspondent.)

CRESSON, PA., July 1.

A SPECIAL train on the Pennsylvania Railroad which left New York at 10 o'clock A. M. Wednesday, June 25, and arrived here about 7 P. M., brought 109 members and guests of the American Society of Civil Engineers, 40 of whom were ladies, to the convention. The majority started from New York, but smaller parties joined at Trenton, Philadelphia, Harrisburg and Altoona, where the only stops were made. Dinner was served in the dining car, and social enjoyment and the beautiful and picturesque scenery afforded universal entertainment throughout the trip. Various engineering structures of interest that were finished or under construction along the line of the road were noted during the ride, among them some skew masonry arches.

THURSDAY MORNING SESSION.

The first session of the convention was held Thursday morning, Vice-President William Metcalf presiding. J. Foster Crowell presented a paper on "The Designing and Erection of the Oakley Arch," a structure notable for its obliquity of 42° 32′ (which, the author said was about the most unsafe angle to which a semicircular arch could be applied,) for an original device for attaining security, and for its excellent mechanical execution and workmanship. The arch carried one double-track railroad, and embankment, over another, its abutments rested on pile foundations, and its barrel was made of brick, the rest of the masonry of stone. During construction traffic was maintained by the alternate trestle system. Great trouble was experienced from the faulty formation of the underlying rock. A detailed description was given of the methods of design, which were considered valuable on account of their simplicity, conciseness, dependence upon computations instead of intricate drawings, and their reliability and interchecking character. Full-sized templates and not drawings were used by the mechanics. The exact angles of the ring stones were cut at the bridge site, to a level gauge. The diagrams, progress and construction of the arch were fully described and illustrated, and the laying out of the different stones and lines of the structure minutely explained. The author noted the comparison of alternate designs and estimates, all of which were less economical than that adopted. The masonry used cost about $10.50 per cubic yard, against $10 for adjacent first class straight work. The conclusions deduced were, that in ordinary cases of average dimensions the average cost per cubic yard of the entire masonry of a skew construction would be increased 3 to 4 per cent. by the helicoidal treatment, that in many cases of light skews it is not worth while to deviate from straight joints, and that the helicoidal treatment, though imperfect, affords security to the vulnerable parts of the arch and is to be commended for its uniformity and preciseness of application as against the complicated variations of the theoretically perfect equilibrated arch. Also, that it secures the full measure of strength of material and high economy, and should be adopted because more nearly approximating to all the requirements where symmetry and strength are desirable and unsightly features are to be excluded.

After the presentation of this paper, another by A. S. C. Wuertelle, M. Am. Soc. C. E., on "The Stability of Loaded Masonry Arches," was read by title and presented in printed form for discussion with the Oakley Arch Mr. Wuertelle's paper contained analytical and graphical investigations and mathematical deductions on the strains in the middle third of the arch, locating the line of pressure, finding the depth of the keystone, unequally loaded halves of arches, and the conditions of stability. A supplement to this paper contained an analytical investigation of and mathematical formulæ for uniformly varying stress in foundations for reservoir walls and abutments to arches and for the greatest intensity and deviation from center of pressure in foundations.

Discussion.—Desmond FitzGerald: "Would it have been advantageous to have made the acute wing nearer right angles to the arch?"

Mr Crowell: "No, on account of the position of the creek on one side. Its direction was considered in proportioning and no loss resulted."

D. J. Whittemore: "Was an estimate made of the comparative cost of an iron girder structure?"

Mr. Crowell: "Yes, showing little difference. The design was determined by the necessity of providing for future raising of the grade embankment."

Mr. Whittemore said that in a cold climate the action of the frost usually separated the brick from the ring stones, his remark being based on his experience in the Northwest.

H. M. Wilson: "I recently saw in India a peculiar skew arch, which was a combination of road bridge and masonry regulator, at the head of a Ganges canal that was at a peculiar angle to the river so as to have caused silting with a different angle of arch. The structure was double decked, with gates 15 feet high and an overhead roadway. The engineers made a large preliminary brick model of it, 60 feet high."

G. Bouscaren: "Why is 40° 30′ the most unfavorable angle for this arch, as stated by Mr. Crowell?"

Mr. Crowell replied that on account of the position of the point of eccentricity the culmination of insecurity comes between 45 and 40 degrees, and illustrated his remarks by a blackboard diagram.

Col. Latham Anderson: "What quality of stone was used?"

Mr. Crowell: "Ordinary good limestone at an average cost, for all masonry, of $10 per yard. Oolitic limestone in large blocks was used for the ring stones at an extra cost."

Question: "How much camber did you give?"

Mr. Crowell: "None, and there was no settlement."

Mr. Anderson: "What was the strength of the oolitic stone, and how did it spawl at the angles? What is the compressive strength of Indiana flat rock, Salem quarries? I have found it to crush under small loads."

Mr. Crowell: "There were no comprehensive tests made. Layer stone would probably be stronger in its natural bed, but a stone was required to resist equally in both directions, and to have large dimensions, both of which qualities were secured in the oolitic stone used. I had misgivings as to the durability of any stone under such acute angles, but these pressures were not abnormal."

Prof. O. H. Landreth: "In recent tests of Indiana oolitic stone I got about 5,000 pounds to the square inch in a set of 15 cubes, two of which were accidentally set with the bed vertical, and gave very different fractures which extended across the cube at an angle of 30 degrees with the bed of the machine."

Francis Collingwood said that he would always avoid filling the joints close to the face until the mortar is well set. Point it up afterwards, and this often prevents serious spawling.

Mr. Crowell: "It is very important not to point at first. In a certain brick arch the inner course was carefully filled and pointed, and the other seven courses were laid with less care, and when the center was struck the inner course was crushed along the skew backs and had to be replaced."

J. B. Francis: "Two reasons for spawling have long been known; the edges are more perfectly cut, and the stone is absolutely weaker at the edge as shown by experiments. The ancients fitted stones carefully and then shaved off the edges."

Charles Paine: "It would be well to record many instances of skew arches. There is a handsome cut stone arch of 50 feet span at Silver Creek on the Lake Shore Railroad."

A voice: "There is a skew arch under Seventh Street, St. Paul."

Mr. Crowell: "Will these gentlemen send notes of these instances for addenda to this paper?"

Alphonse Fteley: "The Pennsylvania Railroad is constructing many skew arches. I noticed two of them yesterday that were each composed of many straight arch sections or ribs. Can any one tell why this method is used? I should think the excess of area of face work would make it much more costly. By recent experiments I have found that, under the same head, the flow of water is 40 per cent. less with natural ragged sides than with smooth cement sides of a channel 10 feet wide. A mere wash of Portland cement applied to the brickwork with a brush increases the flow 2 or 3 per cent.; therefore this construction must greatly retard the flow."

Question: "Were these Pennsylvania Railroad bridges over highways or waterways?"

Answer: "Both."

Mr. Crowell: "There are other reasons against this Pennsylvania Railroad arch construction. It decreases the effective diameter, the area of the foundations must be increased, and the use of these parallel ribs precludes bonds except for short distances in the middle of the arch. Adjacent rings can be bonded together but in different relative positions, therefore the railroad above will overload one rib and underload another."

Mr. Francis explained the construction of small skew arches built like straight ones except that the end stones were cut special, and illustrated with a blackboard diagram.

A voice: "At the Johnstown flood a bridge constructed with independent rings, as described by Mr. Fteley, had two of the rings carried away without injury to the remaining ones."

P. F. Brendlinger: "I find the parapet a very important factor of strength of the face wall. I have built many ordinary false skew arches [illustrating by blackboard diagrams] that have stood several years and served satisfactorily. Mr. Crowell's method of arch construction is nice when you have plenty of time and engineers; mine is very simple and easy for large work and can be built by any mason with one tin template."

Mr. Crowell: "A prime object of my paper is to show that the helicoidal system is the simplest. The stones are alike except the faces and all are easily made by the same pair of parallel rules. We built this arch with a contractor who was not skilled and ordinary stone cutters and there were only two stones miscut out of 86. The only four tables required for data I made in a few evenings so that ordinary draughtsmen made the record drawings from them."

Mr. Brendlinger: "What was the total amount of masonry in the Oakley arch?"

Mr. Crowell: "Three thousand five hundred and ninety-three yards, on which there was an extra allowance of about 50 cents per yard."

Mr. Brendlinger: "With small abutments the contractors would certainly increase the bids for this construction."

Mr. Crowell: "This is an average arch with small abutments. In extreme skews the material should certainly be placed to the best advantage. I wish to show that when you build a skew arch it is very easy to build it right."

The Secretary read a paper by F. W. Watkins, M. Am. Soc. C. E., on "A Method of Taking Cross Sections in Deep Rock Cuts by Triangulation." The work described was in a railroad cut half a mile long and attaining a maximum depth of 100 feet. The slope of the material could not be determined until the bottom was reached, and the excavation occupied two years, and was recross-sectioned for final estimate after completion. Many places could only be reached by ropes or ladders, so triangulation by vertical and horizontal angles was made with a transit having a vertical arch and horizontal level tube. The method of working was illustrated and discussed.

Desmond FitzGerald informally presented a diagram and observations concerning evaporation, the result of data got at the Boston Water-Works last summer when the temperature was 80 degrees at the top of the reservoir, and constant at 42 degrees at the bottom, which was constantly filled with organic matter that floated steadily through until turned over in the fall. The water was found at the same temperature at the same level for any depth and was sometimes clear, beginning to cloud at different times at different depths.

THURSDAY AFTERNOON SESSION.

Lincoln Moss, C. E., presented a paper on "Comparative Tests of an Electric Motor and a Steam Locomotive on the Manhattan Elevated Railway, New York." The paper gave a detailed description of the conditions of the experiments conducted by the author with a 4-car train and the methods and apparatus employed, described the electric plant and analyzed the conditions, data and results. It was illustrated by plates and diagrams and developed the estimate that the cost of direct electric propulsion would be four times that of steam locomotion.

Discussion.—A. M. Wellington thought that the results of the paper might be interesting as to the general relative efficiency of electric and steam motors, and that other existing motors might make a better showing.

Mr. Moss: "The great trouble is in handling the current at starting. The loss is great at starting up a grade and the efficiency increases with accumulating velocity. Great losses are caused by external resistances."

A. E. Hunt: "I agree with the paper. We can develop 80 per cent. of efficiency in generating a current, but not 80 per cent from the current back to the motor."

Mr. Wellington: "I know of a plant whose motor does not stop at all, and waste is avoided by utilizing different velocities inverse to the power."

Oberlin Smith: "This shows why New York elevated roads don't run electric motors. They try to run electric locomotives when they should, instead, apply the power directly to the car cables, proportioned to the varying load. If we can utilize 50 per cent. of the force it will be doing well."

A member: "This paper does not represent the best modern results of electrical engines. I have found in a general way, in experimental investigation of street motors, that there is a first loss of 15 per cent. from steam engine to dynamo, 15 per cent. from dynamo to motor, and about 10 per cent. in the line."

J. B. Francis: "Sir W. Thompson stated before the Canadian Parliament that 10.000 horse-power could be delivered from Niagara Falls to Montreal by a ⅝-inch conductor."

Mr. Moss: "There have been two other systems experimented with on the New York Elevated Roads: one where the motor never stopped, and was differentially connected to the wheels; the other had the motive power applied directly to the wheels. Neither system was ever pushed vigorously or amounted to anything. This is simply a record of actual tests of a system that attained results compelling the company to recognize it in competition with locomotives."

H. M. Wilson presented an abstract of a paper on "Irrigation in India." The following are some of the headings enlarged and explained:

Immigration is a necessity to the financial success of any irrigation enterprise in the United States. India was overpeopled previous to introduction of advanced and extensive irrigation enterprises; but since their construction easily supports a much larger population. Administration of irrigation projects in India. Organization there of ministerial and of engineering branches of government. Extent and powers of control over water and land. Seasons; rainfall; crops; evaporation and stream discharges, and methods of determination and nomenclature used. Results, good and bad, of irrigation; alkalinity; water logging; drainage; fevers. Irrigation works—their kinds. Well or lift irrigation. Inundation canals. Protective or famine works. Productive and perennial works. Perennial works good investments. Protective works have not often been financial successes. Why storage (protective) works may pay in United States. Water rates higher in United States. Volumes of discharge of large rivers. Topography in Northern India. Location of canal heads. Location of diversion weirs. Open weirs or "barrages." Weir foundations. Wells or brick caissons. Temporary boulder weirs. Masonry weirs. Under sluices; sluice gates; regulators; escapes. Source of supply. Alignment of canals; duty of water; width of channel and cross-section. Velocity of water in canals; slope of canal bed. Distribution of water; irrigation of fields. Storage reservoirs; location; catchment basins; flood discharges. High dams of masonry; waste weirs; water cushions, scouring or under sluices.

Discussion.—Question: "What is the maximum velocity in canals?"

Answer: "It differs greatly; in light sand from 1¾ to 2½ feet per second. In soils a little more stable from 2½ to 4 feet, and is unlimited in rock and gravel."

J. B. Francis (referring to the great size of the canals): "The flow of the Mississippi in recent floods was 1,300,000 cubic feet per second."

Desmond FitzGerald. "I understand that the water cushion formed the only protection for the bottom against the overflow at weirs; I should like to see it before abandoning the belief and practice of a lifetime."

Mr. Wilson: "At one weir that had a flow of 90,000 cubic feet per second there was, just below, an island formed of 10 feet of gravel by hard pan and kunkar. Wishing to remove it they cut channels through the gravel, but it still remains, having withstood the current for two years without much erosion."

Mr. Francis: "At Niagara the falls have made a water cushion about equal to their own height, and further erosion is prevented by it."

A paper by Arthur Pou on "The Cheapest Railroad in the World," was read by the secretary. It described the conditions and construction of a 19-mile railroad from Dublin to Wrightsville, Ga., the most of which was built at a cost of about $1,100 per mile. It was imperative to construct the road in the absolutely cheapest manner. The engineer only devoted part of his time to it, convict labor at $1 a day was employed, adjacent growing timber was used, and good second-hand rails were bought very advantageously.

A paper by R. H. Thurston on "The Permanent Effects of Strain in Metals; on Their Self-Registration and Mutual Interactions," was read by the secretary. The author summarized previous papers in which he had arrived at the conclusion that if a metal be subjected to a stress of any given kind, or in any stated "sense," sufficient to produce permanent strain and set, then its ultimate resistance to that, or to any other kind of stress, will be sensibly increased, and in all directions, whatever the line of action of the deforming stress. Four series of experiments were made, in illustration in each of which the material employed was subjected to strain in either tension, compression, torsion, or by transverse loading; and the application of another straining force was then made to reveal the permanent effect of the first, and the altered elastic limit and ultimate resistance. The results, visible to the unaided eye, were believed to demonstrate the principle, and from another experiment on brass it was concluded to be possible to detect with it a behavior similar to that of iron. The paper was accompanied by tables of data and photographs and descriptions of the tests.

Discussion.—Prof. J. B. Johnson: "It is well known that any cold working increases the strength of iron. I have drawn 50,000 pound iron to 40,000 or 50,000 pounds and thereby increased its ultimate strength to 70,000 pounds. This increase depends on the time. If a 50,000-pound specimen be broken, one of the pieces may the next day rise to 58,000 pounds, and by waiting two weeks, to 70,000 pounds. Wire drawing is another and a familar illustration. I think this indicates a mistake in the universal objection that engineers have to using iron in structures after it has been strained beyond its elastic limit, and probably improved instead of injured thereby."

F. W. Skinner: "Professor Johnson's remarks seem to imply the desirability of subjecting structural iron to strains beyond its elastic limit before putting it in the structure. Many very serious objections to this immediately arise. We are all familiar with the fact, well established by experiments, that iron which will endure uninjured almost an infinite number of strains each considerably below its elastic limit, will be quickly destroyed by greater strains, especially shocks such as bridges are subjected to, within its original ultimate strength, but equal to, or perhaps somewhat less than, its elastic limit. Machines do not now exist capable of imposing such strains on most full sized structural members, and if it were attempted to strain them after they were assembled and connected in the finished structure, the results, from the very definition of elastic limit as the point where permanent set begins, would cause such distortion and variation of principal dimensions as to entirely change the conditions and destroy the symmetry of the structure. Furthermore, straining any member or element beyond its elastic limit would inevitably aggravate defects, develop and increase flaws, and make dangerous trifling imperfections that would never have become important under working strains."

Professor Johnson: "I don't mean to advocate increased working strains of structures, but that engineers should not hesitate to use iron that has once been strained beyond its elastic limit. For example, a chain strained to a 10 per cent. elongation is improved and has its welds tested. The iron is improved for loads within, but not above, the elastic limit. The great point is what influence the stress in one direction has upon the strength in another direction."

Francis Collingwood: "These stresses impair the elongation. This is not detrimental in wire, but such treatment would take the life out of bridge members and any engineer would hesitate to be responsible for it. Such members, when readjusted to bearing, would take unequal proportions of the working stresses and soon be destroyed."

D. J. Whittemore: "I once tested rods from an old highly strained bridge and found them improved."

G. H. Thomson: "I tested some old Howe Truss Bridge rods that had been used up to 35,000 pounds and they showed an ultimate strength of 70,000 pounds; but so did some unused rods from the same bridge."

William Metcalf: "The statement that the ultimate strength in every direction will be increased by strains above the elastic limit is dangerous to young engineers. Rolling produces its greatest distortion lengthwise by wave motion in the iron in front of the rolls; this gives great increase of strength in the direction of rolling and great loss in the direction at right angles to it. I once found by careful measurements that the dimensions of an iron bar were actually increased by cold rolling, thus showing a separation of particles. Elastic ductility can be secured by hot but not by cold rolling, which is a necessity, not an advantage. Hot rolling would be better if practicable. Professor Thurston's experiments clearly show local distortions; these must be injurious. If you suspect cold rolled material of being brittle, break it transversely and if it shows a black core with a bright ring outside be very careful of it; it is more dangerous than big crystals and shows crushing in the center or some other injury."

THURSDAY EVENING SESSION.—THE PRESIDENT'S ADDRESS.

At the session Thursday evening President W. P. Shinn delivered the annual address, which he said was, according to a constitutional mandate, a review of the year's engineering progress.

Mr. Shinn first mentioned the completion of the Forth Bridge, notable for containing the longest spans in the world; two of 1,710 feet clear, each with 150 feet clear headway beneath them, and tubular bottom chord members 15 inches in diameter. The rivet holes at the connection of one span met within ½-inch, and were brought together by hydraulic jacks. At the other span they were 1 inch apart and, failing to be closed by hydraulic pressure of 170 tons, were brought to place by the expansion of the chords by burning waste in them.

The spans were subjected to 1,800 ton test loads and deflected in accordance with computations, and deflected less than one inch under registered wind pressure of 37 pounds per square foot. The bridge contained 59,500 tons of steel and cost $15,500,000.

The St. Louis Merchants Bridge has a total length of 2,420 feet, including three 525-foot spans, and has been completed under the supervision of E. L. Corthell and G. S. Morrison, members of this society. The Kentucky River Bridge was completed in August, 1889, and is remarkable for its magnitude and rapid construction. It has a total length of 1,658 feet, including a 551-foot cantilever span supported on steel towers 135 feet high, and it was ready for passage of trains six months after the foundations were commenced. The Thames River Bridge in Connecticut was completed last October under the supervision of A. P. Boller, M. Am. Soc. C. E., and is remarkable for its 503-foot draw span, the longest in the world. The Coteau Bridge over the St. Lawrence is 6,035 feet long. Its foundation caissons were taken into position suspended between two floats. The trusses were erected at the required level on false work in six feet of water. The false work was then lifted upon floats on scows which were towed into position and sunk so as to deposit the trusses in final position on the bridge seats.

Of bridges under construction Mr. Shinn mentioned the new Louisville and Jeffersonville bridge, 8,505 feet long, with two spans of 431 feet, and two of 550 feet each, and one of 553 feet, surpassing all previous lengths of truss spans. The Ohio River bridge at Brunot's Island, under the supervision of Past-President M. J. Becker, is to be erected by C. L. Strobel, M. Am. Soc. C. E. The false work will be at right angles to the bridge, and, after the trusses are assembled upon it, will be transferred to pontoons and floated into position. The Mississippi bridge at Memphis will have one span of 791 feet, two of 621 feet each, and nearly a mile of 150 foot spans, and its cost is estimated at $3,000,000. The Tower bridge at London, England, will have its 200 foot middle span divided in the center and hinged at the piers, each end opening upwards to leave a clear opening between towers of 135 feet headway below the upper connecting trusses.

Among proposed bridges Mr. Shinn spoke of the North River bridge with a 3,200 foot span, the construction of which has been authorized by a bill providing for its commencement within three years, and completion within ten years thereafter, with a capacity for ten railroad tracks. The Mississippi bridge above New Orleans is designed by E. L. Corthell, M. Am. Soc. C. E., to have three discontinuous spans of 886 feet each, and to cost $3,000,000. A suspension bridge, 4,440 feet long, to unite Philadelphia and Camden, and accommodate railway, carriage and pedestrian travel, is proposed. The most pretentious project is that of the English Channel bridge, 24½ miles long, with 118 spans and two abutments, and spans of from 500 to nearly 1,000 feet in length. The masonry piers would be in water of 180 feet maximum depth, and carry steel towers 140 feet high, giving a headway of 177 feet. The total weight is estimated at 771,265 tons, and the total cost at $172,000,000.

In regard to bridge floors Mr. Shinn said that a train became derailed and bunched the ties, destroyed one span of the bridge and two passenger cars, killed 13 persons and severely wounded 29, besides causing a money loss of $200,000 at the St. George Bridge, where the rails were spiked to 8 by 12-inch cross timbers laid 8 inches apart on the bridge trusses without other guard rail than a timber at the ends of the cross ties. A similar accident occurred at the Flat Creek Bridge, where there were no guard rails. Both of these disasters might probably have been averted if proper guard rails and tie systems had been used. It is plain that true economy calls for solid iron floors with continuous ballast where stone arches are not used.

Speaking of railroads the President said that the estimated mileage in the United States at the end of 1889 was 161,382 miles with not less than 1,100,000 freight cars. It is to be regretted that, on the average, these freight cars stand still nine days for every day they are in motion. With a proper system of demurrage charges their average movement could readily be increased 50 per cent. Satisfactory improvement is evident in railroad management. Compound locomotives are receiving fair trial in this country. It is in safety appliances that the greatest progress has been made during the last year. Steam heating from the locomotive for passenger trains is being introduced extensively.

Compressed gas is superseding kerosene lamps for car lighting. Great advance has been made in power brakes for freight trains. It appears safe to say that within the present decade all freight cars will be equipped with automatic couplers. The subject of safety signals is one of growing importance. In the year ending June 30, 1889, there were 5,823 persons killed and 26,309 injured by railroad accidents in this country; their number might probably be reduced one-half by the adoption of the safety appliances above mentioned. One of the most important points to which the speaker would call the attention of railway managers is keeping trains on time. The speed and number of trains are matters of convenience, but to put a passenger exactly when and where you advertise to put him is a matter of contract and rests on a solemn obligation. Accidents are something excusable, but the schedule should be made practicable and be rigidly executed.

It was Mr. Shinn's conviction that the regularity and promptness of trains on many of our leading railway lines is not as satisfactory to-day as it was 20 years ago. A $60,000 appropriation towards the survey for the Two Americas Railway, projected from the United States to Chili and the Argentine Republic, has been recommended by the President and the construction of the road is likely to be commenced. The construction of the Chignecto Ship Railway from the Bay of Fundy to the Gulf of St. Lawrence will demonstrate the correctness of Past Vice-President Capt. J. B. Eads' Tehuantepec Ship Railway project. The construction of the Chignecto road is well advanced. It will be 17½ miles long, able to carry 1,000-ton vessels, will have two straight tracks 18 feet apart, and is expected to be finished next year.

As to ship canals Mr. Shinn said that The American Nicaragua Canal appears to be making substantial progress. A. C. Menocall, M. Am. Soc. C. E., is its chief engineer. Among the constructions of last year the Eiffel Tower is remarkable as being, probably, the highest structure recorded by history.

In no other branch of the profession have so great strides been made as in electrical engineering. The first electric railway was built in 1886, and in May, 1890, there were 240 electric street railways in operation and under construction. At the close of 1889 there were in New York State alone 92 electric light companies, one of which had 301 stations, with a total capacity of 554,350 16 candle-power lights. One of the most remarkable advances in the use of electricity is for welding. In one test the metal seemed to have been refined and made more homogeneous.

The present use of water power is but a fraction of that easily available in many sections of the country. A company has been formed to utilize the power of Niagara River by taking water in a canal from above the falls and discharging it through vertical shafts into a tunnel opening into the Niagara below the falls, utilizing the water at a pressure as high as 100 pounds per square inch.

Providing for the sewage of large cities is an engineering branch of growing importance. There are no more important questions than those of water supply and sewage. One of the greatest undertakings of modern times is the drainage of the valley of the City of Mexico with and area of 1,657 square miles at an average altitude of 7,412 feet above sea level. A canal 30 miles long, and tunnel 8 miles long, are proposed, to have a capacity of flow of 61.7 cubic feet per second at a velocity of 7.54 feet. This work was commenced in 1889, and is to be finished in 1891.

Special attention has been lately given to the improvement of our common roads, than which no worse can be found in any civilized country. Several State Governors have given attention to this subject in their messages. Prof. J. W. Jenks claims that in Illinois a full load can be carried on the State roads only three months in the year, two thirds of a load only three months, and half a load during six months. He claims that if the State had a good system of roads the farmers would be benefited $116,000,000 in the value of their farms, and would save annually $15,300,000 in hauling. An estimate of T. H. Johnson, member of a committee of the Engineers' Society of Western Pennsylvania, was to the effect that the loss to that State from bad roads amounts to $6,000,000 per annum, and that the present annual road tax of $4,000,000 is utterly wasted. No better example of the effect of good roads is to be found than in Union County, N. J., where the population of Elizabeth, Westfield, and Plainfield, would not have been attracted without good macadamized roads. Steps in the right direction have been taken by the University of Pennsylvania in offering prizes of $100, $200, and $400, for papers on road-making and maintenance, and by the Case School of Applied Sciences in Cleveland, offering free instruction on road-making in the form of three lectures.

One of the most remarkable improvements in the driving of shafts is that of the Poetsch freezing process, applied in quicksand. It consists of sinking iron pipes around the shaft and circulating through them a solution of chloride of calcium at a temperature of about — 17° Fahr. The natural heat of the ground is thus absorbed and the earth around the pipes is frozen into a solid impervious wall. The process is controlled in this country by a company, at the head of which is General W. Sooy Smith, M. Am. Soc. C. E. Its first work was at Iron Mountain, Mich., where it sunk a shaft 15½ by 16½ feet by 100 feet deep. A shaft has been sunk in Belgium by this process that was 190 feet deep to the quicksand and was carried 62 feet further through it.

Great advances are being made in metallurgy. Within ten years the output of a blast furnace has been more than trebled and the production of pig iron has increased 230 per cent. in 11 years. It is now possible to manufacture spiral welded tube of almost any required size and strength from rectangular strips of metal of moderate width. Improvements in the manufacture of aluminum have increased its range of application in the manufactures.

The lesson of the failure of the South Fork Dam is undoubtedly that from a too contracted spillway, and, although the rainfall which caused it was, as with the failure of the Walnut Grove Dam in Arizona, unprecedented, it shows that provision must be made for a flow of water greater than any recorded.

The engineering profession is the oldest known to history, antedating law, medicine and priesthood. Roman aqueducts, with an aggregate capacity of 28,000,000 cubic feet of water per day, are recorded 50 years before Christ. One of them was 63 miles long, including 6½ miles of arches, some of them over 100 feet high. The aqueducts supplying ancient Carthage are said to have been 70 miles long, and to have contained one arcade of 1,000 arches, some of them 100 feet high. Ancient Peruvian aqueducts are said to have exceeded all others of ancient or modern times in length and capacity, some of them bringing irrigation water several hundred miles. From recent Egyptian explorations it is stated that 5,000 years before Christ a dam was constructed that turned the whole river Nile into a location several miles distant from its former bed.

The term "engineer" is misleading in this country, where it is applied alike to the man who designs and who operates an engine, and the degree of Civil Engineer, for which the qualifications requisite for membership in this society should be demanded, is often improperly bestowed. The curriculum of engineering schools should embrace some study of law and accounts, ignorance of which often causes trouble and expense.

One of the notable events of the past year was the European visit of American engineers, who met most courteous and enthusiastic receptions in Great Britain, France and Germany, their dinner in the London Guildhall being an especially marked courtesy, never but once extended to any non-municipal visitors. Members of this society are invited to co-operate in the entertainment of a party of members of European societies that will visit this country next October.

It has long been my opinion, said Mr. Shinn, that expert professional witnesses should be called by the court and not employed to present facts and opinions in support of one side of the case only.

Care and accuracy are very important in all of an engineer's acts and statements. He cannot afford to be careless, his every estimate should be based on known data. Great odium has been brought upon the profession because its estimates have been generally too low. The actual cost of the original Croton Aqueduct was, however, less than 1 per cent. in excess of the estimate by the late J. B. Jervis, M. Am. Soc. C. E. The statement of the civil engineer should impart absolute verity, and, with his opinion, be always based on the best possible ascertainment of facts.

Most engineers have some unique experiences. These, though brief, or embracing only part of a subject, should be reported to this society whose life blood is in its papers and discussions. Our growing society shall thus be made to expand in influence and value, embracing all the members of our noble profession on this continent, a few from the older hemisphere, and become, in fact, The American Society of Civil Engineers.

The remainder of this session was occupied by a description by Robert B. Stanton, M. Am. Soc. C. E., of a five months' boat expedition through the Colorado Canon, of which he made a transit survey, with levels and stadia measurements, topographical notes and 900 photographs for the location through the canon of a low grade railroad. Mr. Stanton described his equipment and methods, the experiences and hardships of the expedition, and the results obtained. The formation of the canons, with brilliant coloring and magnificent scenery, was illustrated by 150 stereoptic pictures.

Friday morning the members and guests of the convention, by the courtesy of the Pennsylvania Railroad, took a special train to Johnstown, Pa., stopping near the site of the South Fork Dam, and at other points in the Conemaugh Valley, and visiting the works of the Cambria Iron Company. At the iron works they were received by Alexander Hamilton, General Superintendent, George Hamilton, Assistant Superintendent, C. S. Price, Metallurgical Superintendent, Joseph Morgan, Jr., Chief Engineer, and other officials of the company, and made a brief inspection of some principal features of the plant.

FRIDAY AFTERNOON SESSION.

Prof. Charles B. Brush read a paper at the session Friday afternoon on "One Way of Obtaining Brine," in which he described the reservoirs, wells, plant and methods of operating the salt works of the Tully Pipe Line Company at Syracuse, N. Y., where double tubes are sunk from the surface of the ground 1,200 feet or more to the salt beds. Fresh water being let into the top of the interior tube becomes nearly saturated with salt and is withdrawn in the form of brine through the outer tube. Thus the deposit is gradually dissolved and a great basin will eventually be formed reaching from well to well. In reply to questions Professor Brush explained that the pipes had ordinary lining that suffered somewhat from the effects of the salt and was liable to be broken by high velocities.

Henry T. Eddy, C. E., Ph. D., presented a paper on "A New Graphical Solution of the Problem, What Position a Train of Concentrated Loads Must Have in Order to Cause the Greatest Stress in any Given Part of a Bridge Truss or Girder." The object of this paper was to introduce a new graphical method for determining what position a moving train of wheel weights must have to produce the greatest stress in any given part of the bridge truss or girder over which the train is passing. The method proposed depends principally upon the construction and use of a class of polygons or curves, named reaction polygons. One of these is the line of shears. One valuable proposition respecting the load line has, however, been in constant use here since 1875, by C. L. Strobel, M. Am. Soc. C. E., and his successors in the office of the Cincinnati Southern Railway, who learned it in 1871 as a student of Professor Mohr. Reaction polygons are readily constructed graphically, and their properties are such as to give with ease the train positions for maximum stresses as well as to decide which of several maxima is the greatest. The proof of these constructions was given in algebraic form. Part I treated the simple girder and single intersection truss resting upon end supports. It contained a full explanation of the properties and methods of construction of reaction polygons and the investigation of all problems of maximum stresses in girders and single intersection trusses by their aid. Part II treated cantilevers with two supports and double intersection trusses with end supports. It showed how the same simple graphical methods suffice to resolve also all important questions of maximum stress, under concentrated loads, for bridges of these more complicated forms.

Discussion.—W. H. Burr: "How did you treat the analytical indeterminate question of a double intersection truss?"

Professor Eddy: "On the ordinary assumption that stresses starting in one system remain there, that chord strains are summations of both systems and that strains do not pass over. Pin loads were avoided by considering wheel loads directly."

W. H. Burr presented a paper on and illustrations of the three spans of the Ohio River bridge, briefly describing its construction and erection, stating that it contained the greatest and heaviest single non-continuous trusses ever made, supporting double railways, roadways, and sidewalks. He explained the details, none of which were special except floor beam and lateral connections. The most of the top chord and post rivet holes were made by multiple drills. Rivets were tested by cold hammering, and the steel plates by hammering out of shape and other severe treatment, with such satisfactory results as to give good confidence in the steel. The weight of the three main spans was 10,000,000 pounds; total weight, 20,360,000 pounds; total length, one mile. The Phœnix Bridge Company designed, built and erected it. The false work and two-thirds of the iron for one span was pushed 1 foot down stream without injury by the drift of one freshet. Another freshet swept out and completely wrecked the false work, traveler, and 700,000 pounds of steel for the 550 foot span. This accident was caused by the freshet piling up drift almost solid to the bottom of the river, below which a scum undermined the false work which would otherwise have endured as it stood the maximum height of water for some hours. The false work was immediately replaced and protected by two 600 foot double lines of piles, 5-foot centers, sheathed with 5-inch scantling and backed every 40 feet by groups of six piles. The lines were built obliquely from both ends of the false work forming a V that protected the new false work and span through several freshets. The substructure was not unusual, comprising both pile and pneumatic foundations, the latter made by Gen. William Sooy Smith. The maximum pile load was 81,000 pounds. The maximum load on the pneumatic foundations was 13,000 pounds per square foot.

The paper was briefly discussed by Frank C. Osborne, Prof. J. B. Johnson, C. L. Strobel, and the author.

The secretary read a paper by J. L. FitzGerald on "The Comparison of Water Supply Systems from a Financial Point of View." From tabulated data of water-works plant, cost, duty, expenses, revenue, etc., for 90 United States cities, the author concludes that "if any conclusions can be drawn, they may be summarized as follows, supposing in every case that the three systems of supply are open to choice: Whatever the size of the town, a gravity system would be most efficient whenever these conditions were all fulfilled; the supply of unquestioned present and future purity; the quantity sufficient for the needs of the next 20 years without great additional outlay; and the original cost such that 8 per cent. thereof will not be greater than 60 per cent. of the total operating expense, including interest and sinking fund.

"A direct pumping system will be the most economical when the town is of such a size that its daily consumption will be more than one-half million gallons; when the supply is good and abundant, but situated at a low level; and when there are no great differences of elevation in the distribution system. If there are highly elevated portions, these, when of small comparative area, or consumption are best supplied with a reservoir system, having an independent force main. When the consumption is less than one-half million gallons, direct pumping with a reservoir stand-pipe of at least 20 hours capacity, situated in the distribution system, will give the most economical results.

"When a town is so unfortunate that its supply is insufficient during certain portions of the year, or when that supply is sufficient for ordinary needs, but affords no margin for fire protection, a reservoir of large capacity will then be necessary. Works of the latter kind can only be regarded as temporary in character, the inevitable growth of the city forcing soon radical changes and possibly reconstruction.

"Although the writer is aware that no hard and-fast rules can be formulated for a choice of a system, and that a hundred local circumstances will determine the final selection, yet he believes that a few general principles like the above will afford some aid to the solution of doubtful cases."

Discussion.—Desmond Fitz Gerald: "Boston's 35,000,000-gallon supply should be classed under the gravity system. We have for several years observed storage action on a large scale, and find that it greatly improves water of a certain degree of impurity. Even good water, though not improved, may be rendered more stable, and its color benefited by storing. Storage is greatly influenced by its conditions."

J. B. Francis: 'I have known at Lowell 8-inch pipes designed for 150 pounds pressure that had been 60 years in service and were working without signs of failure at 200 pounds pressure."

F. L. Fuller: "I think that many pipe systems stand more than 20 years, and question the statement made in the paper that many companies sell water below the cost of production."

C. B. Brush: "As the author says, water-works reports are usually unsatisfactory, and this paper has been compiled from such ones. Here there is no distinction between high and low service works. There are great differences between lengths of force pipes, etc., so that the data is inadequate to draw conclusions from. The inference from the paper is that direct pumping is generally desirable; such is not my conclusion, and I protest against the statements going out without protest from this society. My experience is directly opposed to the conclusions of the writer, which I would not willingly accept without much better data."

H. M. Wilson: "Spokane, Wash., is an instance of a town without extra fire pumps. There the engine broke down just before the 4th of July, the engineer went away, fire broke out, and the town was destroyed."

Prof. J. B. Johnson: "I protest against any deductions from a table of averages where all the items are given equal weight. Here the conditions are so different that there is no comparison. A little village counts just as much as New York. Engineers should weigh facts and give them a proper relative significance. I submit that this is an absolutely vicious basis of argument."

T. H. McCann: "I notice many defects in the statement about Hoboken. If the others are not more accurate I doubt the conclusions."

A member: "I think these tables are valuable for independent use and as giving useful data of many towns."

Mr. Metcalf: "In Pittsburg we had much trouble from the pumps being clogged by mud and drift in freshets of the Allegheny River. To remedy it I had an intake well 12 feet deep dredged, cribbed and covered. We got clear water, but soon great complaint was made of lime in the water that filled up the boilers, etc., and finally it became so serious that the water was analyzed and found to be very heavily charged with saline matter. This water was evidently from a separate source just beneath the sweet Allegheny and contained three times the matter that the river did even in flood times. So we had to destroy the crib, etc., at a considerable expense."

Friday evening over 170 of the members of the convention and their guests, including ladies, attended the banquet, where the toasts and responses pleasantly alternated with the courses.

Saturday morning the majority of the members and their guests visited Bell's Gap, a special train being furnished by the Pennsylvania Railroad Company.

SATURDAY AFTERNOON SESSION.

The regular business meeting of the society was held Saturday afternoon. The Committee on the Compressive Strength of Cements and the Compression of Mortars and Settlement of Masonry reported progress, and that they were awaiting an opportunity to use a large testing machine. The report was accepted and the committee continued.

The Committee on Uniform Methods of Testing Materials used in Metallic Structures reported progress. The report was accepted and the committee continued.

The Committee on Standard Rail Sections did not present a report.

A member of the Committee on Purity of Water Supply presented a minority report, which was received and referred to the Board of Direction for action.

The Committee on Uniform Standard Time reported progress and the preparation of a memorial to Congress to pass an act to legalize this system of time. The report was accepted and the committee continued.

A communication was received from V. G. Bogue, Chief Engineer Union Pacific Railroad, stating that an engineers' room had been furnished in a hospital in Washington. It contained two beds, and $3,000 was required to endow it. The society was invited to furnish $1,500 or $2,000 of the amount, the rest of which would be raised in the West. The communication was referred to the Board of Direction.

The Committee on the Revision of the Constitution and By-Laws submitted its second progress report. It had held three meetings and been mainly occupied in considering the formation of branch societies and affiliation with existing local societies. Sixty-two communications have been received upon the subject, and a circular embodying five different plans has been sent to representatives of 27 local societies, from ten of which responses have been received. The committee has offered every possible opportunity for the expression of the views of local societies on affiliation, and had vainly hoped for personal discussion with them upon the plans suggested. "Your committee is impressed with the idea that obstacles arising in the details would make it extremely difficult to definitely conclude an affiliation plan; they are unable to report in time for action by the convention upon the general subject committed to their charge and therefore submit this report of progress and ask to be continued." The report was accepted and the committee continued.

A communication from the Western Society of Engineers asked that this society appoint a committee of its members to meet in Chicago next October, committees from other engineering societies to consider the holding of an International Engineering Congress in Chicago during the World's Columbian Exposition of 1893. The communication set forth the aims and advantages of such a congress, and proposed an organization for preliminary arrangements. The communication was accepted, and it was voted that the President should appoint from the members of this society representatives who should attend a preliminary meeting and report its action to this society. The President was requested, by a unanimous vote, to be one of the representatives.

It was moved that a committee of three be appointed by this society to meet committees of three from each of the societies of Mechanical, Mining and Electrical Engineers to discuss a scheme of affiliation. This motion was laid on the table and the business session adjourned.

The convention reassembled and selected the following Nominating Committee: A. M. Wellington, W. B. Franklin, Charles Paine (chairman), M. L. Holman and G. Bouscaren, representing, respectively, the first, second, third, fourth and fifth geographical districts, which were arranged as last year.

J. E. Watkins presented a paper on "The Beginnings of Engineering, with Special Reference to Early Engineering science in America." Lack of time prohibited the reading of a great part of the paper. The author gave a resumé of the development of engineering in different countries, and mentioned various special works—an ancient aqueduct tunnel in Judea simultaneously constructed from both ends; the first Roman tramways; the first United States canal, in Orange County, N. Y.; the establishment of West Point; the act of Congress in 1794 for employing French engineers here—and traced the evolution of engineering instruments of precision and the growth of engineering societies, and concluded by saying that in America the engineer typifies the restless progressive practical spirit that has made this country what it is.

Discussion. — Clemmens Herschel said that John Smeaton first signed himself "Civil Engineer," and should be considered truly the first civil engineer; he was also the first expert witness.

Don J. Whittemore told of using, over 40 years ago, one of the first four transits made by Young, and how a large transit, ordered about that time from England, was not provided with a revolving telescope, and a second telescope was therefore inversely mounted on the same axis.

C. P. Bassett presented a paper on "Inland Sewage Disposal, with Special Reference to the East Orange, N. J., Works." The author exhibited maps and photographs and briefly described the conditions, construction, operation and efficiency of the works described, which have been illustrated in THE ENGINEERING AND BUILDING RECORD.*

Discussion.—Question (in reference to the amount of chemicals, etc., advised by Mr. Bassett and not adopted in the sewage treatment,) "What would your proposed improvements in chemicals cost?"

Answer: "About $4,000 a year."

Saturday evening the most of the members and guests of the convention went by special train to Altoona, where they were given a reception by Mr. and Mrs. Theodore N. Ely.

MONDAY MORNING SESSION.

At the opening of the Monday morning session the secretary read an abstract of a paper on the "Littoral Movements of the New Jersey Coast," with remarks on beach protection and jetty reaction by L. M. Haupt, M. Am. Soc. C. E., illustrated by maps and photographs. It discussed the subject at length under the following heads: Resultant direction of drift; predominating forces causing movement; angular wave action; reaction *vs.* velocity; normal scum in tidal inlets; enormous deductions; decriptions of special localities. The Node: practical applications; shore protection; insular wave breakers, and reaction.

Discussion.—F. Collingwood: "At Ocean Beach, N. J., I have frequently observed a constant travel of the beach material from south to north: this was also the case during a violent northeast storm."

J. B. Francis: "This wave action was visible at Seabright, N. J., last year, and was not confined to storms, but operated continuously. A similar motion is given to floating objects, which, on a still day, I estimated to move 10 feet a minute."

Prof. O. H. Landreth presented a paper on "The Electric Street Railway System of Nashville, Tenn," in which he noted its remarkably rapid development and extension resulting from the change from mules to electricity. There are now 64 miles aggregate length of track and over 100 cars. The overhead single trolley system was employed. The power developed was 670 nominal electrical horse-power at 500 volts pressure. He described the plant, its details and operation, estimating by three different methods the total amount of power developed, and gave data of the effective power, cost of production, etc.

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* Pages 87, 107, 117, and 150, Vol. XIX.

Discussion.—J. F. Crowell: "Have you worked out the return of power?"

Professor Landreth: "Only by assumed data."

F. Collingwood: "Have they found electricity more economical than mules?"

Professor Landreth: "Yes, greatly. The operating expenses are very little increased, and the receipts are nearly doubled, both by expansion of the line and increased speed, which induces people to ride for pleasure."

Oberlin Smith: "Dynamometer tests of the cars would be valuable. Have any cars been provided with single instead of double motors, and what is the maximum grade?"

Professor Landreth: "The maximum grade is 8 per cent. There are several 6 and 5 per cent. grades."

Mr. Fava: "In Washington, D. C., a new system is soon to be built having a main circuit and local ones with connections about 90 feet apart. This system has given good results on a 2,000 foot line, and is economical in construction, the cable, trolley, wires, yokes, etc., being on top of the ties and very accessible."

C. B. Brush read a communication on "Water-Works" from F. E. Siekels, which consisted mainly of a description, with illustrations, of some important machines, etc., of his construction, including a steam steering apparatus, a machine for cutting holes in pipes, a watertight pressure regulator valve, now in use by the Kansas City Water-Works, and an air vessel for a direct acting pump, designed to secure the best possible vacuum and promote smooth working.

The secretary read a paper N. W. Eayers on "The Ventilation of Tunnels." The author discussed two methods of removing smoke and gases from tunnels, by natural and by mechanical means. The first operates by producing circulation by temperature and barometric differences, and does not influence short tunnels with their ends at the same levels, but where the engine acts notably as a piston. Ordinary ventilation requirements only necessitate the clearing away of smoke in a time less than the headway of trains. The Hoosac Tunnel is the most important example in this country of natural ventilation. It has a shaft over 1,000 feet deep with connecting galleries at the center, and in winter has closed doors at the ends, and near them warming furnaces to prevent freezing of the atmospheric moisture. The St. Louis Tunnel has a ventilation stack 130 feet high, and a fan house and fan near its center. A description was given of their duty and details and of recent anemometer tests of the circulation of the air. In America natural ventilation so far proves sufficient for the mountain tunnels. In Europe artificial ventilation is most developed in England. In the Mersey Tunnel fresh air is admitted at stations from an auxiliary parallel air tunnel, and the circulation is here, as in several other English tunnels, maintained by fans of from 30 to 40 feet diameter. The conclusion was that successful ventilation lies chiefly in keeping smoke and gas out of the tunnel, instead of admitting and then removing it.

The secretary read by title a paper by F. A. Velschow, on "The Cause of Trade Winds." Meteorological changes were explained and illustrated by charts, and the following conclusions deduced: The surface air becomes dry by resting over the large arid zone lying north and south of the equator, and is formed into cushions of dry air which are ultimately thrown westward over the surface of the oceans. By getting cooled down over the sea surface the dry air appears there as centers of high pressure which are kept up or fed by the continual flow of dry air from land which circulates round these centers of high pressure. The trade winds in each of the five oceans is, therefore, each of them one continual current of dry surface air issuing from a dried-up land district lying to the east of them. The direction of the circulation does not depend upon the earth's rotary motion, but upon the interposition of the centers of high pressure and the corresponding dried-up land districts, the former always lying a little further from the equator than the latter.

The secretary read by title a paper by Charles E. Emery, on "Observations on the Forth Bridge," in which the author describes the location and conditions of the bridge, giving principal dimensions and data, and describes details, construction, erection and plant, adding records and diagrams of temperature movements of the trusses.

A paper by Robert Moore, on "Some Experiments on Anchorage of Iron Bolts in Rock," another by Onward Bates, on "Truss Bridges," and another by W. E. Worthen, on "Steam Heating," had been announced, but were not presented to the convention.

The secretary read a paper on "The Turn-Table on the Main Track of the Silverton Railroad in Colorado," by C. A. Gibbs. The author described this railroad as the steepest, crookedest and best paying one in Colorado. It traverses a very rough country, and had to run over a switch back, for whose operation this turn-table in the main track is necessary for the engine. The train runs by gravity both ways to the turn-table.

John Bogart presented a paper and drawings describing the repairing of a break in the Champlain Canal in New York. A small stone culvert with foundations some distance above bed rock, but in apparently good material, carried a little stream under the canal. At this point the vertical wall of the canal on the tow-path side suddenly gave way and was carried out by the water of a four mile level. The break was repaired in the usual manner by a timber crib, puddled and sheet piled, but in a day or two there was another break on the opposite side of the canal, and as the ground under the culvert was evidently honeycombed, sheet piling was driven to refusal across the canal above and below the break and in this section a timber aqueduct was built with vertical walls, wings and a puddle lining, thus bridging the treacherous culvert. In making the concrete used stone was lacking but was replaced by coal from a boat stranded in passing. The work was rapidly executed from materials at hand and has proved satisfactory.

The paper was briefly discussed by P. F. Brendlinger, J. F. Crowell and A. N. Snyder.

The regular papers having been finished A. N. Snyder, C. E., of the Pennsylvania Railroad Company, gave, by request, a very interesting account of the history and construction of the South Fork Dam, illustrating it with maps, profiles and blackboard diagrams. A very animated and interesting discussion followed on the failure of the dam last year and the destruction in consequence of the Pennsylvania Railroad viaduct bridge No 6 in the Conemaugh Valley about two miles below the dam, which W. H. Brown, Chief Engineer of the Pennsylvania Railroad Company, attributed to undermining and failure of one of the abutment foundations which, in compliance with State specifications, had been built on a timber platform which the rebuilding of the structure showed to have been only 4 feet above bed rock. Other opinions were advanced to the effect that the failure was due to the impact of the flood wave, to the ramlike effect of floating debris, etc., and the general theories of flood wave form and motion and the causes and manner of failure of the South Fork Dam, with descriptions of its former and present appearance, were given by J B. Francis, M. J. Becker, P. F. Brendlinger, J. F. Crowell, C. B. Brush, Col. W. E. Merrill, Mr. Snyder and others.

With this session the convention closed.

Monday afternoon many of the members and guests, through the courtesy of the Pennsylvania Railroad Company, took a special train to Altoona and there visited that company's extensive shops, while others made an excursion to the site of the South Fork Dam. Tuesday morning the most of the Eastern members who remained returned by special train to New York.

THE ATTENDANCE.

The following members and guests were present at the convention:

William L. Abbott, Pittsburg, Pa.; W. A. Aiken, Mt. Vernon, O.; Latham Anderson, Miss Anderson, Cincinnati, O.

Max J. Becker and three ladies, Charles Blackwell, W. A. Ballard, A. H. Browne, A. F. Brown, Pittsburg, Pa.; M. F. Bonzano, Mrs. Bonzano, W. H. Brown, Philadelphia, Pa.; G. Bouscaren, Cincinnati, O.; William Henry Baldwin, Mrs. Baldwin, P. F. Breadlinger, Mrs. Breadlinger, Yonkers, N. Y.; W. F. Booth, Poughkeepsie, N. Y.: Charles B. Brush, John Bogart, Mrs. Bogart, Miss Bogart, Miss E. G. Crans, W. A. Brackenridge, New York City; O. F. Balston, Mrs. Balston, Brooklyn, N. Y.; Thomas W. Baldwin, Mrs. T. W. Baldwin, Miss M. J. Baldwin, Miss C. A. Baldwin, Bangor, Me.; M. L. Byers, Mahoningtown, Pa.; A. Bonzano, Mrs. A. Bonzano, Hubert Bonzano, Mrs. Bonzano, William H. Burr, Phoenixville, Pa.; C. Ph. Bassett, Newark, N. J.; John W. Bacon, Mrs. Bacon, Danbury, Conn.; C. M. Bolton, Washington, D. C.

J. Foster Crowell, F. Collingwood, New York City: O. Chanute, Chicago, Ill.; W. C. Cushing, Zanesville, O.; Amory Coffin, Mrs. Coffin, Phoenixville, Pa.; H. Wadsworth Clarke, Syracuse, N. Y.; Mendes Cohen, Mrs. Cohen, Miss Cohen, John Cassard, Baltimore Md.; Miss R. H. Cole, Boston, Mass.

Harry G. Darwin, Stancliffe B. Downes, Miss Bazena T. Downes, New York City; Paul Didier, Charles Davis, Miss A. H. Davis, Allegheny City, Pa.; F. G. Darlington, Mrs. Darlington, Indianapolis, Ind.; John B. Duncklee, Mrs. Duncklee, Washington, D. C.; James G. Dagron, Baltimore, Md.; J. M. Davis, Philadelphia, Pa. Charles B. Dudley, Altoona, Pa.; G. S. Davison, Mrs. G. S. Davisson, A Dempster, A. Dempster, Jr., Pittsburg, Pa.

Theo. N. Ely, Altoona, Pa.; Henry T. Eddy, Cincinnati, O.

James B. Francis, Lowell, Mass.; Frank L. Fuller, Mrs. Fuller, Boston, Mass.; Desmond FitzGerald, Brookline, Mass.; J. Foster Flagg, Brooklyn, N. Y.; Burr K. Field, East Berlin, Conn.: Clark Fisher, Trenton, N. J.; E. Fisher, Mrs. Fisher, Detroit, Mich.; W. L. Ferguson, Baltimore, M. D.; A. P. Folwell, A. Fteley, New York City; F. R. Fava, Jr., Washington, D. C.

Charles E. Goad, Toronto, Can.; Bernard R. Green, Washington, D. C.; Miss E. L. Griffen, Phœnixville, Pa.; Edward B. Guthrie, Mrs. Guthrie, Buffalo, N. Y.; Carl Gayler, St. Louis, Mo.

S. S Haight, Samuel Garlton Haight, West Farms, New York City; Clemens Herschel, Mrs. Herschel, George R. Hardy, Mrs, Hardy, New York City; K. Emil Hilgard, Cincinnati, O; Caspar Wistar Haines, Mrs. Haines, Miss Haines Philadelphia, Pa.; Peter C. Haines, Washington, D. C.; W. M. Hughes, Alfred E. Hunt, Mrs Hunt, Pittsburg, Pa.; A. C. Hippey, Altoona, Pa.; R A. Hale, Mrs. Hale, Lawrence, Mass.; W. E. Hoyt, Rochester, N. Y.

Thomas H. Johnson, Mrs. Johnson, Pittsburg, Pa.; C. L. Johnson, Albany, N. Y.; J. B. Johnson, St. Louis, Mo.

William B. Knight, Mrs. Knight, Kansas City, Mo.; Walter Katté, Mrs. Katté, Miss Katté, New York City; George W. Kittredge, Gustave Kaufman, Pittsburg, Pa.; Paul S. Kiny, Buffalo, N. Y

Thomas D. Lovett, Cincinnati, O.; Albert R. Leeds, Hoboken N. J.; Olin H. Landreth, Nashville, Tenn.; Thomas B. Lee, New York City; D. Jones Lucas, Mrs. Jones, Philadelphia, Pa.; W. B. Leeds, Mrs. Leeds, Richmond, Ind.

Henry C. Meyer, T. Spencer Miller, Lincoln Moss, Mrs. Moss, New York City: T. H. McCann, Hoboken, N. J.; H I. Miller, Mrs. Miller, Louisville, Ky; Henry G. Morris, Mrs. Morris, Stephen Morris, Philadelphia, Pa.; William Metcalf, Mrs. Metcalf, Pittsburg, Pa.: H. D. Morse, Wilmington, Del.; W. E. Merrill, Mrs. Merrill, Cincinnatti, O.; R. H. McKee, Washington, D. C.: Mace Moulton, East Berlin, Conn.

George B. Nicholson, Covington, Ky.; Edward Nichols, Pittsburg, Pa.

F. S. Odell, Mrs. Odell, New York City; Frank C. Osborn, Cleveland, O.; W. A. Osbourn, Buenos Ayres.

Robert E. Pettit, Altoona, Pa.; Henry G. Prout, New York City; Charles Paine, Robert Pitcairn, Pittsburg, Pa.; W. A. Pratt, Wilmington, Del.; John A. Partridge, Washington, D. C.; George W. Parsons, Mrs. Parsons, Harrisburg, Pa.; W. A. Pike, Minneapolis, Minn.

P. C. Ricketts, Troy, N. Y.; Thomas Rodd, Pittsburg, Pa.; J. R. Richards, Mrs. Richards, Boston, Mass.; Percival Roberts, Jr., Philadelphia, Pa.; J. Ramsey, Jr., Cincinnati, O.; Benjamin Reece, Chicago, Ill.

William P. Shinn and Miss L. A. Meade, R. H. Soule, Pittsburg, Pa; Henry B. Seaman, Brooklyn, N. Y.; Frank W. Skinner, Horace Skinner, New York City; C. C. Schneider, Mrs. Schneider, Mrs. W. J. Cole, S. L. Smedley, Miss J. L. Smedley, Philadelphia, Pa.; Oberlin Smith, Mrs. Smith, Bridgeton, N. J.; J. Parker Snow, Woonsocket, R. I.; C. L. Stroebel, Chicago, Ill.; J. Guilford Smith, Mrs. Smith, Buffalo, N. Y.; Reuben Shirreffs, Paterson, N. J.; F. L. Sheppard, Altoona, Pa.; R. B. Stanton, Denver, Col.; Henry Szlapka, Phœnixville, Pa.

John Thomson, Mrs. Thomson, Stevenson Towle, L. L. Tribus, Calvin Tompkins, G. H. Thomson, A. W. Trotter, New York City; Bushrod W. Taylor, Mrs. Taylor, Louisville, Ky.; George E. Thackray, G. E. Thackray, Mrs. G. E. Thackray, Johnstown, Pa.; E. B. Taylor, Mrs. Taylor, Pittsburg, Pa.; M. M. Tidd, Miss A. S. Tidd, Boston, Mass.; M. W. Thomson, M. Trump, Altoona, Pa.; T. K. Thomson, Ceredo, W. Va.

Joseph Wood, B. L. Wood, Jr., W. G. Wilkins, Mrs. W. G. Wilkins, Victor Wierman, Pittsburg, Pa.; A M. Wellington, New York City; Fred. C. Weir, Cincinnati, O.; J. Elfreth Watkins, H. M. Wilson, Washington, D. C.; D. J. Whittemore, Mrs. Whittemore, Milwaukee, Wis.; F. M. Wilder, Indianapolis, Ind.

ENDURANCE OF IRON IN THE KIEFF BRIDGE.

IT appears by the excerpt minutes of proceedings of the Institution of Civil Engineers that tests have recently been made of wrought iron links that were used 40 years in the Kieff Suspension Bridge, and also of spare links manufactured with those put in the structure but never used. The members were 1 by 12 inches and 12 feet long, and four specimens (A) 1 by 1⅛ by 8 inches were cut longitudinally from a link taken from the structure, and as many (B) from one of the unused duplicates. A 4-inch tranverse test piece (C and D) was also cut from each member.

Single tests of C and D and the means of four tests each of A and B gave results as follows:

Specimen	Tons per Square Inch.		Per cent. of Elongation.	Per cent. of "Contraction."
	Tensile Strength.	Elastic Limit.		
A	21.8	11.1	14.05	17.35
B	22.2	11.93	13.42	18.75
C	14.9	.....	2.1	1.6
D	17.32	.....	6.0	6.8

DESIGNS FOR THE GREAT LONDON TOWER.

THE Committee of Award in the competition for designs for a great tower in London, instituted by the Tower Company, has made its report, giving the first and second prizes to the designs shown in the accompanying illustrations and numbered, respectively, 1 and 2. A third design, given honorable mention, was that of Max am Ende, illustrated in the issue of this journal of May 17.

The design shown in Fig. 1, submitted by A. D. Stewart, M. Inst. C. E., J. M. MacLaren and W. Dunn, A. R. I. B. A., all of London, and awarded the first prize of 500 guineas, is for a tower 1,200 feet high, having an octagonal skeleton 300 feet in diameter at the base. It is to be of steel throughout, and fitted with elevators to the top.

The design given the second prize of 250 guineas, submitted by John L. Webster, M. Inst. C. E., and J. W. Haigh, both of Liverpool, is for an octagonal steel tower 1,300 feet high, with a base 470 feet in diameter. Hydraulic elevators are included, and the lower part of the tower and upper platforms are provided with buildings for residences and other purposes.

The illustrations and data are from London *Industries*. The report of the committee to the Tower Company is as follows:

Gentlemen:—Having completed our investigation of the competitive designs for the proposed tower, we now submit our report. Invitations to compete were advertised on October 23, 1889, and 68 designs were sent in. We met to consider these designs for the first time on March 15 last. Every drawing has been carefully examined by the majority of the committee repeatedly, and while on exhibition at the Drapers' Hall (where the fullest opportunity was afforded of comparing the respective designs), we devoted an entire day there to the work, and throughout have given the most detailed consideration to the question before coming to a final decision as to the award of prizes. The designs were of very varying merit, and although there were good points about many of them, we must confess to a feeling of disappointment on the whole as to the result of the competition, there being no single design which we could recommend as it stands for execution. In justice to the competitors, it must be remembered, however, that the existence of the Eiffel tower and the desire to avoid imitations necessarily considerably enhanced the difficulties of the problem, because in the Eiffel tower the most natural and obvious way of combining economical construction and suitable architectural effect had already been appropriated. As a result some of the designs submitted were wildly eccentric or extravagant, while others were marked by an entire absence of architectural merit.

We found little difficulty in eliminating the larger proportion of the designs, but the final award was not arrived at without repeated and prolonged consideration. Confining ourselves to the designs properly worked out by competent men, we found that, in some cases, the chief consideration had been given to economical construction and in others to architectural effect In other words, some designers approached the problem from the point of view that the main thing was to get 1,200 feet above the ground with a form of tower which, having a fairly good outline, was specially adapted to resist wind pressure and other stresses with the minimum weight of steel, while others adopted the opposite view, namely, that the primary object was to get the best architectural effect without special regard to economy in construction or general practicability. In comparing the designs, we endeavored to do the competitors justice by judging of the merit of their work from the point of view adopted by themselves, and we also gave weight to the amount of time and care which had been devoted to the elaboration of the designs and calculation of tresses and estimates. After very careful consideration, we have decided to award the prizes as follows: First prize (500 guineas), to Messrs. A. D. Stewart, J. M. MacLaren and W. Dunn, 21 King William Street, Strand, joint authors of design No. 37; second prize (250 guineas), to Messrs. J. J. Webster and T. W. Haigh, 67 Lord Street, Liverpool, joint authors of design No. 51.

It is unnecessary for us to set forth the reasons of our decision in detail or to classify in the order of merit designs for which no prizes are available, but the committee desire to state that they consider the design No. 50, by Mr. Max am Ende, deserves honorable mention.

We are, gentlemen, your obedient servants,

E. H. CARBUTT, Chairman,
FREDERICK BRAMWELL,
B. BAKER,
E. J. HARLAND,
ALEX. B. W. KENNEDY,
C. LIDDELL,
J. F. MOULTON,
THOMAS VERITY.

JUNE 17, 1890.

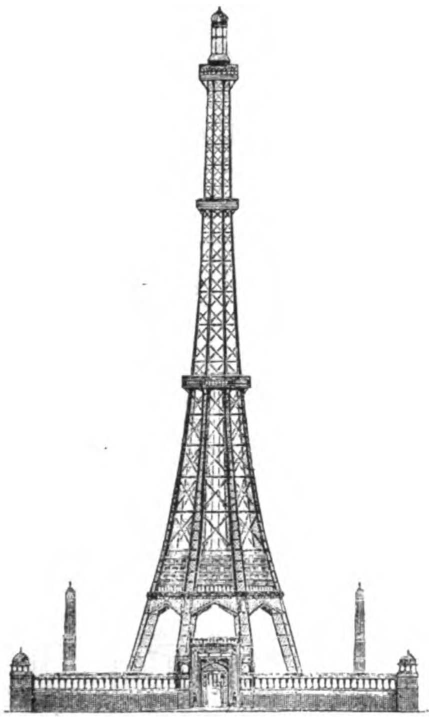

FIG. 1.

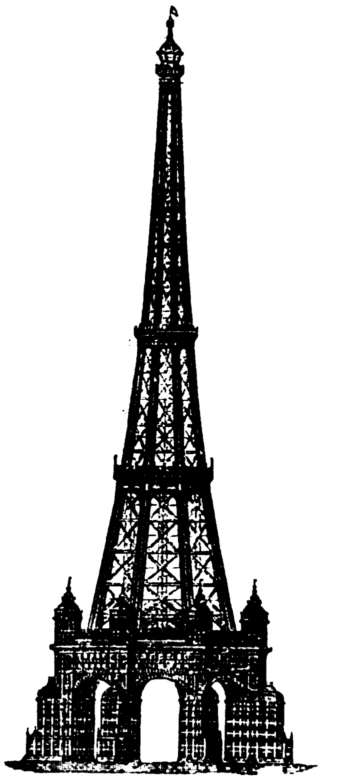

FIG. 2.

PRIZE DESIGNS FOR A TOWER IN LONDON.

WATER-WORKS FOR GALT, ONT.

WILLIS CHIPMAN, civil and sanitary engineer, of Toronto, Ont., has just made a report to the Mayor and Council of the town of Galt, Ont., on a proposed system of water-works. After reviewing the various sources of supply he advocates Sudden's Lake as the source, to be supplemented from springs when the necessity arises. This contemplates a gravity system, as the elevation of the lake is sufficient to give a pressure of fifty pounds to the inch. He thinks that ultimately it will be necessary to put in pumping machinery to maintain a sufficient fire service. The estimated cost of the work is $125,000, made up as follows: Distribution system, $70,000; purchase and improvements, $3,000; 16,000 feet of mains $32,000; building, $6,000; pumping machinery and boilers, $5,000; engineering and contingencies, $9,000. Mr. Chipman commends the authorities for deciding to build the works themselves and publishes a table of towns in Ontario that have their own works "as an investment, and are paying good dividends."

IMPROVEMENT WORKS ON THE RIVER RHONE.*

THE works described in these articles are still in progress, but as portions of them have been in existence some time and stood the test of both floods and droughts, the success of the complete scheme seems assured, and the author thinks a similar course of treatment applicable to other similar rivers.

The course of the river is divided into three sections:
(1) Above Lyons 120 miles not navigable.
(2) Below Lyons to Arles, 175 miles, navigable.
(3) Below Arles to the sea estuary, 30 miles, navigable.

The regime of the river is described in considerable detail. The main feature of it is the fact that very heavy floods occur from the melting of the snows of the Swiss mountains where the main stream takes its rise, modified by the fact that the principal affluents are not snow-fed, and therefore do not coincide with the main stream in their periods of flood. The bed of the river is of gravel easily eroded, varied at a few points by isolated rocks emerging from the bottom. Until the new works were undertaken, every flood led to a new channel being opened in one part or another of the stream. The object of the work has been to fix the channel of the river and put an end to erosion of the banks and bottom, and the result has so far been most satisfactory. A longitudinal section of the river in any part shows an alternation of deeps and shallows, the deep occurring in the middle of a curve (in plan) at its outer side, and the shallow at a point of inflexion between two successive curves. The author explains how isolated dredging in the shallows reduces the level of the reach above, and generally tends on the whole to reduce the navigable depth rather than increase it. Illustrations are given of the very large variations in velocity of flow that exist in short distances depending on the changes of depth, the curvature of the channel, and other causes, and of the tendency of these variations to disappear as the river rises. The effect of dredging in one of the shallows is to lower the water level and diminish the velocity at that point, and the lowering of level extends through the next reach upwards to the nearest shallows above at which the slope and velocity must therefore be increased and the depth of water diminished. Similar effects are shown to follow in many cases from an isolated embankment narrowing the stream in a shallow. The first effect is of course to raise the level in the shallow. This increases the velocity and sets up an erosion of the bottom which goes on till equilibrium is restored. The net result is a water level which will in general be lower than the primitive level over a great part of the distance affected by the training wall and a diminished depth of water for navigation. As an illustration of these effects a description is given of a certain length of about six miles of the Rhone, on which various isolated embankments were made at different times, between 1858 and 1874, showing that while the immediate effect was beneficial, the indirect results were such as to diminish the available depth in the end. It is seen therefore to be essential, in disturbing the conditions of a river bed liable to erosion, to determine what the condition of equilibrium will be after the new works have produced their full effect, and to make sure that a remedy directed to a specific evil will not produce greater evils elsewhere.

Correspondence.

Communications giving information or opinions on matters of general interest to the engineer, the architect, the contractor, or the municipal officer, will be welcomed in this column. Fairness will suggest that when communications are sent simultaneously to this and other journals we should be informed of it at the time. Anonymous letters will not be noticed.

LAKE CURRENTS AND SEWAGE DISCHARGE.

To the Editor of THE ENGINEERING AND BUILDING RECORD:

SIR: The preliminary report of Mr. Rice, late City Civil Engineer of Cleveland, on current observations in Lake Erie is of more than ordinary interest because the subject of lake currents has not received much attention, and a great deal of the experience is either fragmentary or not published. Four years ago a similar series of experiments (results not published) was made in Lake Michigan opposite Chicago to ascertain the probable dispersion of sewage if discharged into the lake. Generally three floats were used at each station, one at the surface, another at mid-depth, and a third near the bottom. A large number of bottle floats were also used, single and double, the lower one at the starting point being placed 10 to 20 feet deep. The general results were similar to those since found at Cleveland. Unless affected by local irregularities of the shore the currents were found to go substantially with the winds in water of moderate depth, and to respond quickly to any change. In deep water the surface currents also soon changed with the wind, but those at mid-depth and at the bottom did not generally partake of the same motion, sometimes being more than 90 degrees different, which is probably due to the equalization caused by the heaping of the water on the lee shore. Inasmuch as the lake currents are so variable we can, for purposes of sewage disposal, rely only upon dispersion and dilution of the foul matter, but not upon absolute removal from any given localities. Mr. Rice's suggestion of ponding the sewage near the shore during unfavorable winds is a new one I think. Undoubtedly the expedient would be efficient in many instances, although it might cause some deposit. It is conceivable, however, that the large area or mass of ponded diluted sewage, after flowing into the lake, could, by a sudden return of the unfavorable wind, reach the water intake in a less desirable condition, because less dispersed, than if the sewage had been continuously discharged into the currents passing the head of the proposed embankment. It seems to me that the least objectionable method of discharging sewage into our lakes is to screen it thoroughly, if no better partial purification can be afforded, to get it into currents as soon as possible, and to keep the outfall as far from the water intake as as local conditions and finances will show to be prudent.

RUDOLPH HERING.

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* A paper by L. Clavard in *Nouvelles Annales de la Construction* abstracted in Excerpt Proceedings of the Institution of Civil Engineers

BUILDERS' AND CONTRACTORS' ENGINEERING AND PLANT.

No. XCV.

(Continued from page 408, Vol. XXI.)

REINFORCING AN IRON FLOOR.

FIGURE 1 is a diagram of the iron work of an upper floor in a large sugar refinery.

N N are cast-iron columns carrying the longitudinal girders N N, etc., which support the transverse girders K K, etc., on which the wooden floor is laid.

Figure 2 shows elevations of some of these transverse and longitudinal girders with loads concentrated on the iron pedestals J J. All these original girders were 15-inch 200-pound rolled beams, and were in nearly every case used in pairs. A few single beams were used, but they are not distinguised in Fig. 1, where all the original girders are shown by full double lines for uniformity. This floor was very heavily loaded, and after a time it was determined to reinforce it with additional beams, which were required to be set without disturbing the floor and could not much diminish the headway of the story below.

Under these conditions it was decided to support each transverse girder K at its center by longitudinal beams, A A, etc., and B B, etc., which are carried on cross-girders connected to the old longitudinal girders L L, etc., very near the columns.

If the load had been uniformly distributed, each girder K would have been relieved of one-half its total load, and three-fourths of the maximum bending moment; the loads being, however, irregularly concentrated, the results were not exactly in this ratio, but were in most cases nearly as good.

In the case of each longitudinal girder L, about half the load was removed from its bearing with K, and returned at a point as close as possible to the end, thus greatly reducing its bending moments. All the new girders are shown by single broken lines. A A, etc., and B B, etc., are all 20-inch steel I-beams, weighing 272 pounds per yard. A A, etc., are shown in Fig. 8; they are set parallel to the old girders L L, etc., and with their upper flanges in a horizontal plane about ½-inch below that of the top flanges of the girders L L, etc. They are connected to the webs of the new cross-girders by the angles M and M. B B, etc., are the same as A A, etc., except that the angles M are omitted at one end, which has a bed plate for bearing on the wall.

The new cross girders C^1, C^1, D, E, H, I, O, P, P^1 and Q, shown in Figs. 3 to 7, inclusive, are set with their top flanges in the horizontal plane of the top flanges of A and B.

Figure 3 shows an elevation of the girder D and sections at Z Z and Y Y.

Figure 4 shows a end and side elevations and section at Z Z of the girder H.

The girders I are like H (Fig. 4), except that one end is made as shown in Fig. 5 so as to rest on the wall. The girders E are like D (Fig. 3), except that one end rests on the wall and is made similar to that shown in Fig. 5. The girders C^1 are like H (Fig. 4), except at the center, which is made as shown in Fig 6. The girders C are like the girders C^1, except that the brackets S S are omitted. The girders P^1 and P are like the girders C^1 and C, respectively, except that one end is made as in Fig. 5. The girder Q is like the girders H (Fig. 4), except that the center is as shown in Fig. 7. The girder O is like the girders C (Figs. 4 and 6), except that one end is made to rest on the suspended seat shown in Fig. 9, where the new cross girders are supported by the old longitudinal girders L, L, etc., they rest on their lower flanges, to which they are accurately fitted by the heavy plates A A (Figs. 3 and 4), shaped in a cast-iron former to exactly fit the angle and fillet of the flange.

After the new girders were all set very careful diagrams were made showing the deflections of the old girders and the clearances between the girders A and the girders K (which was intended to be about ½ inch) at their intersections. It was then calculated what the deflections of both would be under the required distribution of load, and they were sprung apart by 10-ton hydraulic jacks until the clearances between the lower flange of the girder K and the upper flange of the girder A at their intersection equaled their original clearance, plus the required deflection of A plus the difference between the original and readjusted deflection of K. Wrought-iron shims of the exact required thickness were then inserted between the girders K and A, and, the jacks being removed, the girders adjusted themselves to the required loading.

In most places the jacks were applied as shown in Figs. 11 and 12.

Figure 11 is an elevation at V V, Fig. 12, and Fig. 12 is a section and elevation at W, X, Y, Z, Fig. 11. Four pairs of angles C C were placed as shown with one flange vertically against the web of the girder A; the other flanges were milled to exactly fit the lower flange of the girder A at P P, and were connected by cross angles B B, fitting snugly at the top and bottom of A. Brackets D D were riveted to the angles C C, etc., and received the suspenders E E that supported the platform beams F and G on which were carried the hydraulic jacks J J, whose tops engaged the girder K. H H were spacing pieces. As the pistons of the jacks were pumped up they separated the girders A and K* until the shims could be inserted, after which the pressure was removed and the jacks and attachments taken to another point.

A different arrangement was required at the points T, T, T and T (Fig. 1), where each load taken from the old girders K, K, etc., was to be transferred to two new cross girders which received it from a section (A^1) of the girder A that was so short that there was not room for the above described arrangement, and one shown in Figs. 13 and 14 was adopted.

Figure 13 is a section and elevation at V V, Fig. 14, and Fig. 14 is a section and elevation at Z Z, Fig. 13.

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* There was an initial clearance between these girders which is, for convenience, omitted in all the illustrations.

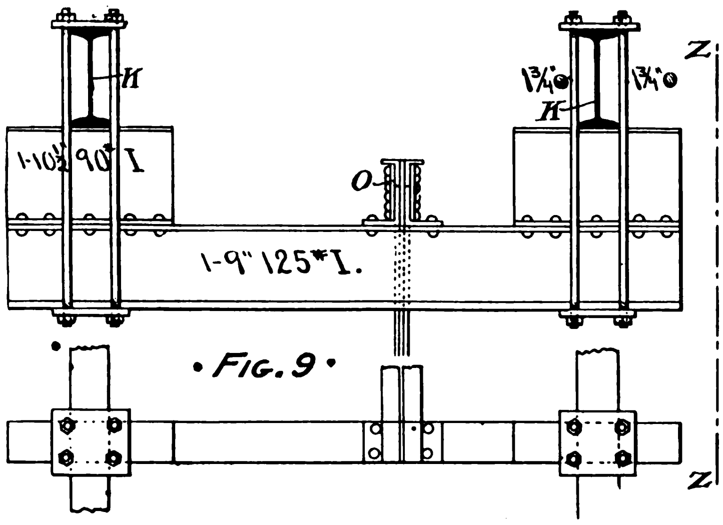


FIG. 9

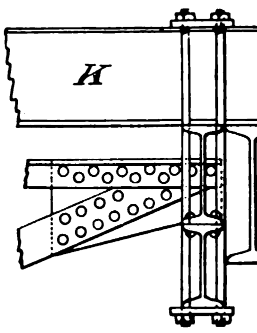


FIG. 10

REINFORCING AN IRON FLOOR

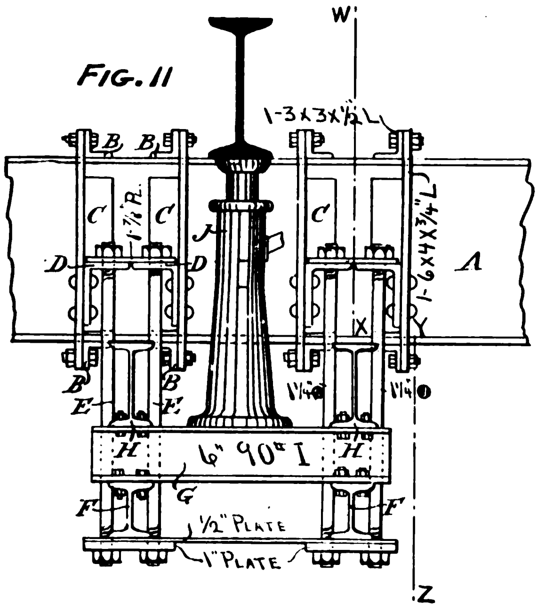


FIG. 11

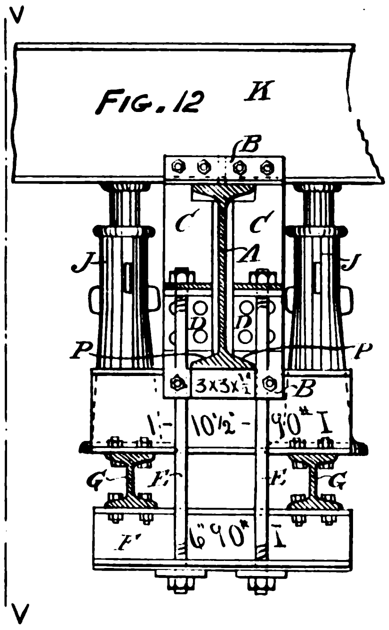


FIG. 12

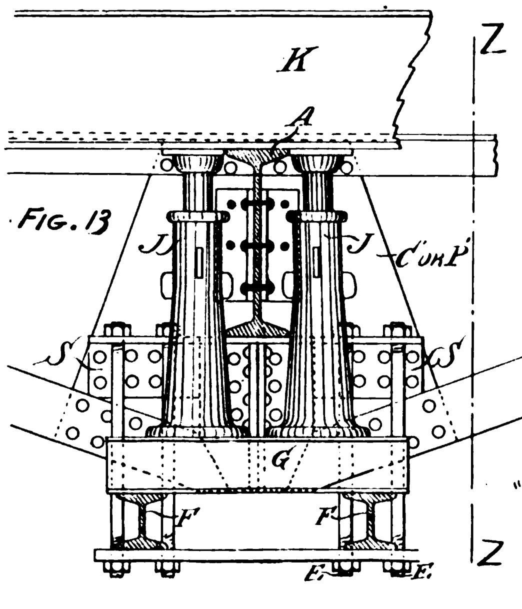


FIG. 13

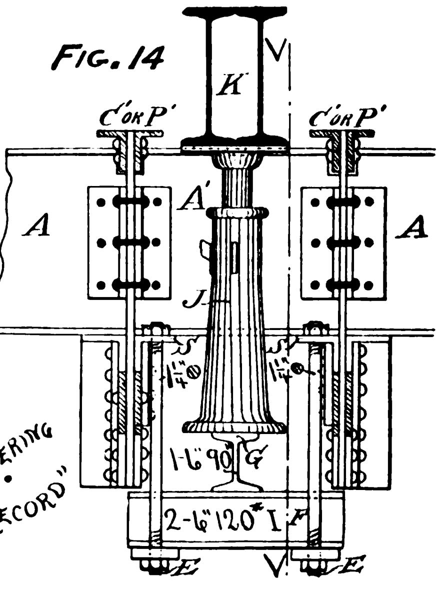


FIG. 14

"THE ENGINEERING • AND • BUILDING RECORD"

Here both jacks J engaged the twin girder K and were seated on the platform beam C that was supported by eight suspender rods E E from the brackets S S riveted to the webs of the new cross girders. In this case, therefore, when the jacks were operated they did not react on the short girder A^1 but caused direct deflection in the new cross girders C^1 and P^1 and in the old girder K.

This reinforcement work was designed and executed by the New Jersey Steel and Iron Company, of Trenton, N. J., which furnished data from which the above description and illustrations have been prepared in the office of this journal.

WATER SUPPLY AT NEW ORLEANS.

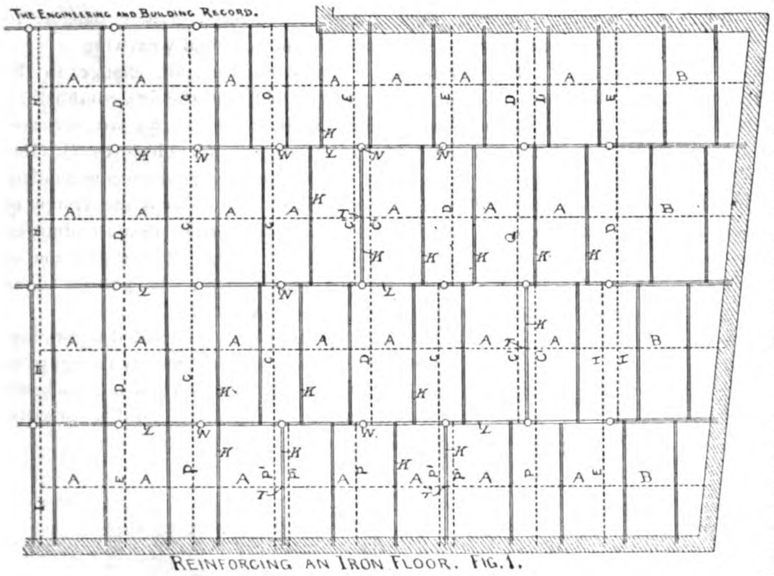
ACCORDING to the recently issued report of the Louisiana State Board of Health for 1888 and 1889, the chief source of water supply in New Orleans is the overground cistern. These cisterns vary in capacity, the smallest holding 1,000 gallons, and the largest from 18,000 to 22,000 gallons. The Charity Hospital has 14 cisterns which aggregate 200,000 gallons. These cisterns are made of cypress staves, belted together with strong iron hoops, and are generally covered on the top to protect their contents from the soot and dust of the atmosphere. A great deal of the latter, however, is swept into them by the first rain after a drought, necessitating frequent cleansing.

In a large portion of the city, particularly the upper districts, Algiers and the suburbs, there are no water mains, and the cistern and well are the only sources of water supply. It is the custom for many families to filter the cistern water, but the majority drink it fresh from the tank, and although impurities occasionally find their way into this water it may be stated that as a general rule this water is healthy and sweet to the taste. Indeed, if the "cut-off," which is sometimes used to receive the first impure washings of the roof, could be put into general use, the water supply, it is thought, would be more wholesome than any other obtainable. The inability to construct underground cisterns in the city is looked upon as a God-send to the people, and it is considered due to this fact that typhoid fever is there so rare a disease.

The hydrant, which supplies river water from the Mississippi, is in common use in the thickly populated districts. This water is used for drinking purposes by many, but its thick sediment of grayish mud is said to preclude it from general use until after the latter has been separated from it. This is not considered as safe or as healthy a water for drinking purposes as cistern water, though there is no evidence that it has ever been the means of spreading epidemic disease.

Among wells, the artesian, driven and dug wells are used for drinking purposes, though there is a law prohibiting the use of dug wells for anything but cleansing purposes. Frequent attempts have been made to enforce this law, and though public opinion is gradually coming to appreciate its meaning, it is stated that a sanitary force fifty times as great as that now available would be powerless to prevent the drinking of the water as long as a well is allowed on the premises.

Many premises contain both hydrants and cisterns, and these are about as numerous as those which contain hydrants alone. The proportion of premises that have cisterns only is to those that have hydrants only as ten to one, a serious preponderance in seasons of long drought.



REINFORCING AN IRON FLOOR. FIG. 1.

Novelties.

Devices are described under this head purely and strictly as news; because believed to be new and calculated to interest readers.

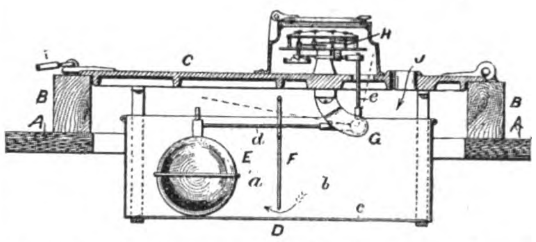
In no case is pay accepted, directly or indirectly, for publishing a novelty notice.

As the subjects are selected for their supposed novelty and interest merely, it will, of course be understood that the selection does not imply indorsement.

WATER CART REGISTER.

THE water cart register illustrated herewith is the invention of S. A. Charles, Superintendent of the Lexington Hydraulic and Manufacturing Company, of Lexington, Ky., and is used upon all watering carts in that place. The device is to be manufactured by the Hersey Meter Company, of South Boston, Mass., and consists of a framework shown in the sketch, marked B, upon which is hinged a cast iron cover C. To the under side of this is attached a pan D, divided into two compartments *a* and *b*, by a partition F, sufficiently removed from the bottom of the pan to allow communication between the two compartments. In the compartment *a* is a copper float E, resting upon the bottom of the pan, and connected by means of a rod *d*, so that it has a fulcrum in a casting G. This rod is extended at the other end of the fulcrum, as shown at *e*, and is connected with a registering mechanism H so that upon the lifting of the float the hands of the registering mechanism are moved so as to indicate the lifting. Directly over the compartment *b* is an inlet hole J in the casting through which the water is directed to the pan.

Water Cart Register



The whole device is mounted upon the watering cart, which is represented at A A, so that the float pan hangs

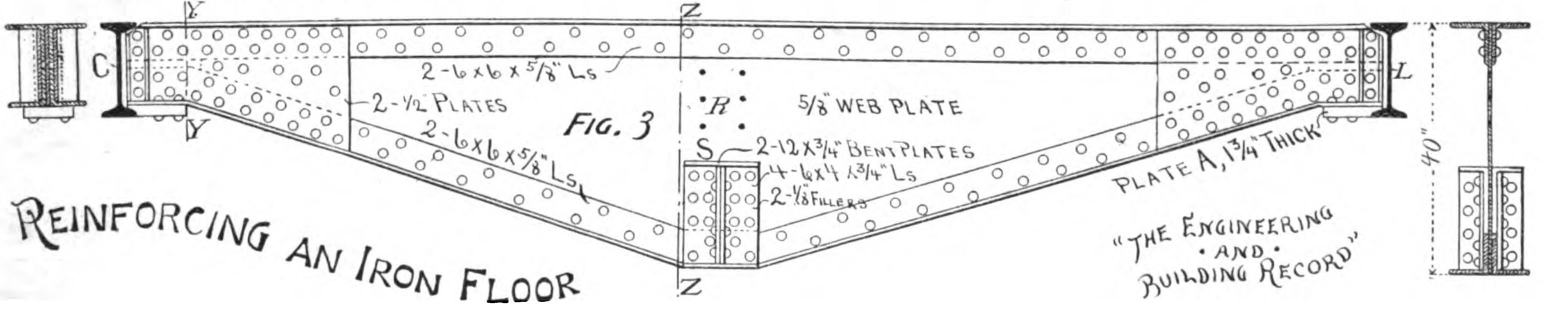


FIG. 3

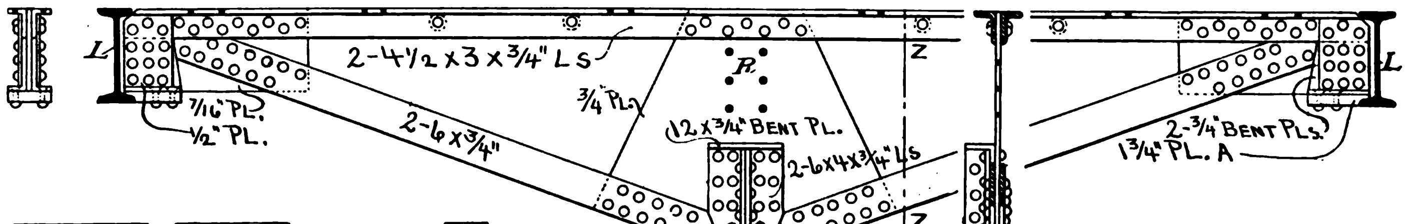


FIG. 4

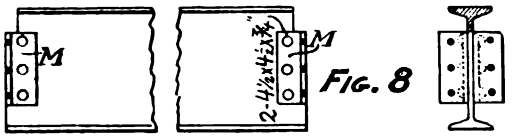


FIG. 8

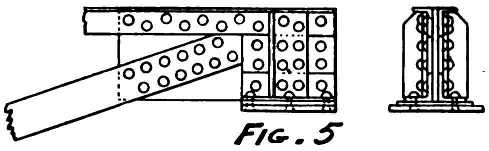


FIG. 5

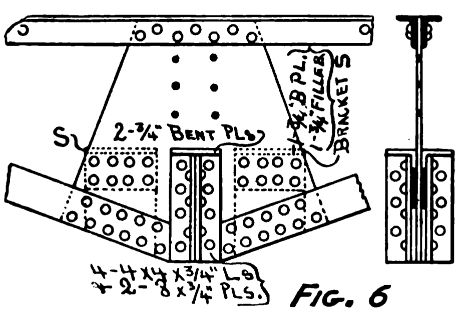


FIG. 6

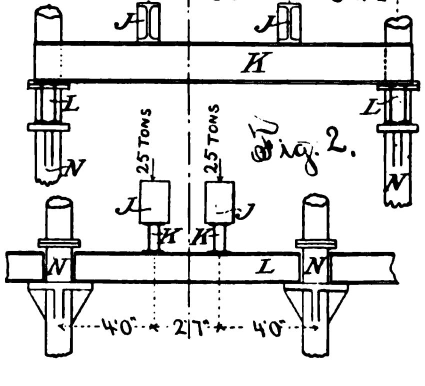


Fig. 2.

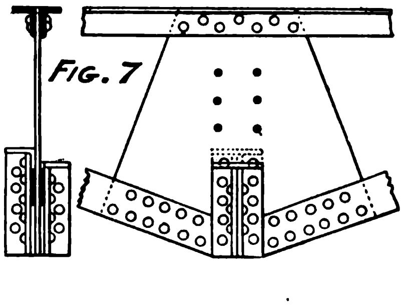


FIG. 7

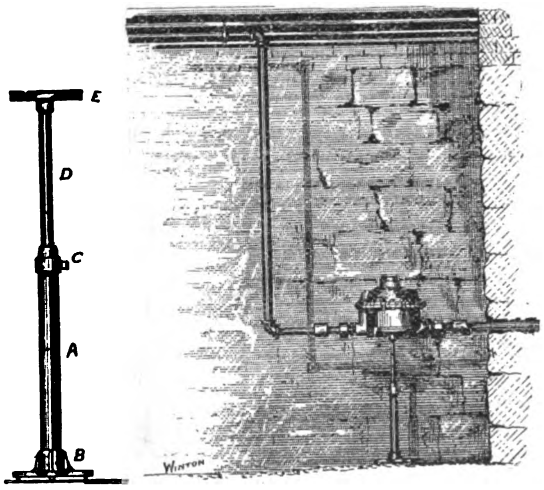
in the cart. The operation of the device is as follows: The supply pipe for filling the tank is placed in the inlet hole J on the top of the casting, allowing the water to pass into the compartment *b*, whence it passes into the compartment *a*, and lifts the float, which causes the register to indicate the inlet of the water. When the pan is filled it overflows into the cart over the sides, and so long as the supply pipe remains, the cart will continue to fill through the overflow of the pan. When the supply is cut off the water remaining in the pan will gradually drain out through several small holes indicated at *c*, and allow the float to return to its normal position. It will be seen that it is impossible for the cart to be filled without recording upon the register. It is necessary that the cart be completely filled each time or it would be to the detriment of the one taking the water. The department knowing the capacity of the tank, and taking the readings of the register, determines exactly the amount of water used by the several carts, and makes the rates accordingly.

The cover upon which the device is secured is locked by a padlock, as shown at *i*, the key of which is retained by the department. The inlet passage J being the only place at which the cart can be filled it is impossible for water to be obtained by the driver of the cart without proper record of it. The cover is large enough to admit of a person getting into the tank, if it requires to be cleaned out, and the whole registering mechanism can be lifted out of the tank with the cover.

ADJUSTABLE WATER METER SUPPORT.

The adjustable water meter support shown in the accompanying illustration was designed by the Hersey Meter Company, of South Boston, Mass., and exhibited by them at the recent Portland meeting of the New England Water-Works Association.

The device consists of a piece of pipe A, to which is secured a casting B, which forms a foot. Upon the other end of the pipe is a casting C, through which a smaller pipe D slides. This smaller pipe has secured to its upper end a casting E, shaped to receive a meter and hold it firmly. The smaller pipe is adjustable up and down, to accommodate meters set at different heights, and is secured by the set screw C.



ADJUSTABLE METER SUPPORT

The device is intended to be used in places where a meter is hung in the pipe, as shown in the sketch, to relieve the weight of the meter from the connections and pipe. It is a simple and neat substitute for a wooden shelf or bracket which it is frequently necessary to build in cellars and other places where meters are set.

THE OTIS ELECTRIC ELEVATOR.

An electric elevator has just been placed on the market by Otis Bros. & Co., of New York City, which is said to be well suited to many places where it has heretofore been impracticable to use such an apparatus. The winding machinery and safety appliances are such as they have been using for many years, but the motor, of which Rudolph Eickmeyer, of Yonkers, N. Y., is the inventor, possesses many novel features and was specially designed for elevator service.

Among the advantages claimed for electric power generally and for this motor in particular are its safety, simplicity, efficiency, the absence of noise, smell, smoke, ashes and heat and freedom from liability to damage by frost or by careless manipulation.

Referring to the illustration, A is the car with the usual safety attachments, running in guides B B and supported by the hoist ropes C C. The other ends of these hoist ropes C' C' wind on drum D from whose opposite side at the same time unwinds the counterweight rope X. E is the hand rope by which the motion of the car is controlled. Its two ends E^1 and E^2 wind on opposite sides of wheel H, which by arm I throws shifting bar M. This by arm Y and the sector and pinion motion at L operates the switch at S which cuts off or changes the direction in the motor Q of the electric current that enters and departs through wires F. When bar M is in mid position the elevator is stopped and the notch N permits roller R to drop into it and weight W on lever Z then applies brake O to the motor shaft, which is not shown. This shaft has an end bearing at P and carries commutator L, passing through motor Q, by which it is driven, and casing T it ends in box U where it carries an endless screw or worm which drives a worm gear in casing V. This gear is attached to the hoisting drum and so operates the elevator.

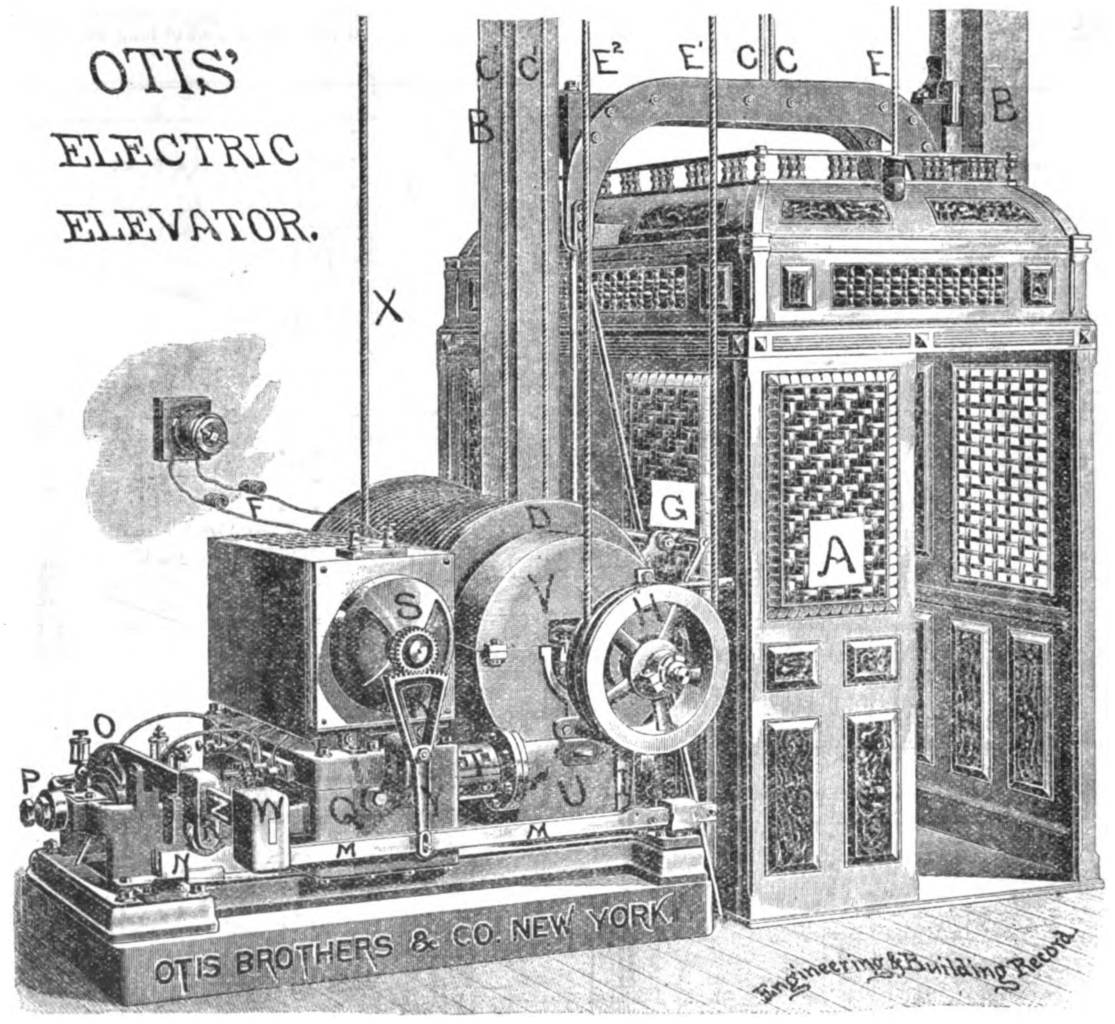
Wheel H is carried loose on the end of the drum shaft, but when the latter has made a certain number of revolutions either way wheel H is carried with it and thus automatically stops the car at either end of its travel.

At G is shown a part of the slack cable stop by which, should the car ever get stuck while descending, the machinery would be instantly stopped and injury to it and the cables prevented.

When it is desired to start the elevator up or down a pull on the hand-rope E, which passes through the car, by the mechanism before described moves shifting bar M, which by moving notch N lifts roller R and weight W and releases brake O, while at the same time the switch sends the electric current to the motor in the desired direction.

If the attendant in stopping the elevator should not get the switch in mid position and by leaving a slight contact run the risk of burning the switch, an alarm or "buzzer" in the car will warn him of the danger, and its noise can only be stopped by getting the switch exactly in the middle so as to cut the current entirely off.

A special attachment causes the electric current to be gradually turned on or off so as to avoid any shock in starting or stopping, and the motor is so arranged as to operate at a uniform speed in either direction and at the same time to avoid waste of power by automatically adjusting the strength of the current to the work to be done, while its external magnetism is so slight that a watch may safely be laid on its casing.



SANITATION IN MELBOURNE.

A royal commission appointed two years ago to investigate the sanitary condition of Melbourne, Australia, has just made its final report, accompanied by reports of three engineers submitting sewerage schemes. Melbourne itself has but about 76,000 population, but, including suburbs, which are practically a part of the town in sanitary matters, it has over 420,000 people. All drainage is into the Yarra River, which winds through the city and suburbs, and the stream is further contaminated by refuse from abattoirs, tanneries, etc., on its banks. The drainage is by open channels in the streets, and even this primitive system is very imperfect. The report says that in many sections the liquid house refuse is allowed to largely lose itself in the soil, that the channels are imperfect and the sewage is everywhere polluting the ground, heavy rains make the nuisance from overflowing very troublesome, and to modify this crude underground drains have been constructed in some places, but it is questionable whether the remedy so applied does not involve greater dangers to health than the open nuisance originally existing.

The commission recommended certain changes in the pan system for temporary relief, and the final establishing of a complete sewerage system. As to this last, schemes were proposed by three engineers, W. Thwaites, G. Gordon and W. F. Bell. Each of the gentlemen recommended, in view of the violent rainfalls, the separate system of sewers, with a small part of the earlier rainfall admitted for flushing purposes, and the complete substitution of water carriage for the pan system, the present open storm water channels to be retained.

The water supply of Melbourne is treated separately, and the suggestions of the report are mostly in regard to purifying it. The water is collected from a large basin in the Yan Yean reservoir, is not filtered, and is not satisfactory in quality.

DOMESTIC PLUMBING HEATING LIGHTING & VENTILATION ENGINEERING

PLUMBING IN THE UNION TRUST COMPANY'S BUILDING.

PART I.—ROOF, SUCTION AND DRIP TANKS AND PUMP CONNECTIONS.

THE Union Trust Company's new building on Broadway, New York City, is about 100 feet front, 120 feet deep, and has 13 stories above the basement. It is designed to accommodate a bank on the first floor and the offices of the Union Trust Company on the second floor, while the upper floors are fitted for offices; a restaurant, kitchen, etc., being built on the main roof.

The plumbing comprises, in general, the hot and cold water supply to the toilet-rooms and to basins in all office rooms, and the drainage from all fixtures. The most of the water is pumped through the 4-inch pipe A, Fig. 1, to the iron roof tank T, that is about 14 feet square and 8 feet 6 inches deep, and is closed by iron plates over the top. The tank rests on wooden sills B B B, laid in a sheet iron-lined safe S, which is supported by wooden beams C C C, resting on the floor directly under the sills B B B. The tank overflows through a 4-inch pipe D to the roof gutter, and may be emptied, also to the roof gutter, through a key valve E and 2-inch pipe F. H is a 2-inch supply-pipe to the eighth and ninth floor toilet-rooms, and G is a 4-inch supply pipe to the distribution drums in the cellar. I I are 1-inch vent-pipes to the pipes G and H. J is a vent-pipe from the hot water system, and L is the 1½-inch safe waste, discharging on the roof. M is a wire cable from the tank float operating the index of the indicator in the pump-room.

Water under street pressure is delivered through a 2-inch pipe A, Fig. 2, and ball-cock B to the closed iron suction tank C, about 5 by 5 feet, that is in the cellar near the pumps. This tank overflows through a 4-inch pipe D, which has a trap with a 24-inch seal that is preserved by the constant discharge from the steam drip pipe I. E is a valve for emptying the tank. F and G are 1¼-inch pipes to empty the pump delivery to the tank and the 4-inch supply pipe from the tank to the distribution drums. H is the 4-inch suction-pipe to the pumps.

Figure 3 shows the connections of the special tank pump A and one of the boiler pumps B. H is the 4-inch suction pipe from the tank C, Fig. 2, with a branch E to the pump B. D is the 4-inch delivery pipe to the roof tank with a branch F from the pump B. G is a 2-inch branch connected with the delivery pipe of another steam pump, generally used for the steam boilers. Ordinarily the valves M and N are open, while I is closed, and the tank is filled by the pump A; but if the valves I, K and L are open the pump B can also be turned to the tank, and by opening the valve J the third pump may also be used for the tank in case of fire or in any other emergency.

Figure 4 shows the cellar drip tank A which is simply an iron shell about 6 feet long and 30 inches in diameter to receive the overflow from the suction tank C, Fig. 1, the waste from emptying the pipes of the distribution drums, discharge from drip sinks and cellar drainage, all of which is below the street sewer level. B is a collector from the waste pipes of the floor strainers I I, etc., and the drip sinks. C is the emptying pipe from the distribution drums and D is the emptying pipe from the tank C, Fig. 2. E is an aspirator to which steam can be admitted through the valve F to produce suction and draw the contents of the tank A out through pipe G, which discharges through a branch K to the house drain L that empties into the street sewer. H is a vent pipe to maintain atmospheric pressure in the tank A.

(TO BE CONTINUED.)

HOSPITAL CONSTRUCTION.*

A HOSPITAL is primarily a building devoted to the care and treatment of the sick and injured poor; in its secondary, and scarcely less important function, it is a training school for the teaching of the science and art of medicine and surgery.

Now, in order that both these functions may be performed to the best advantage, it is necessary that large numbers of patients should be brought together in one hospital, for it will easily be seen that the task of administering one hospital for 300 beds will be far easier and less costly than that of administering ten hospitals for thirty beds each, and for teaching purposes the larger the amount of material the better both for teachers and students. The risks, therefore, inherent on the aggregation of large numbers of sick people are, and must be, encountered, because it would be impossible to furnish the necessary medical and surgical aid to the sick poor in any other way. Let us consider briefly of what these risks consist, and how the experience of the past helps us to overcome them. In the first place, it must be remembered that a hospital ward is filled either with people whose condition is that of disease, the exhalations of whose bodies are laden with infection, or with those with open wounds, to the exposed surfaces of which the contact of impure air means the production of a special class of traumatic or wound diseases. In either case it is the contamination of the air of the ward which retards or prevents the recovery of the patients. This contamination of air may be accomplished in several ways: it may either be by overcrowding of patients in the wards, by imperfect ventilation, by improper arrangement of buildings, by defective drainage, or by defective keeping or maladministration.

In considering the principles which should guide us in the planning of a hospital, the first question to be determined, assuming that the number of patients and staff and the necessary classification has been settled, is the position of the various buildings in relation one to another. There must be in every general hospital—and it is with this class of hospital only that I am now concerned—at least five separate departments: (1) the administration, which comprises all the purely official and domestic parts; (2) the nurses' quarters; (3) the wards; (4) the out-patient department; and (5) the mortuary. In many important hospitals of recent date these have been again subdivided, and separate buildings provided for kitchen, offices and the operation room. The main fact, however, which I wish to impress is that all these five buildings should be as separate and distinct as it is possible to make them. In most hospitals erected during the last century you will find that every department, including also frequently a laundry, is housed in one building, and that every part of that building is in more or less direct atmospheric communication with every other part. The evils of this arrangement have over and over again been demonstrated, and many such hospitals have been within recent years either demolished or very materially altered, much to the gain of the patients.

The detailed planning of the administration building will necessarily vary according to the size of the hospital, and no very minute rules can be laid down respecting it. I may, however, point out that unless the kitchen offices are placed in a one-story separate building they should certainly be put at the top of the house. There is no practical difficulty attending this arrangement, examples of which may be seen at the Hospital for Consumption, Brompton, the Great Northern Central Hospital and the Hastings Hospital. The provision of ample store accommodation is an important point. It is far better to provide too much store room than not enough, for the difficulty of increasing store room in an existing building is very great indeed. We may now pass on to the wards, which, together with their offices, form the most important part of the building. Formerly a ward was regarded merely as a room into which a certain number of beds were to be put, without much thought being taken of how the well-being of the patients would be affected by the conditions under which they were to be housed.

The essential feature of the pavilion system is that the wards are long rectangular buildings, projecting out usually at right angles to a main corridor. The space between the pavilions should be equal to at least twice the height of the buildings, and the long axis of the

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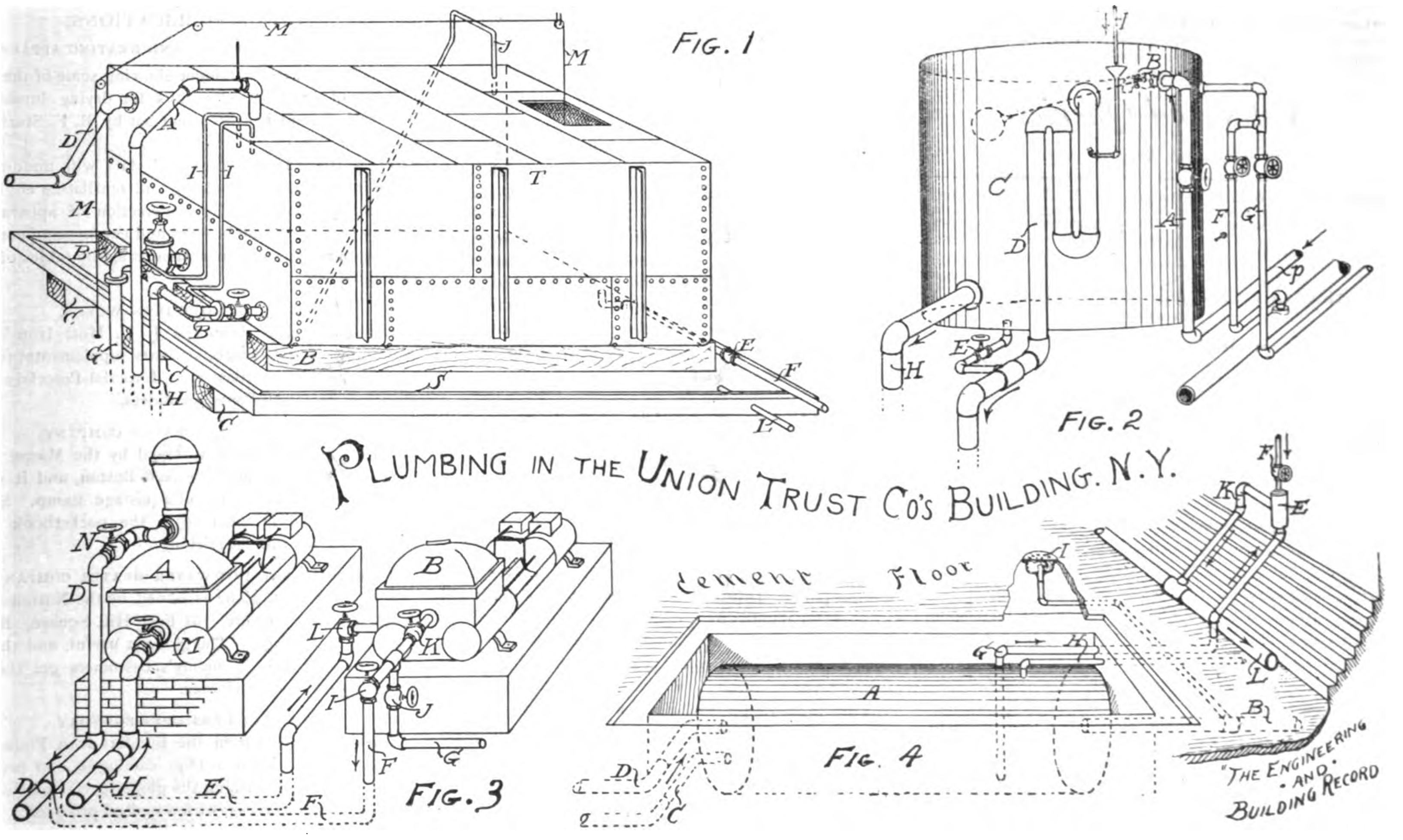
* From a paper read by Keith D. Young before the London Architectural Association.



wards should be nearly due north and south, so that the maximum amount of sunshine available should be admitted to the wards. The question of the number of stories admissible in a ward pavilion is one upon which authorities differ materially. In many of the most recent hospitals in France and Germany, and notably in the magnificent hospital at Baltimore, the wards are restricted to one story only. Such a system is obviously a most costly one in the matter of site; and it seems to me that it is to be justified only on the score of really important benefit to be gained. Personally, I am unable to see any sufficient gain to be obtained at all commensurate to the enormous cost involved. But—and this lies at the root of the matter—if two or three stories of wards are to be superimposed, each must be absolutely independent atmospherically of the other—there must be no shafts, whether for staircases or lifts, to communicate the air of one floor with that above.

In considering the internal arrangement of the wards the first point to be settled is the space to be alloted to each patient. Space in a ward is very commonly referred to as cubic space only; but it is equally important to consider floor space, and the distance to be allowed between each bed and its neighbor. Upon this question of space authorities differ widely. In the table given in Mr. Snell's work the floor space varies from 69 feet per bed to 149 feet, and the cubic space from 864 feet to 2,544 feet. The last figures are those of the Hospital of St. Andrew at Genoa, whose wards are considerably over 20 feet high. Now it was the opinion of so eminent an authority on ventilation as the late Professor de Chaumont that nothing is gained by making the height of a ward exceed 12 feet, and in making calculations in actual practice he was accustomed to exclude all space in excess of this amount. You will see, therefore, how important it is to arrange your cubic space in relation to your floor space, and not to increase the one at the expense of the other. In the first place, then, the wall space or distance from center to center of each bed should be determined. In a large ward, say for 20 beds, the space should not be less than 8 feet—8 feet 6 inches or 9 feet by preference. For the width of the ward 28 feet is a good dimension. It allows plenty of free floor space in the center of the ward, which is a point that must always be remembered, especially where clinical teaching is carried on. These figures give a floor space of 112 feet as a minimum. Taking 12 feet as the standard height, you get a cubic space per bed of 1,344 feet. A height of 12 feet will, however, be found, for appearance sake, too low for a ward upwards of 80 feet long, and I think something must be conceded to one's sense of proportion. Having settled the dimensions of the ward, the next step is to place the beds and set out the windows. In some of the plans shown you will see that the beds are arranged in pairs, with one window to every two beds. This plan of coupling the beds has many disadvantages. In the first place, each bed is unduly near one of its neighbors, instead of being placed in the center of its own air space; secondly, the ventilation cannot be so perfect as when each bed has a window each side of it; and, lastly, the beds are necessarily so close on one side to the windows that much inconvenience arises therefrom in the shape of draughts and cold currents of air from the condensing surface of the glass. Each bed, then, should occupy the center of its own air space, and should be between two windows.

Notes and Queries

on Domestic Engineering.

Communications relating to the practical details of plumbing, heating, lighting and ventilation will be welcomed in this column. The writer's true name and address must always be given, but an assumed name may be used for publication if preferred.

HEATING SURFACE FOR INDIRECT HEATING.

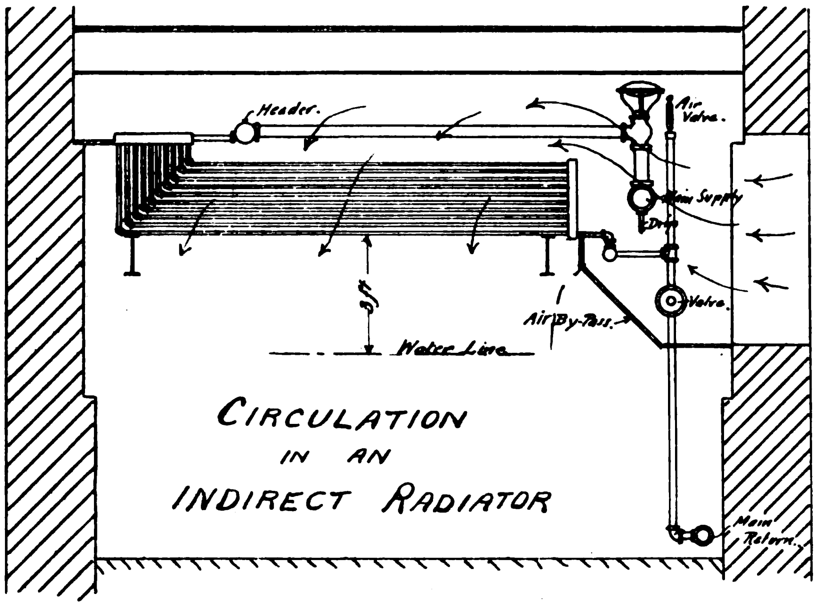
ARCHITECT, of Hamilton, Ont., writes: "Would you kindly give the amount of heating surface required for ventilating purposes by indirect heating where direct heating is used for a dwelling house or public building, and state which is the best kind of radiator, cast or wrought iron, to use for this mode of ventilation? The heating employed is direct by hot water."

[We assume that hot water is, in this case, to be used in the indirect radiators also, though not so stated, and that what our correspondent really proposes to do is to divide up the heating surface for each room between the direct and indirect radiators. The amount of heating surface necessary in the latter will depend upon the amount of air to be supplied to the rooms, and upon the amount of direct radiating surface already on hand or intended to be provided, but in the absence of further data we cannot give a definite answer Generally speaking, however, one square foot of indirect radiating surface, when hot water is used in the ordinary way, will suffice for from 15 to 40 cubic feet of air to be heated in dwellings, offices, etc.; for from 25 to 50 cubic feet in halls, stores, lofts and factories, and for from 50 to 100 cubic feet in churches and large auditoriums. These figures cannot be made more definite, as the exact conditions of the problem are not known. It will be understood that where there is much exposure the lowest estimate should be used, while under more favorable conditions a smaller proportion of surface will do the work.

As to the best kind of radiator, cast iron or wrought iron, we would say that we know of no reliable data on the relative efficiencies of commercial heating surfaces. Both cast and wrought iron are in extensive use, the former most largely.]

CIRCULATION IN AN INDIRECT RADIATOR.

"P. N. K.," Boston, writes: "I inclose a sketch of a fresh air heater made up of 60 miter coils of 1-inch pipe on branch tees. Each coil is 12 feet long by 10 pipes deep; pipes 2½ inches on centers; total heating surface about 2,450 square feet; main supply 7 inches; main section 3½ inches. The heater is divided into sections of 200, 400, 600 and 1,200 square feet, with supply pipes 3, 3½, 4 and 5 inch, respectively. The supply to each miter coil of 40 square feet is 1½ inches diameter. There are to be Johnson diaphragm valves on supply and return of each section.



A fan draws a maximum of 30,000 cubic feet of cold air per minute through the heater. There has been some discussion as to whether there would be a good circulation of steam in this heater and I should be glad to have your opinion on the matter. The water is returned to the boiler by gravity and the boiler power is ample; pressure 5 to 10 pounds. Will the heater clear itself of air in good shape and is there any danger of a freeze up? Would you recommend returning the water by tank and pump instead of by gravity?"

[With a difference of level of only three feet between the water line and the lowest level of the coil we should prefer to return the water to the boiler by a pump, taking the water out of the system as rapidly as it is formed. With a gravity return the arrangement may work satisfactorily, but there is always a possibility that the water will back up into the radiator and give trouble. With a pump return we think there will be no difficulty in securing proper circulation. With an indirect system, more particularly where forced circulation of air is used, as in this case, we would nearly always recommend the use of a pump for the water of condensation. It insures certainty of action and the extra cost of its installation will be found a good investment.]

HEATING BY EXHAUST STEAM.*

THE economy of using exhaust steam for heating shops and factories seems to be very little appreciated, and it is not at all infrequently that we see a direct steam-heating apparatus in use when the exhaust steam from the engine would heat three or four such buildings.

If we have a 10 × 12 engine making 250 revolutions, using steam at 85 pounds gauge pressure, it gives about 25 horse-power. If it is an automatic cut-off engine it will use about 30 pounds of steam per horse-power, or 750 pounds per hour. Expanding four times, the steam at exhaust will be at 10 pounds gauge pressure, and will contain 1,155 heat-units per pound, of which 975 heat-units are available for heating, and the total available heat in exhaust steam per hour is 731,250 heat-units. This, under ordinary conditions, will heat a shop two stories high and 40 × 120 feet, or as large a shop as that of which the engine would run the machinery. However, some may wish to use the exhaust steam for heating the feed water, but in that case, with a good heater less than one-fifth of the exhaust is needed, and besides, by conveying the drip from the heating coils to a hot well the best feed water will be obtained at a high temperature. If one objects to the back pressure on the piston of the engine, let the feed pump or injector be connected to the end of the heating coils when the back pressure can be reduced to zero, but at the University of Michigan there are several exhaust heating coils of 1¼ inch pipe over 100 feet long that do not raise the back pressure more than one pound. It has also been suggested that the condenser, if the engine be a condensing one, might be connected to the end of the heating coils. The vacuum at the back of the piston would then be less, by the amount of friction and resistance in the coils, than if the condenser were closely connected, and the temperature in the coils would be that due to the pressure, so that the coils would need to have more surface, and on that account the arrangement might not be as economical as to do away with the condenser altogether when the building has to be heated. Few condensers actually increase the power more than 25 per cent., counting in the cost of running them, while if the same space is to be heated by a direct steam return system it will require the burning of nearly as much coal as is needed to run the engine, or at least 90 per cent. additional. Hence it appears to be more economical to do away with the condenser in cold weather. When one reflects that in many shops the exhaust steam is totally wasted he can not wonder that manufacturers continue to cut down the wages of their employees more and more as the cost of fuel increases; but the economy of employing cheap men is and must always remain very doubtful, and there are few engine plants today, in charge of ordinary engineers, that would not be rendered from 10 per cent. to 50 per cent. more productive by the employment of a first-class man.

TRADE PUBLICATIONS.

STEAM HOT-BLAST DRYING AND HEATING APPARATUS.

A NEW illustrated catalogue showing some of the latest designs of hot-blast apparatus for drying lumber and heating buildings has been sent out by B. F. Sturtevant, of Boston, Mass.

The published engravings and data will undoubtedly prove interesting to all heating and ventilating engineers, and to those contemplating the erection of apparatus of that class. Sturtevant blowers and engines and complete plants are shown, and are accompanied by tables of sizes, capacities, etc.

THE J. L. MOTT IRON WORKS.

WE have received from the J. L. Mott Iron Works, New York and Chicago, circulars supplemental to their plumbing catalogue, illustrating Imperial Porcelain sinks; also their patent all Porcelain Bidets.

THE MASON REGULATOR COMPANY.

A POSTAGE stamp case is issued by the Mason Regulator Company, 22 Central Street, Boston, and it will be sent on request on receipt of a postage stamp. Stamps may be carried in the case in the pocketbook in the hottest weather without sticking.

THE NATIONAL HOT-WATER HEATER COMPANY

A TERRESTRIAL globe is issued by the National Hot-Water Heater Company, 191 Fort Hill Square, Boston, and also of Chicago. The globe is useful, and the idea seems to be that the company's customers get the earth in getting the Spence Heater.

THE BUILDERS IRON FOUNDRY.

WE have received from the Builders Iron Foundry, of Providence, R. I., their 1890 catalogue and price list, illustrating and describing the globe special castings and fittings for water-works, with a revised price list.

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* From *The Technic*, the annual of the Engineering Society of the University of Michigan. Contributed by G. S. Williams.

CONTRACTING NEWS DEPARTMENT.

A WEEKLY RECORD

OF SPECIAL INTEREST TO CONTRACTORS, BUILDERS AND MANUFACTURERS OF ENGINEERING AND BUILDING SUPPLIES.

ARCHITECTURAL COMPETITIONS

Greenville, Miss.—Jail.—Plans are wanted until July 7, for a jail at this place. Address C. M. Johnson, Clerk Board of Supervisors, as above.

CONTRACTING INTELLIGENCE

Our readers will oblige us by notes, clippings, or any information which will put us in the way of obtaining early and reliable news for our "Contracting Intelligence." *Information of importance sent to us exclusively, and not elsewhere published will be liberally paid for.*

Persons who make any use of the information they find in these columns we trust will not omit to mention The Engineering & Building Record as the source

For works for which proposals are requested see also the "Proposal Columns," pages i-ii-x 80.

WATER.

For Additional Water Items see Proposal Columns.

Union, S. C.—Reports say that this place is to have a system of water-works, and that the Mayor can furnish particulars.

Winston, N. C.—The Mayor can furnish important information regarding a projected water-wor s system for this place.

Warrior, Ala.—Reports say that this place is to have a system of water-works, and that the Pearson Coal, Iron and Railroad Company can furnish information.

Norma, Neb.—It is now proposed to issue bonds at once in the sum of $3,000, for the purpose of establishing a system of water-works.

Milwaukee, Wis.—Schedule of bids for constructing a water-works tunnel, 7½ feet in diameter, extending out 3,000 feet under Lake Michigan, for the city of Milwaukee, Wis. Bids for this work were opened June 20, but as the prices were too high the work was readvertised and opened June 30, as follows:

Bidders.	Furnishing and putting in place the crib complete.	Shore tunnel per lineal foot including distributing wells with connections, and the gate well copings and covers. 260 lineal feet.	Shore shaft complete per lineal foot with coping and cover and all connections complete. 153½ lineal feet	Lake shaft, complete, per lineal foot, including iron cylinders with all connections. 140 lineal feet.	Lake tunnel, per lineal foot, and extensions on opposite sides of each shaft. 3,157 lineal feet.	Rock excavation, per cubic yard. 120 cubic yards.	Section No. 1, of the intake complete (not including crib), in the aggregate.
C. H. Starke	$38,000.00						
John J. Crilley		$20.00	$400.00	$431.00	$20.00	$7.00	$191,200.00
John O'Neil	34,000.00	28.00	80.00	172.00	28.00	7.00	132,876.00
Thomas R. Bentley and Wenzel Strachota		42.50	85.00	170.00	29.40	10.00	141,089.00
William Forrestal	34,500.00	30.00	100.00	125.00	27.50	10.00	128,667.50
Shailer & Schniglau	40,000.00	30.00	55.00	145.00	26.50	12.00	121,643.00

The contract for the crib was awarded to John O'Neil, and for the rest of the work to Shailer & Schniglau.

Central, Ill.—A proposition to put in water-works on the franchise plan has been made by H. Hungerford, of New York. He proposes to lay six miles of mains, and furnish sixty hydrants for a rental of $3,000 yearly.

Gananoque, Ont.—There is talk of building an improved system of water-works at this place, the estimated cost of which is $43,000.

Spring City, Tenn.—W. W. Stephenson, Secretary of the Anglo American Association, writes: "We have not yet made definite arrangements for the construction of water-works. As soon as we are ready to let out the contracts we will let you know."

Hunter, N. Y.—Village Clerk A. E. Green writes as follows: "An application of certain parties in this place to form a water-works company has been granted. Work to be completed before July 1, 1891. For further information, address William J. Rusk, President of Water-Works Company."

Bridgeport, W. Va.—Regarding the published report that this place was to have water-works A. D. Fitzhugh, the Recorder, writes: "There are no water-works contemplated in our town; we have but 400 inhabitants and not likely to have water-works soon."

Parkersburg, W. Va.—Mayor G. Z. Gibleing writes: "No definite action has as yet been taken by the Council on the subject of extending the water-works plant, but I have recommended that they put in an extra set of boilers—viz., two tubulars, 16 feet long and 60 inches in diameter. The committee will probably agree, after which the Council will take some definite action in the matter."

Blaine, Wash.—Town Clerk J. W. Sauner writes; "A franchise has been granted to J. V. Chown and J. M. Weistling, of Seattle, Wash., to put in a system of water-works to be in operation by January 1, 1891."

Hamilton, Can.—A new 6-inch water main is to be laid here. For particulars address M. A. Pigott, as above.

Toronto, Can.—A scarcity of water prevails in this city, and the question of increasing the supply is being discussed.

Griffin, Ga.—Reports say that work on the projected water-works system for this place will begin inside of 90 days.

Los Angeles, Cal.—Urgent measures are being taken in this city towards providing a system of water works. A committee, with Dr. H. Linsabaug at its head has been appointed to investigate the matter.

Malden, Mass.—S. M. Allis, Superintendent Water-Works, is now getting prices for 400 tons of water-pipe, mostly 10 and 12 inches, for replacing old pipe and extensions.

Frankfort, Mich.—The Michigan Pipe Company, of Bay City, Mich., have the contract for the entire system of water-works for Frankfort. The work calls for work pump house, two sets of duplex pumps, one reservoir, about 20,000 feet of pipe of assorted sizes, 34 hydrants and 21 valves, etc. The work is to be finished before December 1, next.

Phillipsburgh, Kan.—City Clerk Frank R. Stinson writes: "We have voted $20,000 bonds and will immediately put in that sized plant. Bids have been advertised for, for bonds and for the construction of plant in full or in part. All bids, if a sufficient number are received in time, will be opened on July 2. S. K. Felton, of Belleville, Kan., is our engineer."

Water-Works.—See our Proposal Columns for information regarding water-works and water-works furnishings at the following places: Fargo, Dak.; Sioux City, Iowa; Newark, N. J.; St. Louis, Mo.; Imlay City, Mich.; Hicksville, O.; The Dales, Ore.; Marion, O.; Dayton, O.; Athens, Ga.; Fremont, O.; Watkins, N. Y.; Washington, D. C.; Key West, Fla.; Para, Brazil; Coshocton, O.

Grand Rapids, Mich.—The Cook Well Company, of St. Louis, Mo., has made a proposition to the Board of Public Works of this city to introduce an improved system of water supply. The matter is now in the hands of the Committee on Ways and Means.

SEWERAGE.

For Additional Sewerage Items see Proposal Columns

Highland, Ala.—The city will, it is reported, petition the Legislature to authorize the issuance of $50,000 of bonds for a sewerage system at South Highland.

Winston, N. C.—It is now probable that the projected sewerage system will be established at this place.

Green Bay, Wis.—The project for establishing a system of sewers is still being discussed here. For particulars, address Mayor Elmore, as above.

Avondale, O.—Arthur S. Hobby, C. E., has completed plans for the construction of a system of sewerage for this town.

Geneseo, N. Y.—The following bids for the construction of sewers were received by W. A. Wadsworth, President Board of Sewer Commissioners, June 27: Barlow & Martin, Seneca Falls, N. Y., $12,881; John W. Vickers, Geneseo, N. Y., $15,545.25; Green & McGregor, Buffalo, N. Y., $15,977.50; Thomas F. Moore, Buffalo, N. Y., $16,475.50; Murray & Kennon, Elmira, N. Y., $17,996.50; Sullivan & Co., Utica, N. Y., $18,405; R. Y. McConnell & Son, Rochester, N. Y., $19,042.80; Bennett & Doll, Utica, N. Y., $19,902.50; Willard & Neff, Geneseo, N. Y., $19,943; Aug. Gisel, Buffalo, N. Y., $20,014.50; Brummelkamp & Conron, Syracuse, N. Y., $20,171; Bauer, Bruff & Albright, Rochester, N. Y., $21,104; N. L. Brayer, Rochester, N. Y., $21,131.50; A. H. Coons, Kingston, Pa., $22,102.50; Bovier & Beondsly, Elmira, N. Y., $23,629.

Uhrichsville, O.—This city has adopted plans for a complete system of sewerage and will soon advertise for bids on same. For particulars address E. J. Moore, City Clerk.

Jersey City, N. J.—Numerous sewer extensions are to be constructed here.

Pittsburg, Pa.—Additional sewers will be constructed here.

BRIDGES AND IRON STRUCTURES.

For Additional Bridge Items see Proposal Columns.

Harper's Ferry, Va.—The Secretary of State has chartered the London Bridge Company, for the purpose of building a bridge over the Shenandoah, at this place.

Nebraska City, Neb.—A special election will be held July 8, to vote on the proposition to issue $100,000 in bonds for a wagon bridge across the Missouri River.

Sioux City, Iowa.—Reports say that the State Railroad Commissioners have ordered the building of a viaduct, to be 180 feet long, 60 feet wide, with approaches on either side of 450 feet.

Llano, Tex.—It is proposed to erect a bridge over the Llano River. The Mayor can furnish particulars.

Knoxville, Tenn.—The plans are now ready for the Fifth Avenue bridge, which is to be erected at a cost of $14,675.

Clinton, Iowa.—The Clinton and Illinois Bridge Company are preparing plans and will soon advertise for proposals for the erection of a high wagon bridge over the Mississippi River at this place.

Niles, Mich.—The Michigan Central Railroad Company will build a large wagon bridge crossing their tracks at this place.

Triangle, N. Y.—Appropriations have been made by the local officials for the repair of 12 bridges recently damaged by the floods.

Paterson, N. J.—The Passaic County Board of Freeholders met July 1 and voted to build three new iron bridges across the Passaic—one at Little Falls, one at Fifth Avenue, Patterson, and one at Thirty-third Street. The consent of the Bergen County Freeholders will be necessary to the erection of the last two.

Zanesville, O.—Press dispatches say that several bridges have been swept away in this vicinity by the recent storms, and steps will soon be taken to replace them.

Albany, N. Y.—The following bids for constructing a lift bridge over the Erie Canal were received by Edward Hannan, Superintendent of Public Works, July 1: On superstructure, W. H. Shepard & Sons, Havana, $10,190; Groton Bridge Manufacturing Company, Groton, $12,820. On substructure, Weider & McMahon, Rochester, $3,226.50; George Chambers, Rochester, $2,703; James Robinson, Rochester, $3,347.50. The contracts were awarded to the lowest bidder.

Bridges.—See our Proposal Columns for information regarding bridge construction at the following places: Foreman, N. D.; Mitchell, Dak.; Pembina, N. D.; Ritchie, W. Va.; Eureka, Cal.; Alder Point, Cal.; Shannel Co., Kan.; Evansville, Ind.; Albany, N. Y.

STREET-WORK AND PAVING.

New Brunswick, N. J.—See our Proposal Columns for particulars of work to be done here.

Akron, O.—Considerable street paving is to be done at this place.

Jersey City, N. J.—Considerable street paving is to be done here.

New York City.—The contract for repaving Broadway from the Battery to Thirty-second Street has been awarded to Matthew Baird. The gross sum for the work is $252,000.

GAS AND ELECTRIC-LIGHTING.

Warehouse Point, Conn.—An electric light plant is projected for this place.

York, Pa.—An ordinance is being prepared for letting out the contract for public lighting. Address the Mayor for particulars.

San Francisco, Cal.—The city clerk has been directed to advertise for bids for lighting the streets for two years.

Brooklyn, N. Y.—The Kings County Electric Light and Power Company has been incorporated in this city with James T. Lewis as one of the trustees. Its operations are to be carried on in the city of Brooklyn and on Long Island generally. The company proposes to manufacture, buy, vend, lease and operate apparatus and machinery for the generation of electricity and manufacturing, supplying, vending and leasing electric light, heat and power. The capital stock is $300,000.

Verona, Pa.—An electric light company has been incorporated at this place.

Phillipsburgh, Mont.—This place is to have an electric light plant.

Marysville, Kan.—The electric light plant at this place is to undergo alterations.

Ballston Spa, N. Y.—The local electric light company will increase the capacity of the plant.

Ottawa, Ill.—The Councils of this place are considering the bids of several companies, with the view of purchasing a municipal plant to cost about $20,000.

Alameda, Cal.—This place is to have electric lights.

Ogden, Utah.—The Citizens Electrical Light Company has been incorporated here with a capital stock of $30,000. Messrs. H. W. Smith, F. C. Priestly and others, are incorporators.

Randolph, Mass.—The streets of this place are to be lighted by electricity.

Petersburg, Ill.—An electric lighting company is to be incorporated.

Electric Railways.—New electric railways will be established and improvements will be made to those already built at the following places: Amsterdam, N. Y.

GOVERNMENT WORK.

Philadelphia, Pa.—Vault doors for cashier's vault, United States Mint; Opened June 28. Bidders: Hall Safe and Lock Company, $745; Farrell & Son, $470.

WASHINGTON, D. C.—The following proposals for the work specified were opened on the given dates by the Supervising Architect of the Treasury Department:

Texarkana, Ark.—Erection and completion of the United States Court House and Post Office; work does not include heating and approaches. Bidders: McCarthy & Baldwin, Washington, D. C., $102,756; Robert M. Jack, Wichita, Kan., $86,000; L. L. Leach & Sons, Chicago, Ill., $113,485; James M. Brown, Camden, Ark., $87,500; Anderson Bros., St. Louis, Mo., $120,000; James H. Coster, Baltimore, Md., $91,351.

BIRMINGHAM, ALA.—Iron floor, ceiling and roof construction for brick and terra cotta arches, etc., for United States Court House and Post Office; opened June 27. Bidders: Pennsylvania Construction Company, Pittsburg, Pa., $50,659; Fred. J. Myers Manufacturing Company, Covington, Ky., $45,450; McHose & Lyon Company, Dayton, O., $53,725; McCarthy & Baldwin, Washington, D. C., $48,725.

WASHINGTON, D. C.—Bids were opened by the Lighthouse Board July 2, for the erection on Outer Diamond Shoal, off Cape Hatteras, N. C., of a lighthouse. Each bidder submitted his own plans for doing the work, and the contract will not be let until the Lighthouse Board has studied these plans and decided which is the best. The bids received were as follows: Theodore Cooper & Co., New York, $474,000, the lighthouse to be completed by January 1, 1893; Anderson & Barr, Jersey City, $485,000, to be completed January 1, 1892; William Sooy Smith, Chicago, $488,325, to be completed within three years from date of contract, and James Andrews, Allegheny City, and Gustav Lindenthal, Pittsburg, joint bid, $1,820,300, to be completed within two years from date of contract.

INDUSTRIAL.

XENIA, O.—John A. North, of this city, has the contract, at $3,000, to reconstruct the plumbing at the Ohio Soldiers' and Sailors' Orphan Home.

ST. PAUL, MINN.—A steam regulating plant, to cost about $9,000: for the court house and city hall is being discussed.

CHICAGO, ILL.—The Wells Glass Company, of Chicago, have been awarded the contract for furnishing the stained and pyrographic glass for Hermann's new Brooklyn Theater, and for the Gaiety Theater, New York.

CHICAGO, ILL.—The Lincoln Iron Works and the Jackson Architectural Iron Works, of New York, have established an extensive branch at 369 Wabash Avenue, Chicago, under the management of Messrs, M. E. Butler & Co.

PROPOSALS.

(Continued from page x.)

SEWERS, Athens, Ga.—Proposals are wanted until July 20, for building 4,000 feet of separate system sewer; Address R. L. Bloomfield, Sewer Commissioner, as above.

SEWERS, Marion, O.—Proposals are wanted until July 18, for constructing about 17,300 feet of 18-inch outfall sewer. Address H. S. Jones, City Engineer, as above.

PIER, New York City.—Proposals are wanted until July 9, for building a new wooden pier, with appurtenances, including sewer boxes and a dumping board, at the foot of East One Hundred and Tenth Street, Harlem River. Address the Department of Docks, Pier A, North River, as above.

BRIDGE, Ritchie, W. Va.—Proposals are wanted until July 12, for the construction of a steel road bridge over Hughes River. Address the County Clerk of Ritchie County, as above.

SEWERAGE SYSTEM, Para, Brazil.—Proposals are wanted until September 16, for the construction of a system of sewers here. Address Justs Leite Chermont, as above.

WATER-WORKS, Ashland, Ky.—Proposals are wanted, no date specified, for the construction of a system of water-works Address the Ashland Water Supply Company, as above.

ROAD WORK, Dunkirk, N. Y.—Proposals are wanted until July 8, for doing certain road work here. Address Edward Madigan, City Clerk, as above.

LIGHTING, Binghamton, N. Y. — Proposals are wanted until July 14, for lighting the streets, etc., of this city by electricity for one year. Address W. J. Flanigan, City Clerk, as above.

SEWERS, St. Louis, Mo.—Proposals are wanted until July 8, for the construction of certain sewers here. Address Emory S. Foster, Secretary Water Commissioners, as above.

WATER-WORKS, Hicksville, O.—Proposals are wanted until July 16, for the construction of a system of water-works at this place. Address J Cook, Consulting Engineer, Toledo, O.

PROPOSALS.

CITY OF NEW BRUNSWICK, N. J.

Notice to Contractors.

SEALED PROPOSALS WILL BE RECEIVED by the undersigned, Clerk of the Common Council of the City of New Brunswick, N. J., until 12 o'clock noon, WEDNESDAY, July 23, 1890, for laying a 12-inch **MACADAMIZED PAVEMENT** on Livingston Avenue, in said city, from George Street to Comstock Street (about 20,000 square yards of pavement). The work to be done under the authority of and in conformity with Chapter No. 148 of the Public Laws of the State of New Jersey, passed 1889.

All bids must be made upon the blank forms furnished by the City Surveyor, at whose office, No. 1 Paterson Block, the form of contract and specifications may be seen, and other necessary information as to excavation, etc., obtained.

The Common Council reserves the right to reject any or all bids.

H. B. COOK, City Clerk.

New Brunswick, N. J., July 3, 1980.

ARMORY, Poughkeepsie, N Y.—Proposals are wanted until July 16, for the erection of an armory at this place. Address Josiah Porter, Adjutant-General, Albany, N. Y.

PAVING, North Tonawonda, N. Y.—Proposals are wanted until July 14, for doing certain paving at this place. Address T. F. Warner, Village Clerk, as above.

WATER-WORKS, Imlay City, Mich.—Proposals are wanted until July 11, for the construction of a system of water-works Address Charles P. Marshall, as above.

SEWERS, Fremont, O.—Proposals are wanted until July 22, for the construction of certain sewers. Address the City Clerk, as above.

GRAVEL ROADS, Corinth, Miss.—Proposals are wanted until July 14, for building a gravel road here. Address J. A. Scully, as above.

PRISON, Ellisville, Miss.—Proposals are wanted until July 8, for the erection of a prison here. Address E. B. Sharp, City Clerk, as above.

PAVING AND SEWERS, Buffalo, N. Y.—Proposals are wanted until July 7, for paving certain streets and constructing certain sewers. Address George E. Mann, engineer, as above.

LIGHTING, Los Angeles, Cal. — Proposals are wanted until July 14, for constructing and maintaining an electric light plant for a period of two years. Address the City Clerk, as above.

WATER-WORKS, Watkins, N. Y.—Proposals are wanted until July 23, for the construction of a system of water-works at this place Address Daniel Beach, of the Board of Water Commissioners, as above.

SEWERS, Newark, N. J.—Proposals are wanted until July 8, for the construction of certain sewers. Address John Hunkele, Street Commissioner, as above.

SEWERS, Dayton, O.—Sealed proposals will be received at City Auditor's office until July 18, for constructing about 2,000 feet of pipe sewer according to plans on file at City Engineer's office.

WATER MAINS, Sioux City, Iowa.—Proposals are wanted until July 8, for furnishing, laying, etc., certain water mains. Address L. H. Drumm, No. 1411 Geneva Street, as above.

TUNNEL, Pittsburg, Pa.—Proposals are wanted until July 8, for doing certain tunnel work. Address M. J. Becker, Chief Engineer, P. C. & St. L. Ry., as above.

WATER-WORKS, The Dalles, Ore.—Proposals are wanted until July 17, for the construction of a system of water-works at this place. Address Mayor M. A. Moody, as above.

BRIDGES, Shawnee County, Kans.—Proposals are wanted until July 17, for the construction of numerous bridges. Address J. M. Brown, County Clerk, as above.

SEWERS, Providence, R. I.—Proposals are wanted until July 10, for the construction of certain sewers Address John A. Coleman, Commissioner, as above.

THE Editor of THE ENGINEERING AND BUILDING RECORD is always glad to receive items of news for the Contracting News Department. But such items are not considered news except when the prices and particulars of the award of a contract are given. The announcement that ——— has sold ——— to ——— without giving the *prices* and particulars concerns only the buyer and seller. Such notices are always excluded, except in the case where a certain firm is stated to have taken a certain contract, the execution of which would require that they should buy certain materials. Such an item would be used if deemed of more than local interest, because it would suggest to some readers the possibility of their making a sale or securing a sub-contract.

Building Intelligence.

We solicit from each and every one of our readers information relating to projected buildings in their locality, and should be glad to receive newspaper clippings and other items of interest.

ABBREVIATIONS.—*b s*, brown stone; *br*, brick; *br st*, brick store; *b s dwell*, brown-stone dwelling; *apart house*, apartment-house; *ten*, tenement; *e*, each; *o*, owner; *a*, architect; *b*, builder; *fr*, frame.

NEW YORK.

South st, e s, bet Rutgers and Jefferson sts, on bulkhead platform, iron freight shed; cost about, $15,000; lessees, New England Terminal Co; a, S P Staats.

301 Broome st, br and s flat; cost, $19,000; o, B Barnett; a, S F Heinecke; m and c, C Hubner.

181 East Broadway, br flat; cost, $23,000; o, Pauline Ryshpan; a, Schneider & Herter.

136 Madison st, br and s flat; cost, $18,000; o, J Emrich, Jr; a, A I Finkle.

341–45 W 24th st, 3 br and s flats; cost, $22,000 each; o, J McFarland; a, J W Cole.

68th st, s s, 100 e 10th av, br and s police station and prison; total cost, $80,000; o, Municipality of the City of New York; a, N D Bush.

79th st, s s, 150 e Amsterdam av, 2 br and s flats; cost, $22,000 each; o, J A Breakel; a, J W Cole.

West End av, s e cor 72d st, 5 br and s dwells; cost, $20,000 each; o, W E D Stokes; a, J H Taft.

151st st, n s, 85 w 3d av, 2 br flats; cost, $15,000 each; o, A Rinschler;a, A Pfeiffer.

336 W 15th st, br flat; cost, $16,000; o, W H Ramsey; a, G F Pelham.

S w cor 7th av and 12th st, br hospital; cost, $60,000; o, St Vincent's Hospital; a, W Schickel & Co.

W s Greene st, 175 n Bleecker st, 2 br stores; cost, $150,000 all; o, F H Mela; a, Cleverdon & Putzel.

61 Grove st, br flats; cost, $40,000; o, P & J Goelitz; a, F Baylies.

74 Christopher st, br flats; cost, $24,000; o and a, same as above.

41st st and Broadway, br hotel; cost, $25,000; o, I S Plaur; a, T E Thomson.

150 E 43d st, br stable and dwell; cost, $12,000; o, R Westcott; a, G H Guibel.

N s 142d st, 600 w Boulevard, 3 br dwells; cost, $9,000 all; o, L Hildenstein; a, J Sullivan.

102–06 Wooster st, br store; cost, $50,000; o, D L Einstein; a, not given.

Riverside Drive, s e cor 82d st, 9 br dwells; cost, $90,000 all; o, A C Squier; a, Rose & Stone.

N s 116th st, 150 w 8th av, 2 br flats: cost, $40,000 all; o, J and J Walker, a, A Spence.

54 Wall st, br office bldg; cost, $8,000; o, Central Trust Co; a, C W Clinton.

MISCELLANEOUS.

BOSTON, MASS.—Border nr Decatur st, br power and engine house; cost, $10,000; o, E B Dry Dock Co; a, H I Crandall; b, M S & G N Miller.

Westerly Terrace, Center st, 7 fr dwells; cost, $39,000; o, Workingmen's Building Assn; a and b, Geo W Pope.

E Lenox st, 6 br dwells: cost, $33,000; o, a and b, T Connelly.

Rockview st, 2 fr dwells; cost, $9,000; o, E C Kellar; a and b, G A Cahill.

Westerly Terrace, fr dwell; cost, $8,000; o, Catherine Oberhauser; a, C A Halstrom; b, D McDonald.

Albany nr Pike st, 6 br dwells; cost, $36,000; o and a, N M Jewett; b, T Connelly.

Bunker Hill cor Elm st, fr alteration and addition; cost, $7,000; o, Walter Nash; a, C A Halstom; b, A F Sheffield.

191 Trenton st, fr dwell; cost, $8,000; o, Roswell Davis; a, Frank Davis; b, J H Stevenson.

Kilsyth road nr Lanark road, fr dwell; cost, $18,000; o, J N Frye; a, H M Wallis; b, Sullis & Wallis.

BOSTON, MASS.—Standish av nr Harvard av, fr dwell; cost, $9,000; o, Chas Brant; a, H Moseley; b, Boynton & Son.

Lyndehurst st, fr dwell; cost, $8,000; o, a and b, J H Beale.

Harrison av, City Hospital, br library wing; cost, $13,500; o, City of Boston; a, City Architect; b, Sampson, Clark & Co.

CANTON, O.—Nothing over $7,000 in value to report.

DENNISON, O.—Nothing over $7,000 in value to report.

DAYTON, O.—Nothing over $7,000 in value to report.

HARRISBURG, PA.—Nothing over $7,000 in value to report.

LITTLE ROCK, ARK.—Nothing to report of $7,000 or over.

LEBANON, MO.—Plans have been prepared for the erection of a $65,000 hotel at this place. Address Architect L C Miller, Laclede Building, St Louis, Mo.

MADISON, WIS.—Nothing over $7,000 in value to report.

OIL CITY, PA.—Nothing over $7,000 in value to report.

POUGHKEEPSIE.—Nothing over $7,000 in value to report.

ROCHESTER, N. Y.—Nothing over $7,000 in value to report.

ST. LOUIS, MO.— N w cor Page and Prairie avs, br dwell; cost, $7,500; o, A & C Meglitsch; b, A Meglitsch.

S w cor Maple and Lindell avs, fr church; cost, $8,200; o, West Pres Church; b, J Coultas.

Leffingwell av and Walnut st, br dwell; cost, $15,000; o and b, Kiel & Danes Cont Co.

Washington and Newstead avs, 3 br dwells; total cost, $21,000; o and b, Costano & Martin

SAN LUIS POTOSI, MEXICO.—2 market houses; cost, $200,000; o, City; a, Alfred Giles; b, Alfred Giles & Co.

SIOUX CITY, IOWA.—Pierce st, cor of 13th st, 2 dwells; cost, $8,000; o, E E Selsmer; a, J W Martin; b, not let.

Pierce st, cor 13th st, block of br dwells; cost, $20,000; o and b, F F Beck; a, same as above.

SPRINGFIELD, MASS.—Maple st, granite retaining wall; cost, $35,000; o, D B Wesson; a, B H Seabury; b, Flynn Building and Construction Co, of Palmer.

Maple st, br stable, granite trimmings, fireproof construction; cost, $30,000; o and a, as above; b, Patrick Beston.

ST. PAUL, MINN.—Victoria, nr Laurel, 2-story fr dwell; cost, $8,000; o, L A Schak.

TACOMA, WASH.—The plans of Proctor & Dennis, architects, have been accepted for the $300,000 court house at this place.

TIFFIN, O.—A factory building will be erected here, at a cost of $20,000. Address A C Baldwin, as above.

TYLER, TEX.—Architect J H Bothwell has prepared plans for the erection of a $25,000 building at this place.

WALTHAM, MASS.—Lexington nr Main st, br court house and police station; cost, $27,000; o, City of Waltham; a, Hartwell & Richardson; contract not let.

WORCESTER, MASS.—Nothing over $7,000 to report.

WILCOX, NEB.—An opera house will be erected here at a cost of $15,000. Address Wilcox, Parker & Bradford.

YORK, PA.—South George st, br Sunday school bldg, with gallery to seat 1,200; cost, $12,000; o, Christ's Ev Lutheran Church; a, J A Dempwolf; b, contract not yet let.

WILKES BARRE, PA.—No Franklin, 2 semi-detached br and stone dwells; cost, $10,000; o, est B G Carpenter; a, Nipp & Podmore; b, P R Raife.

THE ENGINEERING & BUILDING RECORD
AND
THE SANITARY ENGINEER.

A JOURNAL FOR THE ARCHITECT, ENGINEER, MECHANIC, AND MUNICIPAL OFFICER.

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LET THE SEWER SYSTEM FIT THE CITY.

A CORRESPONDENT calls our attention to an article in a contemporary laudatory of a system of sewerage which, as applied to a large Western city, had no main larger than 20 inches, while the house connections were but 4 inches in diameter, and remarks: "Such publications as this is are being distributed all over the country to the detriment of the cities contemplating building sewers."

We have no doubt that municipal authorities are often seriously misled in this way, and believing that what has proved good for one locality must be equally good for all spend much money on work that any well-informed engineer could have readily told them was not at all adapted to their special requirements.

Such conduct is about as sensible as taking another man's medicine because it cured him without waiting to find out whether he had the same complaint.

The officials of cities contemplating sewerage cannot be too careful to secure competent, disinterested advice before commencing work, and should remember that the "separate" and "combined" systems, so called, each have special advantages adapting them for special conditions, and that even in the same city one system may be best for one part and one for another.

FOOLISHNESS IN MUNICIPAL AFFAIRS.

THE Board of Public Improvements of Cincinnati has taken an extraordinary and indefensible course in its treatment of an engineer whom it had invited to take charge of the city water-works machinery. After the partial disabling of the machinery by the flood last spring a board of expert engineers was appointed to examine and report in regard to it, one member of the board being J. J. de Kinder, of Philadelphia. Some time after the report was made the Board of Public Improvements, which has full control of the water-works, invited Mr. de Kinder to go to Cincinnati and take charge for 90 days and put the machinery in order. The invitation was accepted and Mr. de Kinder went to Cincinnati, but his way was full of difficulties from the start and matters soon took such a shape that he gave up the work and returned to Philadelphia. There were many controversies, mostly personal or political, but with them we have nothing to do. Suffice it to say that after Mr. de Kinder had abandoned the work and left the city the Board of Public Improvements adopted a resolution as follows:

"*Whereas*, J. J. de Kinder, hydraulic engineer and disciplinarian, was engaged by this Board, with his right-hand man, to take charge of the machinery and repairs of the Front Street pumping house for a period of ninety (90) days; and,

"*Whereas*, The said J. J. de Kinder arrived in this city on the 19th of June, and from that date to the time of his departure, Monday, the 30th, he devoted the greater part of his energy and ability in endeavoring to get this Board to permit him to contract with Robert Wetherill & Co. for new pump ends for the Wetherill engines for the sum of $34,000, without submitting plans or specifications, and with the request that such contract be closed without receiving bids from others, all of which is contrary to law; and,

"*Whereas*, Said de Kinder, failing to secure authority from this Board to make such contract, proceeded to devote a portion of his energy and ability in another direction, without complaint of any kind to this Board, from the time of his taking charge. He sent his assistant to Philadelphia on Saturday, June 28, and on the same day he appeared in his chief rôle as the great disciplinarian. He announced to the public through the press, prior to any notice to this Board, the stumbling block thrown in his way, and his inability to secure entire control of the Water-Works Department, which he was determined to have, so that his methods of discipline should govern the entire department in its purchases, etc.; and,

"*Whereas*, Said J. J. de Kinder, in filing paper to the same effect to this Board, having failed to receive the indorsement and recognition he felt his due, he retired gracefully to the bar of the Gibson House, and with kindred spirits he dwelt on the miraculous ability of his favorite subject—de Kinder. He then cancelled his engagement and took the train to Philadelphia in search of his right-hand man, from whom it is presumed he kept all knowledge of what his left was doing.

"Now, therefore, be it *resolved*, That the thanks of this Board be and are hereby tendered to Mr. de Kinder for the entertainment he has afforded us in his great rôle as disciplinarian, and for the relief he has given by his voluntary retirement."

All the members of the Board present voted for this except one, and he did not vote at all. It goes without saying that such a demonstration cannot possibly harm Mr. de Kinder, but it is hard to believe that men charged with the administration of affairs in a great city could possibly commit themselves to such an expression, let the facts be what they might. It is an astounding exhibition of bad temper and bad taste and mental weakness. It is said that "politics" are responsible for the present lamentable condition of things in the Cincinnati water-works, but politics rarely makes men give such a public exhibition of silliness.

WOOD PAVEMENTS IN THE CITY OF MEXICO.

SOME time since the City of Mexico introduced what was hoped would be an improvement on the old cobblestone pavement in several of its streets, laying a Trinidad asphalt pavement on some and a wood pavement on others. Now the papers of that city object strongly to the wood pavement.

It has long been the custom in that city to wet the pavement thoroughly every morning, which makes the wood blocks slippery; besides, as the ground water is within 18 inches or 2 feet of the surface, the houses in the poorer part of the city are entirely without water closets or sinks of any kind, so that the population utilizes the center of the streets in the gray of the morning and throw slops there through the rest of the day. These conditions under a tropical sun, notwithstanding the altitude of the city, call for a monolithic pavement, as the wood pavement has become more offensive than the pavement it replaced

It has been suggested as a partial remedy that until a tunnel draining the valley is completed allowing of better sanitary arrangements, there be used disinfectants like sulphate of iron, and sanding the pavement when it is too slippery. Even in a temperate climate disinfectants could be used with advantage during the summer on wood pavements, and this practice would be a good one on Fifth Avenue, New York City, where the coal tar pitch has been worn out of the joints to a depth of over half an inch in many instances, so that shortly after sunrise on warm mornings a very fetid odor is given off from the animal and other refuse which has gathered in the cracks between the stones.

DEATH OF SIR EDWIN CHADWICK.

SIR EDWIN CHADWICK, K. C. B., died at Mortlake, near London, England, July 5, at the age of 90 years. He originated so much in regard to the healthfulness of human habitations and was so long a prominent figure in matters of the kind that he is often called the "Father of sanitary science," but still his work was primarily that of a philanthropist rather than of a man of science. He was not an engineer, and had professional education only for the law, but he saw the importance of what is now called sanitation, demonstrated the truth of his beliefs, and held them before the public with indefatigable persistence, and in the end exercised a great power.

Edwin Chadwick was born at Manchester, England, January 24, 1800. He studied law, entered as a student the Inner Temple in London, and became a barrister in 1830. While pursuing his studies, however, he supported himself by newspaper work, later he became a contributor to the reviews, and it was in this writing that his attention was turned to what became his life work. A statement made before a Parliamentary Committee in regard to the duration of life in the middle classes led Chadwick to investigate the subject, he finally wrote an article showing that the length of life had increased under the better conditions, and thereby touched the keynote of sanitary science, and that in a way to attract wide attention. Chadwick became associated with Jeremy Bentham, and assisted him in the great work on the administrative code of English law.

Chadwick's prospects in the legal profession were bright, but in 1832 a Government commission was created to examine the working of the poor law, Chadwick was offered a place as assistant commissioner, with the duty of making investigations from place to place, and, after some hesitation, accepted. He was from the first very active in the work of the commission, and in 1833 was made a chief commissioner. He was made a member of a Government factory commission the same year, and was active in urging much reform legislation. One of the first measures was the law prohibiting the employment of children in factories under a certain age, and the limiting the time of their work. Following this came an enactment called "the half-time system of education," which enabled factory operatives to have their children sent to primary schools. In 1838 Chadwick began the first movement looking to sanitary reform in London, the occasion being the breaking out of a fatal epidemic in the east end of the city adjoining some stagnant pools. He ordered an inquiry to be made as to the cause of the sickness, and the result was an exposure of existing evils as the cause of disease which led to the establishment of a sanitary commission whose duty it was to extend their inquiries throughout Great Britain. In 1848 Sir Edwin became the President of the first Board of Health. He had previously been honored by the title of Knight Commander of the Bath, by order of the Queen, for his exhaustive report on the sanitary condition of the laboring population of England presented to Parliament in 1842. The Board of Health broke up in 1854, and with it ended Chadwick's service in office. He repeatedly acted for the Government in regard to the health of the army, etc., in a semi-official way after that date. His last important public work was as President of the Association of Sanitary Inspectors.

Besides his work in the sanitary field Chadwick gave some attention to many political, economical and social subjects—taxation, civil service reform, temperance, education, etc.—and his writings were published in 1887 in two volumes, with the title of "The Health of Nations," the title being given by the editor, B. W. Richardson.

ACCORDING to John Richards experiments have shown that in rope transmissions more power is consumed in stripping the ropes from the grooves in the pulleys than was at first suspected. The incentive of a lower first cost led to making the angles more acute to secure traction, but the wear and loss of power increased accordingly. Modern practice tends to angles of 45 degrees and the pulleys should not be less than 30 times the diameter of the rope.

SMOKE ABATEMENT.

A correspondent of *Indian Engineering* suggests an original scheme for smoke abatement by asking whether it has ever been proposed to have a smoke duct running through a town connected up with the different furnaces. He suggests that such a duct might be carried outside of the city to a condensing station; an exhaust machine being employed to force the draught. At the condensing station the soot-laden air might be made to pass through water and thus deposit the solid matter, the air passing away comparatively pure, while the soot thus deposited might easily be collected, caked and sold as fuel. The size of the duct would have to vary, as in water and other mains, according to the work to be performed.

SOLID ORGANIC MATTER IN SURFACE WATER.

DR. DROWN, of the Massachusetts Institute of Technology, says that the amount of solid organic matter in a surface water which is fairly turbid with suspended plants is excessively minute. In the water of the Ludlow reservoir at Springfield, Mass., there is frequently an excessive growth of blue-green algæ, so that one would naturally suppose that the water contained a large amount of solid substance. But when this green mass is thoroughly dried the amount is less than one grain of solid, dry vegetable matter to the gallon. Whether, if taken in large quantities, it might have any appreciable effect has not been determined, but the dose is so minute, that even if it were a strong poison it would not do any particular harm.

TESTIMONIAL TO MAJOR MICHAELIS' FAMILY.

IT appears that Major O. E. Michaelis, of the United States Ordnance Corps, who died at Augusta, Me., in May, in consequence of injuries received in trying to save two of his children from drowning, left a family with almost no resources, and a move is made to raise a fund to assist them, to be invested in buying a house or otherwise. The widow has six children to provide for; she has taken steps toward assuming the burden and the fund was started without her knowledge. A circular, setting forth the facts in the case has been issued, signed by a number of engineers, to either of whom contributions can be sent, as follows:

William P. Shinn, 127 East Twenty-third Street, New York City; M. J. Becker, Chief Engineer P. C. and St. L. R. R., Pittsburg, Pa.; Charles B. Brush, 1 Newark Street, Hoboken, N. J.; F. Collingwood, Elizabeth, N. J.; John Bogart, 127 East Twenty-third Street, New York City; T. Comerford Martin, 150 Broadway, New York City; R. W. Pope, 12 West Thirty-first Street, New York City; S. S. Wheeler, 432 West Fourteenth Street, New York City, and George M. Phelps, 150 Broadway, New York City.

AMERICAN PUBLIC HEALTH ASSOCIATION MEETING.

THE Eighteenth Annual Meeting of the American Public Health Association will be held at Charleston, S. C., December 16, 17, 18 and 19, 1890. Topics for consideration are announced as follows:

1. Sanitary Construction in House Architecture.
    - (*a*) Heating.
    - (*b*) Lighting.
    - (*c*) Drainage.
    - (*d*) Ventilation.
2. Sewage Disposal.
3. Maritime Sanitation at Ports of Arrival.
4. The Prevention and Restriction of Tuberculosis.
5. Isolation Hospitals for Infectious and Contagious Diseases.
6. Establishments in Favorable Climates for persons having Tuberculous Predispositions.
    - (*a*) Schools for Children and Adolescents.
    - (*b*) Sanatoria.
    - (*c*) Permanent Residence.
7. Papers on Miscellaneous Sanitary and Hygienic Subjects.

Communications relating to local matters should be addressed to H. B. Horlbeck, M. D., chairman of the local committee of arrangements, Charleston, S. C. The address of the Secretary of the Association is Irving A. Watson, M. D., Concord, N. H.

JAPAN is making rapid progress in electric lighting. At present there are five companies having central stations, with a combined capacity of 22,300 lamps. Ten smaller companies, recently formed, are about to begin operations. They will supply 16,800 lamps.

NOTES.

THE Board of Health of New York City has formally declared the mains of the New York Steam Company in a down-town section of Broadway a nuisance, and ordered their use discontinued. This is the result of an inspection of a part of the company's street pipes.

A BOARD of the United States Engineers' Corps, consisting of Colonel W. P. Craighill, Colonel C. B. Comstock and Major C. W. Raymond, are at Philadelphia making an examination with regard to a new harbor line for the city in connection with the removal of the obstructing islands in the Delaware River.

A SCHEME is reported in St. Paul, Minn., for building an underground railroad from the Northern Pacific Railroad track through the alley between East Fifth and East Sixth Streets nine blocks to Broadway. The purpose is to deliver freight to wholesale stores along the route, and it is reported that Henry Villard and other influential railroad men are interested in the enterprise.

THE hydraulic valve described in the article entitled, "A New Method of Cleaning Reservoirs," in this journal, June 28, was designed by Capt. Edward Ruger, Chief Engineer of the American Water-Works Company.

A NEAT little pamphlet comes to hand with the title, which clearly indicates its contents, of "Recollections of General Grant; with an Account of the Presentation of the Portraits of Generals Grant, Sherman, and Sheridan at the U. S. Military Academy, West Point, by George W. Childs."

IT is reported that an electric railway company in Siam has been incorporated and that a road will be built at once from Bangkok to Paknam, a distance of 30 miles. This road is to cost $400,000, and Siamese capital will alone be used. An electric light company has also been organized and the plant ordered for Bangkok.

IT is announced that water will be temporarily turned on through the new Croton Aqueduct Tuesday next. The intention is to fill the Central Park Reservoirs and then shut the water off and complete some work about the Aqueduct.

OBITUARY.

WILLARD MARCY, President of the American Frost Meter Company, of Boston, died suddenly July 5.

PERSONAL.

J. A. STEWART was recently elected City Engineer of Cincinnati, O.

W. A. SOMERS has been appointed Engineer of the Water-works Department of St. Paul, Minn.

WILLIAM TAYLOR, Water-Works Superintendent of College Point, N. Y., has resigned his position.

JACOB J. RUECKERT, formerly with James W. McLaughlin, architect, of Cincinnati, has opened an office at the corner of Twelfth and Walnut Streets, of the above-named city.

GEORGE W. KITTREDGE has resigned his position as Engineer Maintenance of Way on the P. C. and St. L. Railroad to accept the position of Assistant Chief Engineer of the Big Four. F. T. Hatch will succeed Mr Kittredge.

CALVIN TOMPKINS, manufacturer and dealer in cement, stone, sand, etc., has just returned from Europe, where he has been investigating the methods of preparing and daily distributing ready mixed mortar from a central depot to buildings in construction throughout the city, and he is preparing to establish such a system in this city.

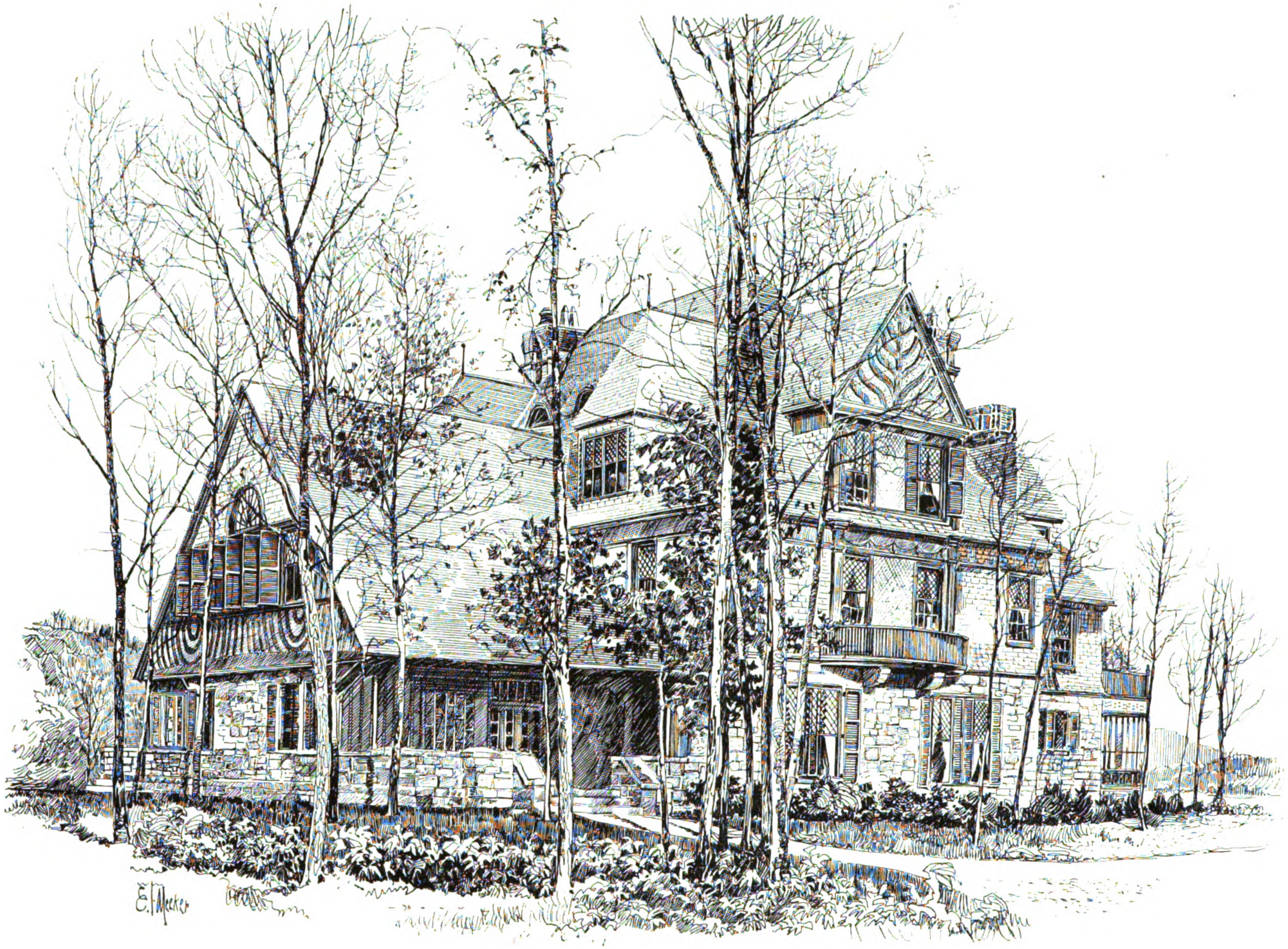
COL. JOHN MACLEOD, M. Am. Soc. C. E., has taken charge, as General Manager, of the construction of the Richmond, Nicholasville, Irvine and Beattyville Railroad from Versailles, 97 miles, to Beattyville, Ky. His office will be at Louisville, where he will continue his practice as consulting engineer. Colonel MacLeod is also building the New Albany Belt Railroad at New Albany, Ind.

OUR ARCHITECTURAL ILLUSTRATIONS.

HOUSE AT TUXEDO PARK, N. Y.

JAMES BROWN LORD, ARCHITECT, NEW YORK CITY.

DOORWAY OF PURDY HOUSE, WASHINGTON, D. C.



THE ENGINEERING AND BUILDING RECORD ILLUSTRATED SERIES.

HOUSE AT TUXEDO PARK, N. Y.

JAMES BROWN LORD, ARCHITECT, NEW YORK CITY.

NEW YORK, VOLUME XXII.

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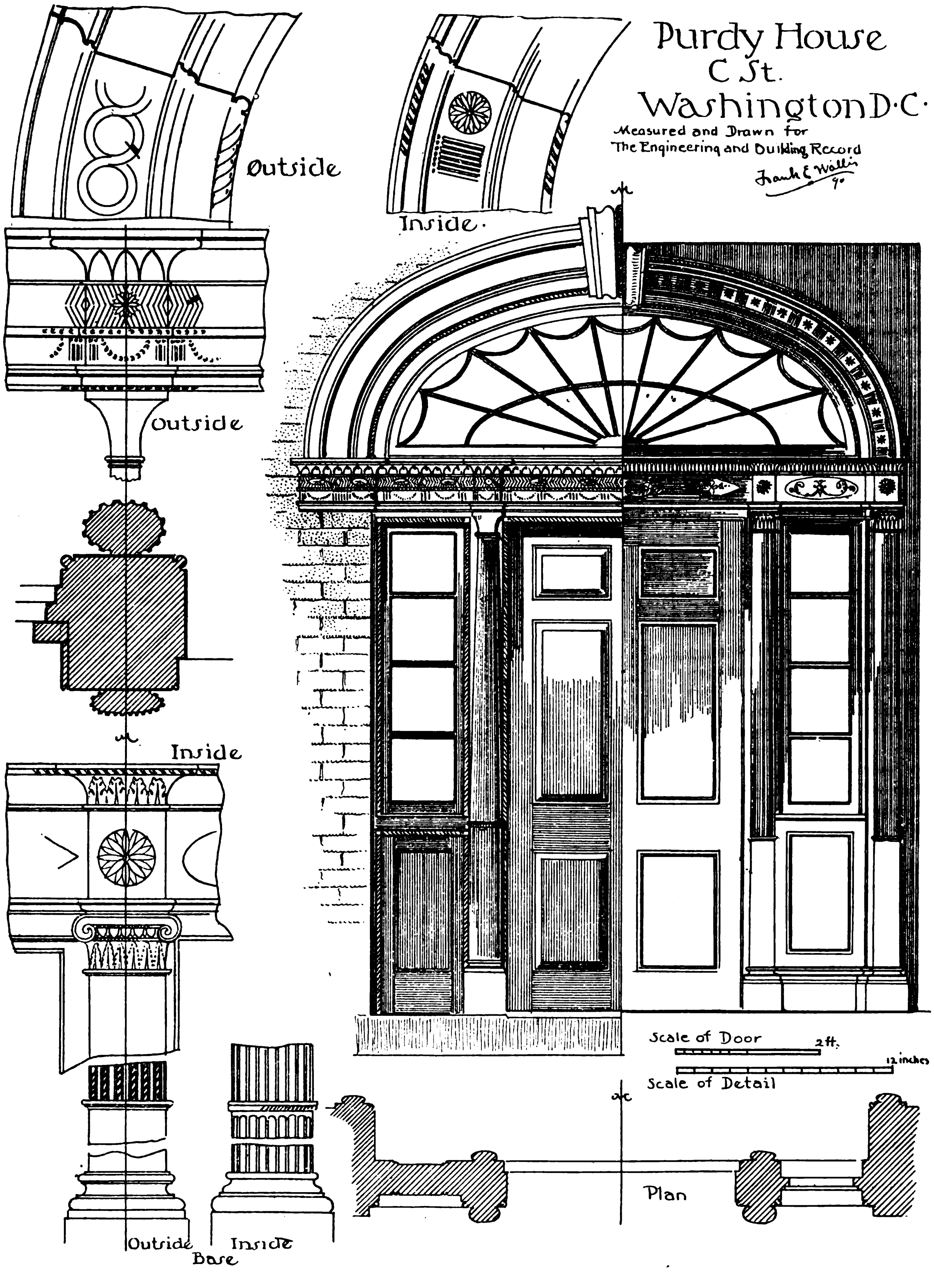
LETTER FROM ENGLAND.

LONDON, June 20, 1890.

THE Prince of Wales has exercised a wise discretion in expressing his opinion that an international exhibition should not be held in London before 1899 or 1900. This opinion has been criticised, but perhaps the best argument which can be advanced in its support is the fact that some manufacturers are actually using, as a recommendation for their goods, the statement that they have not been exhibited in certain exhibitions. The reason for such a statement is undoubtedly the very indiscriminate distribution of medals and certificates. Indeed it was openly said in connection with more than one exhibition that these medals and certificates were not available to those who did not go the right way to work to get them, while, on the other hand, the man who could afford to pay for them held a very great advantage.

In view of the approaching holiday season the authorities at Eastbourne are attempting to offer additional inducements and security to visitors. They have, therefore, decided that certificates of the sanitary condition of the various houses shall be issued where called for, and have appointed an additional staff of sanitary inspectors. These certificates are, of course, intended to affect the dwelling houses which are let out in lodgings during the season, but the optional nature of the certificate will undoubtedly defeat the objects of the scheme. While lodging houses, strictly and properly so termed, are obliged to have certificates from the health authorities, those dwelling houses which are, equally with the others, public lodging houses during the season have no such compulsion. It is not likely that in the scramble and competition which obtains throughout the height of the season, when householders are able to get their own exorbitant prices for their lodgings, the visitors will take the trouble to find out as a general rule whether the landlord's health certificate has been properly visèd.

The business of Oswald Mordaunt & Co., of Southampton, has been turned into a limited liability company trading as the Southampton Naval Works, Ltd., with J. H. Biles, lately with J. & G. Thomson, Clydebank, as General Manager, and Mr. Gearing, formerly Superintending Engineer to the Inman Line as engineer. The Southampton company proposes to turn out vessels of all tonnage, and claims to have additional facilities for that purpose.



THE PROPOSED SEWERAGE OF PART OF TRENTON.

A SYSTEM of sewerage proposed for that part of Trenton, N. J., known as Chambersburg, and lying south of the city along the Delaware River, is the subject of a report made by Rudolph Hering, of New York City, November 22, 1889, and recently published by the city authorities.

In recommending the adoption of Mr. Hering's plans, the Sanitary Committee call attention to the fact that "the problem to be solved was one of considerable intricacy, as the surface is so nearly level that it was impossible to apply the separate system except to small portions," and add, "no estimate of the cost of construction is presented for the reason that our people are becoming familiar with the expense necessarily entailed in the procurement of good sewer work."

It would appear that Mr. Hering had in 1885 reported a plan for the older part of the city, and the present report is therefore much in the nature of a supplement to the previous one, and the removal of sewage, surface and subsoil water have been "considered in the same light" as before.

The main outfall from the city, 5 feet 9 inches in diamter, passes through this new district, whose sewage it also receives, discharging it into the Delaware River a short distance below, although it is intended that ultimately the outfall shall be further down the river.

The laterals are designed for sewage only, the surface water being carried in the gutters for two or three blocks before entering the sewers, which thereafter carry everything until the main interceptors are reached, which are below the other sewers and consequently catch all their flow under ordinary circumstances, but when the flow is swollen by a storm then the greater part of it leaps over the interceptor into the overflow beyond, by which it is discharged directly into the river or into a creek leading to it, thus relieving the main outfall. This arrangement appears to give most of the advantages of the "combined" system, with much of the economy of the "separate" one.

The soil is gravel, loam and clay, and therefore easy to excavate, which is fortunate as, owing to the flatness of the ground and other reasons, some of the main sewers are over 20 feet deep for several blocks.

Much stress is laid upon the importance of thorough and competent inspection on the proposed work, and attention is called to the fact that when a contractor takes work at a price hardly sufficient to pay for its execution, it is almost impossible to prevent the slighting of some of it, and the recommendation is made "in the interest of good work," that contracts be awarded only to competent parties, and at prices which will allow them to do first-class work.

The report concludes with an acknowledgment of the conscientious care which W. L. Anderson, Engineer in Charge, has given to the work already built, by which, in spite of serious obstruction from water and quicksand and the consciousness on the part of the contractor that he was losing money, a fair piece of work was secured, better than is often obtained under similar conditions.

Two large colored sheets accompany the report, which reflect much credit upon those who had charge of its publication. One is a map of Chambersburg on a scale of 400 feet to the inch, and the other contains a set of profiles of all the main sewers.

ENLARGING THE EAST BOSTON DRY DOCK.

THE old Simpson Dry Dock at East Boston, Mass., originally completed in the fall of 1863, is being entirely rebuilt. While its general model will be retained the principal improvement contemplated is an increase in length of 100 feet, which will make the total length nearly 500 feet. On top the dock is 82 feet wide, and at the bottom 48 feet, and it will take in vessels of 19 feet 6 inches draught. While new gates will be built in the same position as the old ones, that is at about 400 feet from the inner end, the entrance to the dock, when extended, will be closed by a wooden caisson or floating gate similar to that in use at the Charleston Navy Yard. When it is necessary to use only a part of the dock the inner gates may be shut, which will give an inclosed space of 400 feet in length as heretofore, while in the case of large vessels when the entire length of the dock will be required these inner gates may be left open, and the caisson at the outer end put in position and there sunk by being filled with water when the dock can be pumped out. For this purpose centrifugal pumps will be used, having a capacity of 45,000 gallons per minute, and so arranged as to draw off water from the dock at any height and keep it entirely dry without the use of any supplementary pumping apparatus.

It is expected that it will take two months longer to finish work, the estimated cost of which is about $200,000. When completed this will be the largest dry dock in New England. M. M. Tidd, of Boston, is the consulting engineer, and James F. Fifield the engineer in charge of the work.

WATER DELIVERY FROM SERVICE PIPE.

AT the recent Portland, Me., meeting of the New England Water-Works Association, Mr. Dexter Brackett presented the appended table showing the quantity of water delivered by service pipes of various sizes, under various pressures. The table was taken from the annual report for 1877 of the Rochester, N. Y., Water Department. The results are given in gallons per minute. The different column headings show the proportion of head of water (H) to the length of pipe (L).

TABLE OF QUANTITY OF WATER DELIVERED BY SERVICE PIPES OF VARIOUS SIZES, UNDER VARIOUS PRESSURES.

Diam. of Pipe. Inches.	$H = 10 L$.	$H = 9 L$.	$H = 8 L$.	$H = 7 L$.	$H = 6 L$.	$H = 5 L$.	$H = 4 L$.	$H = 3 L$.	$H = 2 L$.	$H = 1\frac{3}{4} L$.	$H = 1\frac{1}{2} L$	$H = 1\frac{1}{4} L$.	$H = L$.	$H = \frac{3}{4} L$.	$H = \frac{1}{2} L$.	$H = \frac{1}{3} L$.	$H = \frac{1}{4} L$.	$H = \frac{1}{5} L$.	$H = \frac{1}{6} L$.	$H = \frac{1}{7} L$.	$H = \frac{1}{8} L$.	$H = \frac{1}{9} L$.	$H = \frac{1}{10} L$.
½	19.8	18.7	17.7	16.5	15.3	14.0	12.5	10.8	8.8	8.3	7.7	7.0	6.3	5.4	4.4	3.6	3.1	2.8	2.6	2.4	2.2	2.1	2.0
⅝	34.5	32.7	30.1	28.9	26.5	24.4	21.8	18.9	15.4	14.4	13.4	12.2	10.9	9.5	7.7	6.3	5.5	4.8	4.4	4.1	3.9	3.6	3.5
¾	54.4	51.7	48.7	45.6	42.2	38.5	34.4	29.8	24.3	22.8	21.1	19.3	17.2	14.9	12.2	9.9	8.6	7.7	7.0	6.5	6.1	5.7	5.4
1	111.8	106.0	100.0	93.5	86.6	79.0	70.7	61.2	50.0	46.8	43.2	39.5	35.3	30.6	25.0	20.4	17.7	15.8	14.4	13.4	12.5	11.8	11.2
1¼	195.2	185.2	174.6	163.3	151.2	138.0	123.4	106.9	87.3	81.6	75.6	69.0	61.7	53.5	43.7	35.6	30.9	27.6	25.2	23.3	21.8	20.6	19.5
1½	308.0	292.1	275.4	257.6	238.5	217.7	194.8	168.7	137.7	128.8	119.3	108.9	97.4	84.3	68.7	56.2	48.7	43.9	39.8	36.8	34.4	32.5	30.8
2	632.2	599.7	566.4	528.9	488.1	447.0	399.8	346.3	282.7	264.4	248.8	223.5	199.9	173.1	141.4	115.4	100.	89.4	81.6	75.6	70.7	66.6	63.2
2½	1,104	1,048	987.8	924.0	855.4	780.9	698.5	604.9	493.9	462.0	427.7	390.4	349.2	302.4	246.9	201.6	174.6	156.2	142.6	132.0	123.5	116.4	110.4
3	1.745	1,651	1,560	1.460	1,351	1.234	1,103	955.5	780.2	728.8	674.8	615.9	555.5	477.1	390.1	317.8	275.8	246.7	225.2	208.5	195.1	183.9	174.5
4	3.581	3,397	3.203	2,996	2.774	2,532	2,265	1,962	1,602	1,496	1,385	1.264	1,133	979.3	800.8	653.8	560.2	506.5	463.2	428.0	399.9	377.5	358.1
5	6,247	5,925	5,588	5.227	4,839	4,417	3,951	3,406	2,791	2,613	2,420	2,209	1.976	1,711	1,394	1,141	987.7	883.5	806.5	746.7	698.5	658.5	624.7
6	9,855	9 349	8,814	8,245	7.633	6,968	6.233	5,391	4.407	4.122	3,817	3,484	3,116	2,693	2,204	1,799	1,558	1,384	1.272	1,178	1,102	1,039	985.5

CORNELL'S COURSE IN ARCHITECTURE.

A CIRCULAR of information as to its course in architecture is issued by Cornell University, describing the conditions of admission and study for the four years. The purposes are summarized in a note, as follows: "The study is intended to cover the whole ground of education in architecture—practical, scientific, historical and æsthetic—as thoroughly as is possible in a four years' course. On its completion the student is qualified to take an advanced position in an architect's office. If he wishes to continue his studies he can return to the university as a post-graduate and, after a year's work, duly laid out, completed and approved, may receive the second degree, Master of Science in Architecture."

WATER-HAMMER AND CEMENT-LINED PIPE.

IN discussing the effect of water-hammer on cement-lined pipes at a recent meeting of the New England Water-Works Association, George E. Winslow, Superintendent of the Waltham, Mass., Water-Works, directed attention to the importance of having relief valves on large-supply branches. Among other things he said:

"I have but one elevator in Waltham connected with our mains, and that is from a cement pipe. It is connected with a 2-inch pipe; it was put in by a Worcester firm, and they showed me the valve they were going to use, and I told them I should require a relief valve on the service pipe close to the valve the elevator was worked with. The man in charge of it wanted to know why, and I told him because they could shut the valve so quick that they could create a water-hammer that would burst our main. He thought it was foolish; but I said: 'Our pipes are cement-lined pipes, the iron is thin, and it hasn't got the strength of cast-iron pipe; if it had, perhaps it would not be necessary to take this precaution.' Well, they finally put it on, and we have had no trouble from it, for there is no water-hammer; if there is pressure enough so that we might get a water-hammer the water escapes through the relief valve.

"We also have a stand-pipe in Waltham for the Fitchburg Railroad, and Mr. Turner, the chief engineer of the road, wanted to connect with our mains and put on a slow moving gate; that is, a gate with a fine thread, so they would shut the valve slowly, so they couldn't produce any water hammer. He wanted to get rid of a tank which was an eyesore in front of the depot. I told him I was afraid that, with the men who generally work valves on a railroad, they would burst our pipe by increasing the pressure rapidly by a sudden closing of the valve. He said they wouldn't do it, and he said, furthermore, 'I will put on a good, careful man, and he will be responsible.' But I saw one of those careful men operate a valve in Worcester at the Union depot one day when I was up there to see what kind of an arrangement they had—to see what I could do for the Fitchburg Railroad. The express train came through there along about 20 minutes past three in the afternoon, and I knew they would water up, and so I went to the depot to see them do it. The water was turned on, and the fireman didn't pay attention to his business as closely as he ought, and the consequence was the tank got pretty near full before he noticed it. 'Shut it down, you will overflow in a minute; hurry up, hurry up!' And they did hurry up, and that valve was shut just about as quick as it could be shut. That was the careful man who was taking care of that valve. Now I made up my mind that would be the case in Waltham, so I told Mr. Turner that if he would put on a relief valve which would be large enough I should be happy to put in a service for him. He didn't like that idea; and he is a pretty set man any way, as well as myself, and the consequence was we went through that fall and winter without any stand-pipe. In the spring he came to me one day and he asked me when I was going to put in the service for him. Said I, 'Just as soon as you can conclude to put in a relief valve. As I understand it you want a 6-inch pipe taken off from the street main, run through a 4-inch meter, and then a 4-inch pipe to your stand-pipe?' 'Yes.' Said I, 'As soon as you will put that in, and put in a relief valve close to the valve which operates the stand-pipe, and that shall be a 3-inch valve, and not be set at over 10 pounds above the standing pressure, just so soon we will put it in for you.' Said he, 'I will put in anything you want.' And the consequence was he put it it, and we never have had any trouble."

SHOULD PILES BE SHARPENED?

IN pile driving, it is said in the University of Michigan *Technic* to be held by many experienced engineers, both on the Atlantic Coast and on the Mississippi, that for ordinary ground the pile should not be sharpened. They say that the pile if sharpened rarely has its point in the neutral axis, and that the blows of the hammer are not applied so that the action line of the force passes through the point, and hence a couple is introduced tending to strain and weaken the timber. If, on the other hand, the pile is left blunt, the consolidated earth forms a point which, changing with each blow, keeps itself continually in the line of force and hence the straining couple is not introduced. In ordinary practice, however, the pile is tapered somewhat at the lower end, although not sharpened to a point.

NEW ENGLAND WATER-WORKS ASSOCIATION SKETCHES.

No. XIII.

(Continued from page 230, Vol. XX.)

COAL CAR FOR WATER-WORKS USE.

AMONG the sketches contributed to the recent Portland meeting of the New England Water-Works Association in response to a request which had been sent out for diagrams of any tools or devices of practical water-works interest, was that shown in the annexed illustration, submitted by Rudolph Hering, of New York. The illustration explains itself, the special advantage of the car being that it admits of readily shoveling the coal directly from it into the furnace. The car shown is used at the Toronto Water-Works.

COST OF AN ELECTRIC RAILROAD PLANT.

IN discussing a paper on "Working of Railroads by Electricity," presented by W. E. Hall at the last meeting of the American Society of Mechanical Engineers, F. A. Scheffler, of the Westinghouse Company, Pittsburg, Pa., gave some points on the cost of installing an electric railroad plant.

The ordinary locomotive of to-day when running at the average rate of speed and hauling the average load, does work of not less than 300 horse-power. Supposing the station to be built to have a capacity, to each 30 miles of section, of not more than one locomotive, the capacity of the generating station would, according to Mr. Scheffler, necessarily have to be about 360 horse-power, as the best forms of motors at present have an efficiency of only about 80 and 85 per cent. It will require, therefore, for the generating station a 360 horse-power engine and sufficient boilers for operating the same. The cost of the station can be summed up about as follows:

One 360 horse-power engine	$10,000
Battery of 360 horse-power boiler	7,000
Station building	5,000
Steam connections, pumps, feed-water heaters, etc.	2 coo
Generating dynamo	12,000
Electrical station appliances, etc	1,000
Making a total of	$37,000

The foregoing station outfit will not permit of having an auxiliary plant of engine, dynamos and boilers, which ought really to be included in the outfit, so that in case the engine or dynamos or boilers should at any time become inoperative there would be another set of appliances to operate the railroad with. An auxiliary set of appliances would almost double the total cost of the station.

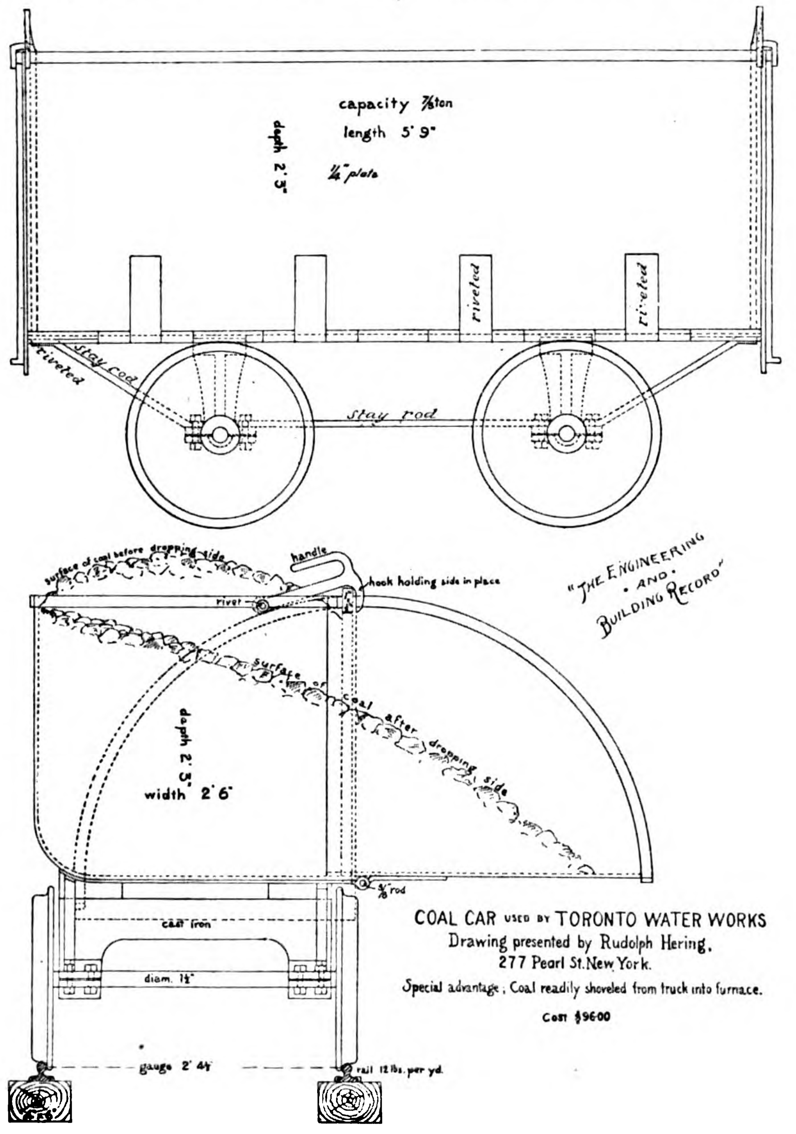
For operating expenses of the station we have the following:

5 per cent. depreciation on engine and boilers	$835
4 per cent. depreciation on dynamo	480
6 per cent. interest on station plant	2,220
Two firemen, night and day	1,440
Two engineers, night and day	2,000
Two laborers, night and day	1,080
Maintenance, such as oil, waste, etc	300
Making a total of	$8,355

per year, not including the cost of coal.

In order to ascertain what the cost of coal would be, we will suppose that the total power is required only for one-half the time, and one-quarter the power for the balance. This will give us 2,774 tons of coal per year required. This assumption is based on the supposition that the engine will require three pounds of coal per horse-power hour. If it was a condensing engine, of course the assumed rate of coal per horse-power would be too high, but the speaker should not think it advisable to use a condensing engine where the power would be so largely variable, and water along railroad plants is not always available for condensing purposes. Basing the cost of coal at $3 per net ton, the expense per year for same will be $8,322; adding this to the operating expenses of the plant at the station, we have a total of $16,677.

So far we have only taken into consideration the necessary cost of operating expenses of the station plant. We have now to consider the erection of the necessary electrical circuits along the line, the depreciation of same and the interest on the cost of same. Suppose that the pressure of the terminals was fixed at 2,000 volts, in order to deliver 300 horse-power to the motor it would be necessary to carry 112 amperes on the line, and allowing 20 per cent. drop in the pressure, by simple matter of calculation we find that the conductors will have to be of an area equal to a copper rod one inch in diameter. The pressure of 2,000 volts is altogether too high to think of using in a safe manner the rails for the return circuit, and a copper conductor would also have to be used for this circuit, making two lines of copper conductors one inch in diameter for the outgoing and return circuits. If the circuit is 30 miles long, it would require the enormous quantity of 476,784 pounds for each conductor, and the cost of copper wire at the present time being 17 cents per pound, the amount required to pay for the copper wire would be $162,106. The interest on this outlay at 6 per cent. would be $9,726. As an overhead circuit would be the cheapest possible way of conveying the current to the motor, and as the wire is of such an enormous weight, it would not be well to have the poles more than 50 feet apart. This would require 6,300 poles. Basing the cost of the poles and erecting same at $2.50 each, we have a total of $15,750. Erecting the line would be charged at $150 per mile, and this is a very low figure; this would give us $4,500, making a total cost of for the line of $20,250. The interest on this at 6 per cent. would be $1,215. Continuing the statement of operating expenses, it will be necessary to add the interest just given to same, and also the depreciation of the line. Putting this latter at about 2 per cent. (which is very low), which would be $3,627, we have a sum total of $31,245 as the actual total annual cost of operating expenses of the station plant, and interest, depreciation, etc., on each section of 30 miles.



COAL CAR USED BY TORONTO WATER WORKS
Drawing presented by Rudolph Hering,
277 Pearl St. New York.
Special advantage; Coal readily shoveled from truck into furnace.
Cost $96.00

It will not be necessary to take into consideration the cost of operating the motor, as this would be about the same as the cost of operating the steam locomotive, and the first cost of same would be about the cost of a first-class locomotive. The only comparison which should be made between the operating expenses of the steam locomotive and the electrical plant would be that of the difference of coal consumed between the station and the steam locomotive, and possibly the cost of repairs of the motor compared with that of the locomotive. The coal consumed by the ordinary locomotive is probably not less than eight pounds of coal per horse-power hour. This being the case, and the locomotive develops 300 horse-power for 12 hours, and one-quarter of this horse-power for the balance of the day, we would have per year a consumption of 6,570 tons. This, at $3 per ton, is equivalent to $18,710. Deducting the same from the cost of total operating expenses of the electrical station, we find that the difference is in favor of the steam locomotive to the extent of $12,475 per year. There would probably not be any difference in cost of repairs between the electrical and steam locomotive. The total cost of the station, copper wire and pole line complete would be $219,356. This amount of money would buy about 20 new locomotives.

The foregoing estimates are all based on inside figures, and if the railroad was 600 miles long it can be readily seen what an enormous expenditure for electrical purposes would be necessary, and comparing this with the cost of the present steam railroad, would be sufficient to upset any calculations in the line of electrical railroads.

A voltage of 2,000 has been taken as a basis for estimating the cost of the line, simply because it would require extraordinary care in insulation for a higher potential where the bare conductors, connections, insulating material, etc., would be subjected to all kinds of rough weather. If it were found that 4,000 volts could be satisfactorily insulated (and this has been done with covered wires in a few special cases), the first cost of line equipment would be very largely reduced to, say about one-half the above estimated cost, thereby reducing the yearly expense of operating by decreasing the interest and depreciation of the plant. As far as safety to human life is concerned, it is not likely that 4,000 would annihilate more completely than 2,000 would, but the chances for leakage of current at the higher voltage would be much greater. This would mean greater coal consumption and reduced efficiency of the electrical apparatus.

The operation of the plant at full power for one-half of the time involves, of course, the use of several motors, which has not been considered in the matter of operating expenses. Such consideration would not make any appreciable difference in cost of operating expenses, because there would necessarily be the same amount of expenses in the line of engineers, firemen and depreciation, etc., on the locomotives as there would be upon an equivalent number of motors.

It is safe to say that unless there are some radical changes made from the ordinary design of electric generators, and in the method of transmission of the current to the motor, as well as a motor of greater efficiency, that we will never see electric railroads operated in this or any other country.

BUILDERS' AND CONTRACTORS' ENGINEERING AND PLANT.

No. XCVI.

(Continued from page 75.)

REPAIRING A CHURCH ROOF TRUSS.

The Warren Avenue Baptist Church in Boston, Mass., is a brick structure built in 1864. Figure 1 shows the general plan, with a tower at Z and entrance wings at Q Q.

Figure 2 is a cross-section showing the roof construction. S and S' are longitudinal trusses that support the "scissors" trusses O O, etc., over the main part, and the inner ends of the lean-to rafters P P, etc., over the side parts. U U, etc., are purlins and R R are 1-inch diagonal rods for wind bracing in the end panels of the roof only.

Figure 3 is an elevation of the longitudinal truss S, whose details are shown enlarged in Fig. 4, which also gives a section at Z Z. The angle blocks and plates W and V were each cut 3 inches into the chords across their entire width, and as the diagonal rods E cut out at least one of the boards which composed the chord the maximum loss of section was over 57 per cent. The trusses were entirely without vertical struts, and the top and bottom chords were only kept from approaching each other when strained by the resistance of the clere-story studding and boarding shown by vertical lines in Fig. 3.

T T, etc., are windows. When first erected the trusses S and S' were found too weak, and were each reinforced by four 1¾-inch rods F F, etc., with nut bearings on iron plates across the ends of the lower chords. The different sections of these rods were simply hooked into each other, and the hooks tied down with strap iron as shown in Fig. 4. The rods were sprung down to the bottom of the chord at the center, and held there by occasional staples driven into the wood.

The scissors trusses O O, etc., were double and their two parts were not fastened together, the cross pieces being put on with 5 by ⅜-inch spikes, three at a joint, that only pierced two pieces and did not connect the twin members.

The roof existed in this condition about ten years, when the longitudinal trusses S and S' were noticed to be spreading at the top, and the adjustable tie rods W (Fig. 2) were put in through their top chords at the foot of each cross truss O. About 12 years later it was accidentally noticed that the trusses S and S' were sprung and canted out of their vertical planes. The boarding was removed to expose them, and their bottom chords were found broken and the roof in the position indicated in Fig. 5, where the center lines of the trusses are shown by full lines for the proper position and by dotted lines for the position which they had assumed, drawn somewhat exaggerated for distinctness. The south truss S was in the worst condition, and, deflecting a certain amount D, had been pushed at the bottom 6 inches towards the center by the side rafters P, which acted as struts pivoted at Y where they were fixed to the wall.

The scissors trusses C C, not having enough rigidity in the spiked joints to resist the strain, became distorted, the top of the truss S carried 4½ inches outward, and by the rods W brought the top of the north truss S' with it. The deflection of S and S' was so great as to throw heavy strains on the rods R R (Fig. 1), and there was danger that they would break, and that the trusses S and S' would capsize and the roof and perhaps the walls fall.

It was decided to immediately reconstruct the trusses. Piers were built under the floor, and above it, on 8x12-inch blocking, a heavy working platform was made and extended to protect all the pews. The weight of the roof was then transferred by jack screws to the main and intermediate piers, and the trusses S S' were rebuilt

In Fig. 6, C C is the center line of the trusses. At the left, half of the south truss S, is shown as reconstructed, and at the right, half of the north truss S' is shown as it was reconstructed.

Figure 7 is a section at Z Z, Fig. 6.

Figure 8 is an elevation of the new connection details, with sections at Y Y and Z Z. The trusses O O, etc., are indicated in Fig. 6, but the rafters P P, etc., are omitted for clearness. In the truss S the top chord was so much twisted that it was turned flatwise, and seven of the eight 2x14-inch plank composing it were bolted to the new 8x8-inch reinforcing pieces M, which overreached it 2 inches, and in this space inclined pieces G were set under the lowest purlins.

In the truss S' the old top chord was not changed, except to add the 8x12-inch reinforcing piece L, and the 2x14-inch plank N to bolt to, and to cut into the face of the old chord to set the braces G.

All the old inclined posts were removed except those marked D D, etc., and were replaced by new ones H H, etc., 8x12 inches in pairs and set in lighter angle blocks, V, Fig. 8, with web pieces to secure the post instead of the 1-inch wooden pins, which, in the old posts, had in some cases been compressed to ⅝ inch in one direction.

The tops of the posts H H were mortised into the pieces L and M, and secured by iron side plates U and cross bolts. The vertical posts and ties I and J were added at every panel, and pieces K were notched on 2 inches at the center of every panel.

Both chords were thoroughly bolted throughout, the lower chord being secured by clamps B B, etc., and having additional hooks A A', etc., to secure the rods F F, etc. The pieces Z Z (Fig. 2) were also added to the trusses O, whose joints were secured by bolts shown by the small circles.

The weight of new castings was about 2,800 pounds less than that of the ones they replaced in each of the longitudinal trusses.

These repairs were estimated to cost $3,000 or $4,000, and were executed by J. Purdy French, of Boston. I. C. Blair, also of Boston, who discovered the distortion of the trusses, erected the staging and had general oversight of the repairs.

REPAIRING A ROOF TRUSS

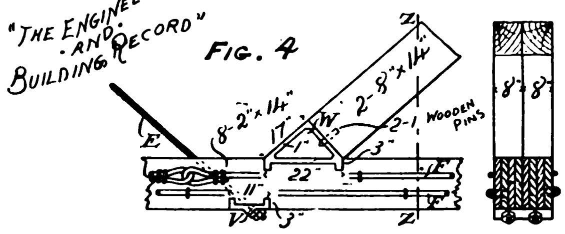


FIG. 4

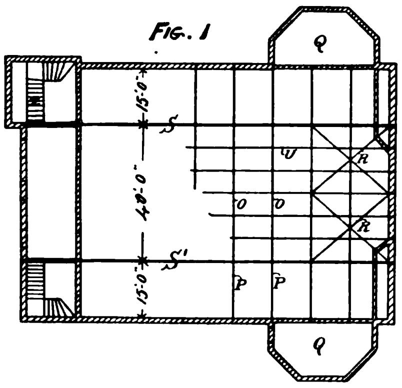


FIG. 1

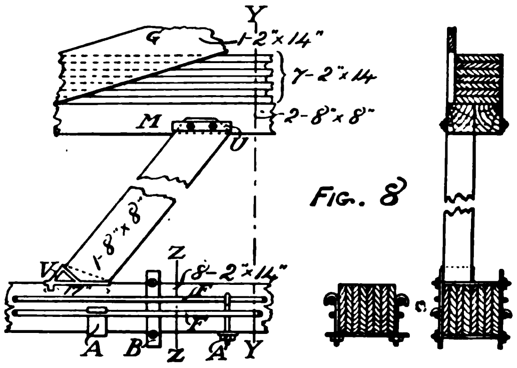


FIG. 8

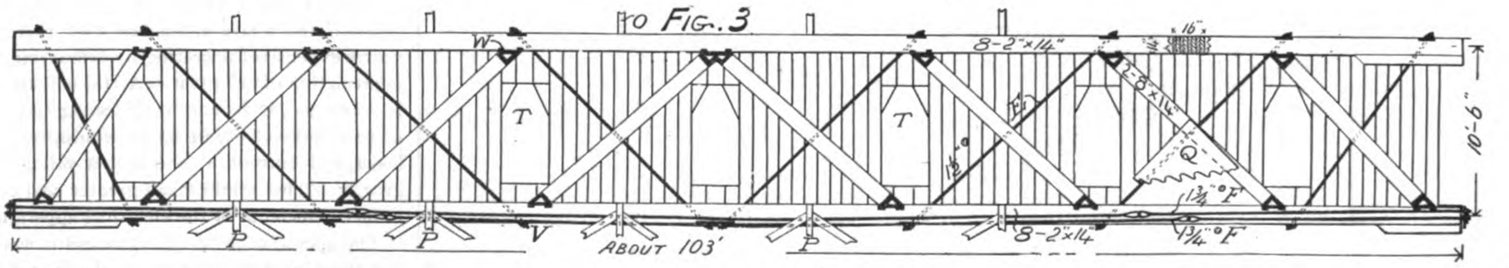


FIG. 3

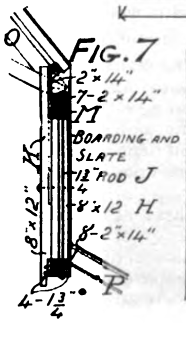


FIG. 7

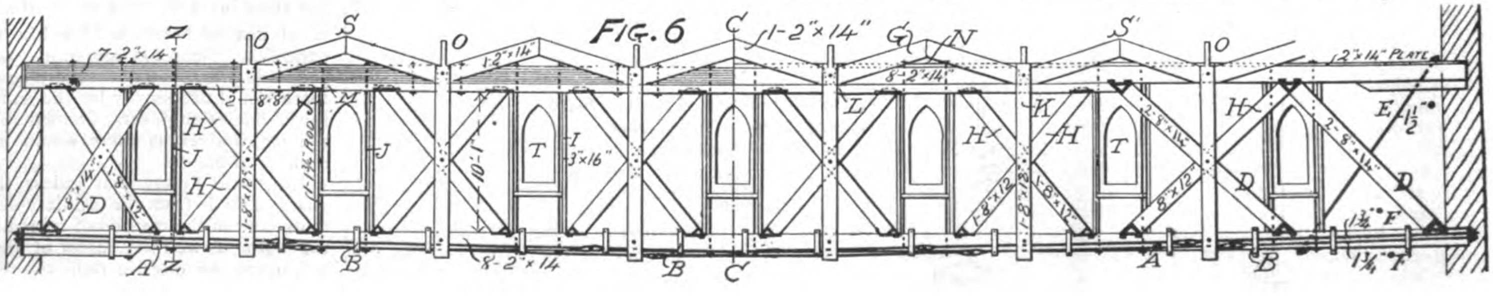


FIG. 6

NOTES ON THE CARE OF SEWERS.*

Assuming first that the sewer or system of sewers has been well designed for the work it is to do, and properly located, the care given to the sewer or system should begin when the first brick or pipe is laid, and should continue so long as the sewer is in use. The average "city father" of the average city is not educated up to the point of believing that anything more is necessary to the procuring of a sewer than the employment of some one to build it. He thinks, in brief, that a sewer is an elongated hole in the ground, surrounded by brick or pipe, laid in some shape by somebody, and that any special oversight or skilled labor used in behalf of the city during construction is an unnecessary refinement of engineering, and any money spent afterwards for supervision or care of the work is so much additional and useless tax upon the citizens. Such is about the belief of the average city father, but I am happy to say that my lot has been usually cast among those of a better belief. We, as engineers, know that almost any man can lay pipes in the ground or pile up bricks and mortar; that it takes a skillful man and a mechanic to make a good sewer of the same materials.

The first great care of the engineer in building a sewer is to see that his alignment and grade are true, and the second is to see that the materials are of the best description and properly placed. In the matter of alignment and grade, it seems almost imperative that each pipe should be laid to a line in order to get the best results. It is the practice in some places to give a stake on the side of the proposed trench, from which to measure for both line and grade, and in other places the line is marked out in advance by stakes, and the grade afterwards given in the bottom of the trench. In still other places the approximate line is worked on the ground in advance, and the grade is given as about so much below the surface here, and about so much there, leaving the sewer builder to regulate affairs in between points as suits him best, regardless of results. Any method which will secure a straight and true line of sewer is a good one; the one of placing grade points on line and at an even number of feet above and parallel to the water line seems to be the best. From these points a line can be stretched, and from this line each length of pipe should be set by a plumb line and a measured pole or steel tape. In case of very large or deep sewers the details may be varied to suit the case in hand. The grade line having been established and the contractor ready to begin, the engineer (unless he has no other employment) will need a competent and reliable inspector to see that the sewer is actually laid as it should be, and to see that the materials are what have been agreed upon. And upon this same inspector rests a large part of the burden of securing an excellent piece of work. He must be ever present and ever watchful, or something may go wrong, and after lying buried for years, perhaps, that wrong spot will show itself in some way to bring discredit upon both engineer and inspector. He must see that each pipe is sound and true before it is lowered to the bottom. He must know that the pipe to follow will fit well to make a true and smooth water line, even if the two pipes are not exactly concentric. He must see that the cement is good and properly mixed. He must see that each pipe is laid to line and grade, the joint carefully made with cement all around the pipe, and not disturbed until it is well filled around and over. He must tell the pipe layer at least a hundred times a day to tamp well around the pipe and to wipe it out so as to remove loose cement or sand which may be inside, and finally cleared of all rubbish. He must measure to locate each Y branch or house connection from the nearest manhole. He must look to it that the manholes are built true in form, smooth in inside finish, well plastered on the outside, steps built in at the proper distance. He must see that the trench is filled, tamped or puddled, and left in good condition for travel. So much care at least must be given to the pipe sewer to insure anything like a good job. In building a brick sewer even more details are to be looked after and greater skill required on the part of builder and overseer than in the case of a pipe sewer. Some one must be on the work to note the character of the foundation as the digging progresses, for a good piece of brickwork, built on a poor foundation, is no better than a poor one, and there is no better time to see what may be needed in the foundation than when the excavation is going forward. Some one must be on hand to see that the timber foundation, or whatever may be used, is properly placed and secured. Then there is care to be taken in setting the profiles or forms for the brickwork; in noting the quality and mixture of the cement; in selecting the hardest, smoothest and best bricks for the invert; in watching the masons to see that they lay each brick to the line with a full mortar joint, and without unnecessary pounding or pushing after it is in place to break the bond of the cement; in having the bricks wet in dry weather and not too wet in wet weather; for cement hates a dry brick and will not cling to it, nor can it hold a soaked one to its place. Then care must be taken in setting the slants for house connections, lest they have insufficient support at the back and are not able to stand the weight of earth on top. The arch must be turned on a good and true center in lines parallel to the axis of the sewer, and so spaced that a full number of courses will make the arch without splitting a course. The earth must be filled in and tamped solidly at the haunches to keep the arch from cracking, and at the same time so placed as not to tear off the plastering on the outside. If there is inside or second sheeting, some one must see that it is drawn above the crown of the arch before filling, for there will most likely be a crack in the brickwork if it is left to be drawn afterwards. In case of water in the trench great care must be used to keep it away from the brickwork until the cement is thoroughly set. I never yet saw a contractor who would voluntarily keep water from flowing over the freshly laid invert, even if the water could easily be taken care of, and would be a nuisance to the masons if allowed to run, and would make him more expense in repairs and delays than the cost of pumping or bailing.

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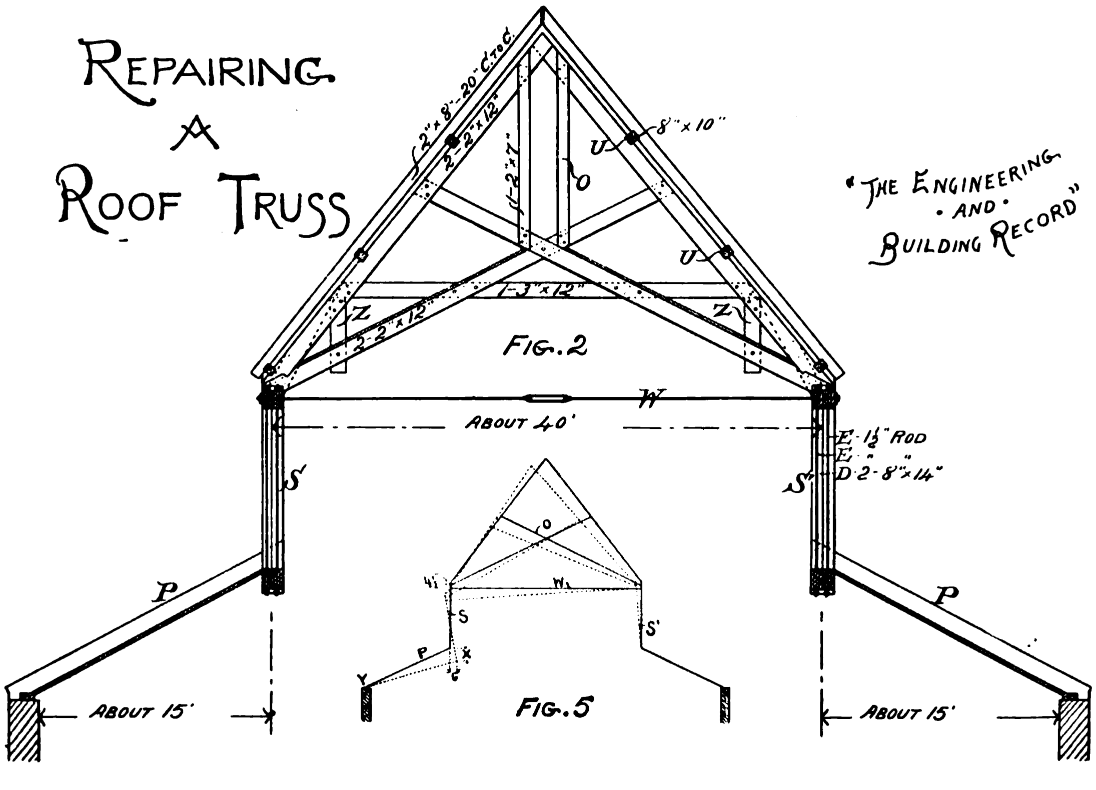
*A paper read by F. Floyd Weld, President of the Connecticut Association of Civil Engineers and Surveyors, published in the Transactions of the Association.

Manholes must be laid out with care to have the foundation firm and substantial, the junctions for lateral sewers built in a smooth and workmanlike manner, the head of the sewer cut in good shape, and the walls carried up to the surface in a symmetrical and smooth piece of work. Finally the sewer should be left clean, free from all rubbish, loose cement, brick chips, sand, mud or other accumulations. And now, having built our sewers with some considerable care and attention, shall we consider the duty of the engineer done, his occupation gone so far as these particular sewers are concerned, and the sewers no longer in need of supervision from anyone for all time to come? I think not. The work of building is over, but the work of running the machine is to come. It would be as reasonable to expect a complicated piece of machinery to care for and run itself as to expect a system of sewers to do their duty without some intelligent oversight. A perfect sewer, used always with the utmost care, with a stream of water of constant and ample volume flowing through it, might need no care for a number of years, but perfection in this world of sewers is rarely attained, and a steady flow of water is not always to be had.

As with persons, "Cleanliness is next to Godliness," so with sewers, cleanliness is next to success. A dirty sewer is an abomination, and if allowed to continue dirty is a failure. It all depends upon the care and oversight given to sewers whether they shall be clean or dirty, whether they shall do in a regular and continuous way the work they were designed to do, without offense or danger to the people, or shall fail to carry off promptly the refuse from our homes, and so become a receptacle for filth, disgusting to clean out and a menace to health.

There is nothing like water to keep sewers clean. If there is a lack of it the heavier parts of the sewage settle to the bottom, and cling there to decompose and send off noxious gases. This trouble is most often found in the separate system on lateral sewers, or on the ends of main lines where but few houses are connected. A flush tank at the end of such lines, arranged to discharge several hundred gallons at intervals of 4, 6, or even 12 hours, will usually keep the pipe clear. If an automatic tank is not used, frequent flushings from a hydrant or from a portable tank on wheels is very effective. Sometimes, on light grades, even where there is a good flow, it becomes necessary to clean out the sediment, and oftentimes a flush of water is not sufficient. In such cases scrapers or brushes have to be employed. I have used, with very good results, a scraper made of two wooden disks, between which a flange of rubber is bolted. This rubber fits the pipes and is drawn from one manhole to another by a rope, the rubber being flexible enough to easily pass any inequalities in the pipe. Where street water is admitted to the sewers the cleaning is sometimes quite an item; for in spite of traps on catch basins, some sediment will be carried over by the rush of water in heavy storms, and will settle at the light grades. To remove this, something more than water is necessary at times. I have used on large pipes and small brick sewers a metal scraper, made of galvanized iron, shaped like a tube, with one end funnel shape, and the other pointed. This is drawn from manhole to manhole by a rope, and raised to the surface by a small derrick. Where the sewers are large enough to admit a man, the cleaning of sand or heavy sediment can best be done by using a wheeled truck, adjusted to fit the bottom and sides of the sewer. This truck carries buckets, which, when filled, are lifted to the surface.



In making connections with sewers care should be taken to see that the pipe is properly fitted and jointed with the branch left for such use. Neglect in this respect makes much trouble for those in charge of sewers. Mud and sand often come in from an opening made to connect with a house, because it is easier to let it run into the sewer than to bail it out. Unless there is some system of license and permit for connections, and inspection of work, there will be frequent tapping of sewers at places other than the proper branches, with the attending results of broken sewer pipes, mutilated brick sewers, and pipes projecting inside to make stoppages. Careless work of this kind has been known to almost ruin a system of sewers. It has happened where it was thought no one was needed to look out for sewers after they were once built.

The best of care on the part of those in charge of sewers will not prevent misuse of them by others, and a complete choking of small pipes may result from the admission of sand or improper articles to the sewer from occupied houses or cellars in process of construction. In case of stoppage, prompt action is imperative to prevent damage to adjoining property. A useful implement to have is a rod for cleaning. Water pipe, 1 inch in diameter, cut into lengths short enough to be handled in a manhole, may be cut with a screw thread on each end, to be joined together with a union. These pieces, fitted together, will make a good rod for forcing an opening through the obstruction, and will usually start a flow of water which will gradually enlarge the opening until the sewer is cleared.

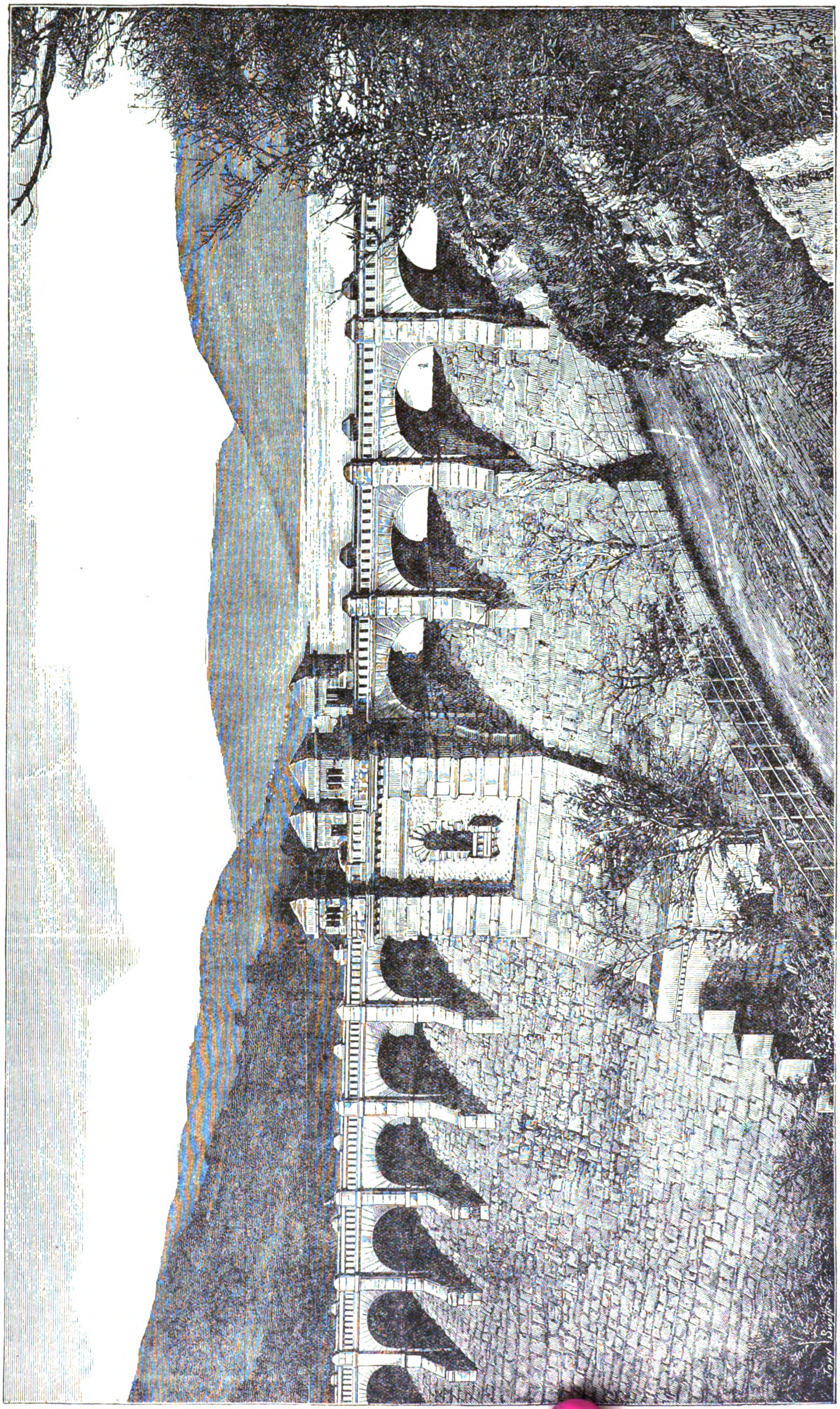
Where storm water is taken into the sewers, the catch basins need attention from the same person who has the care of the sewers; for the basins are a part of the sewer system, and should be cleaned frequently and with care, to work in harmony with the whole. The less sand found in basins at the beginning of a storm the less sediment found in the sewers at the end.

Sewers will wear out in time; but a careful inspection of all weak and hard-used places, with a little work here and there, will prevent a break, perhaps, and save many times the cost of such inspection and work.

EXCAVATING IN QUICKSAND.

An interesting experience in excavating in quicksand was recently related to the New England Water-Works Association by Albert F. Noyes, City Engineer of West Newton, Mass.

Having had occasion to make an excavation some 15 feet deep in quicksand, near buildings, it was found that if the work was conducted in the ordinary way a settlement of the foundations would be likely to occur. Mr. Noyes, therefore, adopted the following method which proved successful: The excavation, as stated, was about 15 feet deep, about 60 feet in length, and 8 feet wide. Usually below these veins of quicksand there are veins of a coarse material which form ready conductors for the water, and the vertical distance through the quicksand is usually less than the horizontal distance; the ground water has the least resistance in the vertical direction, and tends to soften and take up the quicksand with it. If the water is drawn out, or the water level lowered below the bottom of the trench, this fine material becomes compact, very much like clay, and excavations can be easily made with perfect safety, and the use of a light sheeting. In the case referred to fourteen 1½-inch pipes were used and were driven equidistant about the excavation to be made with the ordinary perforated well point, having attached outside a fine-mesh brass screen. They were driven into a stratum of coarse material from 35 to 50 feet below the surface of the ground. The pipes were ganged together, and attached to a common plunger pump, and the water was drawn down. The normal level of the ground water was within some three or four feet of the surface of the ground, so that the ground water had to be drawn down some 10 or 11 feet It was found by test tubes outside of the gang that the water could be readily held to a level, which insured the excavation being made without any difficulty. In fact, the banks were dry, and the lower portion of the excavation was very firm. In this case the well points, after use, were sold at nearly the first cost. The pipes, which were taken from the stock at the pipe yard, were returned and used again, so that there was little loss in that way; and the whole cost of driving the pipe was about $18, so that the expense of that method was really less than sinking a well outside of the excavation in the usual manner.



THE VYRNWY DAM.

THE VYRNWY DAM.

THE accompanying illustrations showing the dam which converts the Vyrnwy Valley into a lake for the Liverpool water supply are reproduced from the London *Engineer*, being intended to show the architectural rather than the engineering features of the structure. In the larger illustration is seen the upper part of a sluice valve culvert through the dam. The similar culvert on the other side passes the water which is allowed to pass down the Vyrnwy River as compensation water. The smaller illustration, from a photograph, shows the character and size of these openings. Other illustrations of the dam, with descriptions, will be found on page 202, Vol. XIII., and page 85, Vol. XV., of this journal.

IRRIGATION IN ITS RELATION TO THE PASTORAL INDUSTRY OF NEW SOUTH WALES.*

THE total area of land in New South Wales is estimated at 196,000,000 acres, and of this area 168,000,000 acres are devoted to pastoral purposes, with very precarious results owing to frequent droughts. Only 1,042,000 acres are under cultivation. These figures show the importance of the consideration whether irrigation cannot be made to assist in developing the pastoral resources of the colony. As an instance, the author mentions a case where unirrigated land on the Lower Darling, which could scarcely support one sheep to every ten acres was found, when laid down in lucerne and irrigated, became capable of supporting more than 20 sheep to one acre. In order to reduce the losses entailed by drought, sheep are frequently sent to the mountains, or to other localities where pasture is obtainable; but this course involves considerable expense and much risk, and frequently results in the loss of a serious proportion of the sheep. The total production of wool in New South Wales in 1888, an unfavorable year, was 205,000,000 pounds, and assuming that on an average for the whole quantity the diminution in value, owing to the nature of the season, amounted to ½*d.* per pound, the loss would amount under this head to £427,000. Besides the prejudicial effects of drought, wool is seriously diminished in value by the break which is caused by a sudden change in the character of the season. The alteration in the quality of wool which takes place immediately after the break-up of a protracted drought is at once apparent, even to the unpracticed eye.

In New South Wales the best rivers for irrigation purposes are the Murray and the Murrumbidgee. The district commanded by them includes only the plains between them, and a moderate area to the north and west of the Murrumbidgee. The only portion of the colony in which irrigation can be carried on with regularity, and on an extensive scale, is in the part of southern Riverina commanded by these rivers, although the author believes that the country west of the Dividing Range is, under favorable circumstances, susceptible of remunerative irrigation. The methods recommended are: 1st, the irrigation of extensive areas of the native grasses; 2d, the irrigation of limited areas of lucerne, or other crops for fodder.

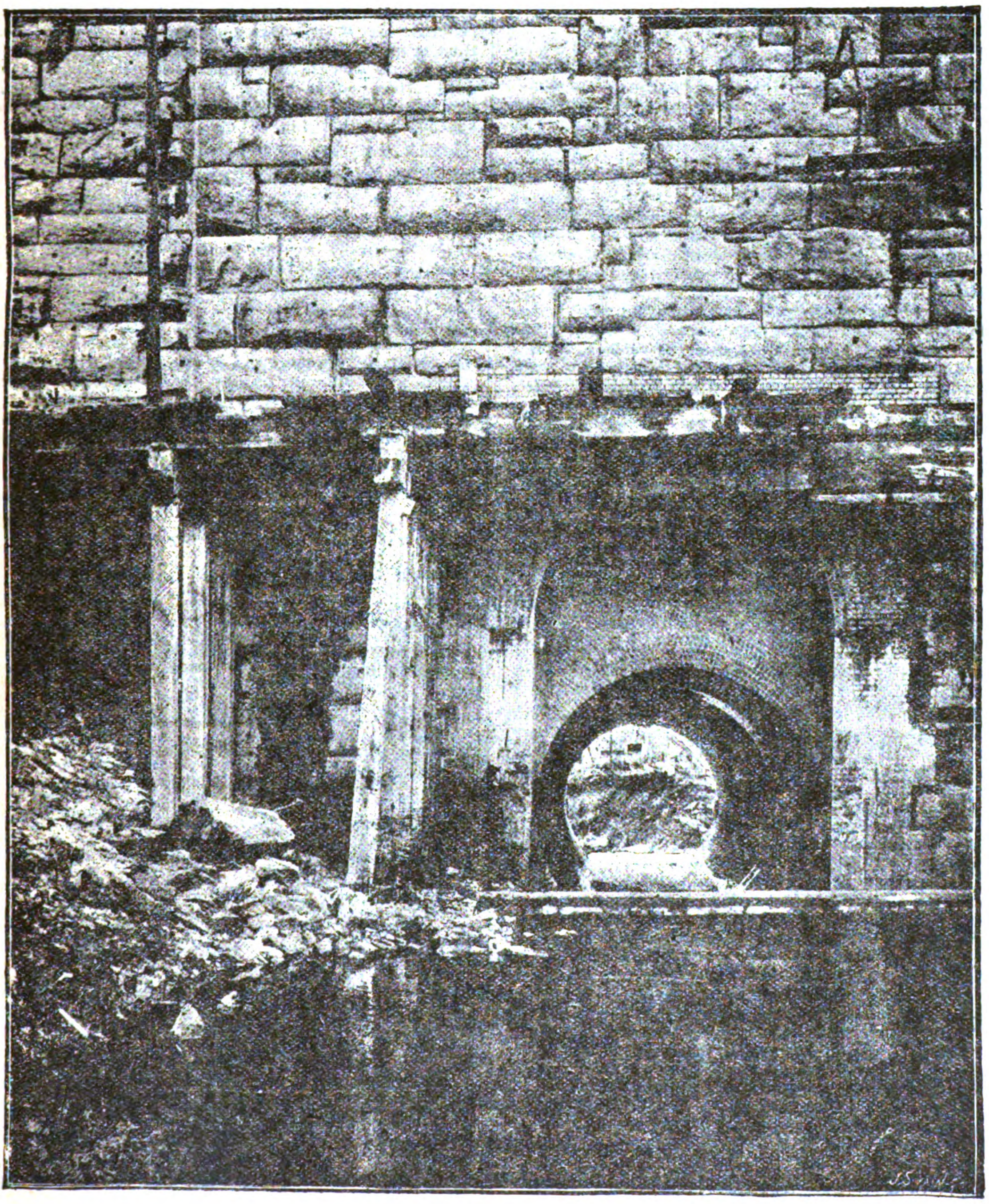
The former system is in natural operation on a large scale on the Lower Murrumbidgee, as well as on a moderate scale on the lower parts of several others of the western rivers of New South Wales. This is precisely the same process which irrigates and fertilizes the valley of the Nile. In some of the cases in which the process is exemplified in New South Wales, the inundations due to flood waters form the chief security of the "pastoralists" whose lands are thus naturally irrigated. As generally happens in the case of rivers flowing through alluvial plains, the banks of the lower parts of the rivers mentioned are higher than the land adjoining. Hence, in order to divert supplies of flood water so as to irrigate by gravitation, it is only necessary to make cuttings from the rivers with a moderate rate of fall, and extend them till they run out at the level of the natural surface. Several cuttings of this kind were made on the Jaunbung Run by Mr. Tyson, and one of them alone is stated to have cost £14,000. How profitable irrigation of the native grasses can be made under such favorable circumstances is very clearly shown in the case of Mr. J. L. Gwydir's experience. In the Corrong Run, with an expenditure of very little over £1,200, Mr. Gwydir succeeded in irrigating over 17,000 acres of grass land during every flood in the Lachlan. Taking interest and cost of maintenance together at £150 per annum, the cost of irrigating an acre amounted to only $\frac{3}{17}$*s.*, or slightly over 2*d.* In this case the profits of the first year's operations more than covered the entire outlay. Before irrigation the land referred to barely sufficed for 4,000 sheep; after the system of watering was adopted it supported 12,000 sheep and 200 horses, besides fattening 150 head of cattle.

Irrigation of the native grasses by pumping, at a gross cost of about 2*s.* 6*d.* per acre, has given a very satisfactory return under favorable circumstances in Victoria. The pumping plant in such cases was erected primarily for the irrigation of crops, but at such times as water was not required for the crops the supply was turned on to the grass lands. Under these circumstances the author maintains that the profitable irrigation of the native grasses is therefore not a question for debate, but an accomplished fact; and the only point for consideration in connection with it is the nature of the circumstances under which it is practicable.

After some remarks on the rates of water for irrigation, the process of flooding pasture land, and the production of fodder by irrigation, the author proceeds to consider the case of the River Darling. He states that the most important functions of that river are threefold—namely: 1st, the provision of reserves of fodder for the western district; 2d, the flooding of large areas of pasture; and, 3d, the provision of a permanent highway for navigation. To effect the last of these objects, a series of weirs and locks is indispensable, and the raising of the water level by this means will materially lessen the cost of pumping for the irrigation of crops. The circumstances of the Darling are extremely favorable in some important points to the construction of works for the purposes referred to. With a series of weirs at suitable intervals, the river at ordinary heights would consist of a succession of reaches of almost still water. The same weirs would also hold up the water in the river to such heights that flooding the land by gravitation could be carried out in the manner already adopted on the Lower Lachlan. The conservation of the waters of the Macquarie is stated to afford "remarkably favorable conditions for the diversion and storage of floodwater," and the author gives at length the conclusions of the second report of the New South Wales Water Commission, which advocates the judicious expenditure of £300,000 in diverting supplies from the Macquarie, and distributing them between that river and the Bogan.

The paper concludes with some general remarks on the progress of water conservation in Victoria, the principal irrigable areas in New South Wales, water legislation, the examination of engineers, the causes of the backward state of water conservation, and statistics relating to losses therefrom.

In the discussion following the paper the importance of the subject was generally admitted. In regard to the suggested interference with navigation which might result from the removal of so large a quantity of water from the rivers, it was stated that in Victoria people were quite reconciled to the idea of navigation being seriously interfered with, believing that much greater good would result from irrigation.



THE VYRNWY DAM—CULVERT AT NORTHERN END.

LAYING SUBMERGED PIPE AT GREENVILLE.

G. S. WILLIAMS says, in the University of Michigan *Technic*, that in the construction of the water-works at Greenville, Mich., during the summer of 1888, it was necessary to lay a line of 12-inch pipe across Flat River, some 200 feet, in water about 4 feet deep. By manipulating dams above and below the point we were able to get the water down to about 2 feet in depth. Eighteen lengths of 12 inch pipe were laid in place in the water and then raised by means of jack-screws placed on horses above, from which the pipe was suspended, until the joints were out of water. The pipe was then set to the proper curve and caulked with lead in the usual manner, after which it was lowered by means of the screws worked simultaneously, until parts of it bore on the bottom. The steam fire engine was then brought to the crossing and two lines of hose taken out with 1⅛-inch nozzles, streams from which at a pressure of about 140 pounds at the engine were played upon the bottom underneath the pipe and the earth was scoured away until the pipe came to a bearing for its entire length. The pipe was then released from the screws and the jets were worked along the pipe until it was buried its full depth in the river bottom, which consisted of sand and gravel. The jets worked better in the gravel than in the sand. This method of laying the pipe was found to be much more economical than by means of a coffer dam, and was in every way successful. The pipe was tested, before being covered, at a pressure of 160 pounds per square inch, and but one joint was found to leak at all, and this leak was immediately stopped by a few strokes of the caulking iron. It appeared, however, that in sinking the pipe further, a nozzle or pipe that was bent to a curve would be preferable to a straight one. In some places the pipe was sunk to a depth of 18 inches.

From the river to the pump house the line extended about 450 feet across a flat where quicksand was encount[illegible] a depth of less than 2 feet. The pipe was laid at the top of the quicksand in a line parallel to grade as nearly as possible and the entire length caulked. It was then lowered to grade very successfully by putting a man on each side of each length and having them dig on both sides of the pipe along the entire line at the same time. In this way we succeeded in lowering the pipe in some places as much as four feet, and none of the joints were sprung so as to leak in an open ditch under 160 pounds pressure. Three hundred feet of 16 inch suction was laid in the same way.

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*A paper by H. G. McKinney, M. Inst. C. E., in Journal and Proceedings of the Royal Society of New South Wales, abstracted in Excerpt Minutes of Proceedings of the Institution of Civil Engineers.

On these works it was not infrequently the case that a joint had to be run when half or two-thirds of it was under water. In such cases we used the ordinary clay-rolls making two openings at the top. We next poured in a small quantity of oil, kerosene will do, but a thicker oil is better, and then slowly poured in the lead at one of the holes. The water would be forced out, the layer of oil apparently keeping it away from the lead and as perfect a run would be obtained as in a thoroughly dry joint. This method was used on all sides from 16-inch to 6-inch and was found uniformly successful, there being neither explosion nor spattering.

THE AIR OF THE ST. GOTHARD TUNNEL.*

DURING the early days of the working of the Saint Gothard Railway, when it was uncertain whether the natural circulation of the air would be sufficient for the removal of the smoke, or whether artificial ventilation might be necessary, a system of temperature observations was organized by placing thermometers in the 15 refuge chambers in the tunnel, which were observed and recorded at intervals of eight hours by the tunnel watchmen, who noted at the same time the strength and direction of the air currents and the density of the smoke in the air, the external atmospheric conditions being simultaneously recorded at the meteorological stations at the Göschenen and Airolo ends of the tunnel. These observation sheets were sent into the engineer's office monthly and at the end of the year the results were plotted as curves for the Swiss Railway Department. The present paper contains an abstract of the results of six years' observations — 1883–1888—from which it appears that the maximum temperature in chamber No. 8, in the middle of the tunnel, has been practically constant 22.8° to 23.4° Cent., while the annual minimum shows a small continuous diminution from—

16.4° ....in March, 1883 to
16.0 ....in February, 1884
15.0 ....in February, 1885-6
14.8 ....in December, 1887
14.5 ....in January, 1888

During the driving of the tunnel the average annual temperature observed in the headings was as follows :

	1876.	1877.	1878	1879.	1880.
Göschenen end—					
During boring	19.4°	21.1°	24.0°	26.4°	30.3°
After firing	20.8	23.4	26.0	29.3	31.2
Airolo end—					
During boring.... ...	23.1	25.0	25.8	28.2	29.3
After firing	26 6	28.5	29.3	30.7	31.0

Before the joining of the headings on the 29th February, 1880, the mean temperatures in the Göschenen end were 26.6 and 29.6 degrees, and in that of Airolo 29.2 and 31.6 degrees, respectively, as during the last month the amount of air delivered in the ends was largely increased, but this only reduced the air temperature to about 1.7 degrees below that of the rock. The latter was in February, 1880 :

At 7,635 meters in on the north side under 1,704 meters of cover, 30.6°
7,041 " " south " 1,480 " " 29.4

The mean rock temperature of the entire length of the tunnel was originally 23.43 degrees, the mean air temperature February 29. 1880. 21.60 degrees ; on February 11, 1881, 19.3 degrees, and on February 11, 1882, 14.2 degrees. These figures show very clearly the diminution in the mean natural temperature of the whole tunnel.

Later determinations of the rock temperature made since the opening of the line gave the following results :

Date.	7,300 meters N. in bore-hole 1 meter deep.		7,050 meters S in. boring 1.1 meter deep.	
	Air.	Rock.	Air.	Rock.
July, 1882............. ..	20.10°	23.9°	21.0°	24.5°
July-August, 1885.. ..	19.65	22.2	20.6	23.0
Diminution.......	....	1.7	....	1.5

As regards the movement of the air, the observations were confined to noting the direction of the current and estimating its strength, which was noted as strong, moderate, weak, or calm. The natural draught in the tunnel results from differences of air pressure at the two ends, the wind blowing from the side of highest pressure, and its strength being proportional to the square root of the difference of the two pressures; the column of 36 meters due to the difference in the relative level of the two ends being sometimes in favor and sometimes against the prevailing wind, according as it is lighter or heavier than the external air. The combined effects of differences of temperature and moisture at the two ends resulted, during the five years' observations, in the following average distribution of the air currents, the draught being either continuously north or south for some time, or changing from one to the other direction at short intervals. In the latter case there are of course periods of calm, but none of them have ever lasted for more than half a day.

Year.	Days of Prevailing North Wind.		Days of Prevailing South Wind.		Days with Alternating North and South Winds.	
	Winter.	Summer	Winter.	Summer	Winter.	Summer
1883	70	75	45	29	66	80
1884	60	82	56	42	67	59
1885	51	80	61	33	67	68
1886	55	70	60	54	67	59
1887	65	79	45	40	72	64

Winter signifies the period October to March, and summer April to September, inclusive.

From these figures it appears that northerly wind is most prevalent in the summer, while in the winter months the draught is tolerably equally divided between north and south. The days on which rapid changes in direction are observed differ but slightly with the season.

The prevailing external wind at the tunnel stations appears to have no effect upon either the duration or the strength of the current in the tunnel, neither is the distributing influence of a passing train acting as a piston more than local and insignificant.

The smoke observations were classified into whole and half days of smoky air; transitory smoke and air free from smoke. These are plotted upon curves, but given without numerical data. From these figures it appears that continuous smoky days are more prevalent at the south than at the north end, and in summer than in winter; and that the number of clear days is similarly larger at the north than the south end, although the difference is but slight. The middle of the tunnel is completely free from smoke for only a very small number of days in the year; but, on the other hand, the number of entirely smoky days is much less than at the ends, while the effect of the transitory smoke is most constant at that point. The most unfavorable conditions are observed on days when the wind is only slight or unsteady in direction. The work necessary for the maintenance of the way, etc., is, as far as possible, confined to days of strong prevailing winds in one direction, or the night hours when the traffic is confined to two express trains and the smoke is at the lowest. Passengers traveling through with the carriage-windows shut suffer no inconvenience from smoke. The six years of observation having proved that the ventilation of the tunnel is practically continuous in one direction or other, the practice of recording the smoke has been discontinued, and the author considers that there will be little further utility in continuing those on temperature and air-movement.

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[*] A paper by R. Bechtle in *Schweizerische Bauzeitung* abstracted in Excerpt Minutes of the Proceedings of the Institution of Civil Engineers.

Correspondence.

Communications giving information or opinions on matters of general interest to the engineer, the architect, the contractor, or the municipal officer, will be welcomed in this column. Fairness will suggest that when communications are sent simultaneously to this and other journals we should be informed of it at the time. Anonymous letters will not be noticed.

THE VALUE OF TRITURATION IN REPAIRING MACADAM ROADS.

NEW YORK, July 7. 1890.

To the Editor of THE ENGINEERING AND BUILDING RECORD:

SIR: When I read in Mr. Owen's article on Repairs to Macadam Roads, "the constant trituration, if I may so call it (and it is a good word), being of far more efficiency than the dead weight occasionally applied," it occurs to me to ask, if this trituration is so efficient an element in road repairing, screenings being discarded, why should Mr. Owen insist on wearing out the hoofs and shoes of New Jersey horses in an effort to triturate off the hard and strong angles of his admirable Orange Mountain trap when the many mountain streams and glacial moraines of his State afford him such a store of well triturated and thoroughly rounded material?

I ask this question knowing, as every one does who has seen his roads and read his essays on the subject, that Mr. Owen's roads are very much better than his theories. They are very good roads, with the single exception that they are a little soft during a prolonged spell of wet weather or when they are alternately freezing or thawing. They, however, are not strong, homogeneous roads, and through their method of construction they must be thicker than if they were strong and homogeneous.

Quoting what I have before said in your columns: The points which should have emphasis in building macadam roads are—a strong and tough stone being obtained, if possible:

First.—Thoroughly compacting the soil by rolling before the broken stone is applied.

Second.—Clean binding, which, if possible, should offer as great or greater resistance to crushing as the stone used in forming the wearing surface; in contradistinction to either filling or lubricating material.

Third.—The use of a steam road roller of competent weight.

Fourth.—The combination of these two in connection with sufficient skill, resulting in a wheelway that is without voids in its lower surface, inviting the percolation of mud from below, that is sufficiently compact to shed rain and has some cohesive strength; while the clean binding, which is strenuously insisted on, prevents movement of the stones among themselves and keeps their angles from wearing off.

Such a road may be safely made four inches thick on nearly all soils, even when designed for the heaviest traffic. A road, on the contrary, of that thickness, filled with clay, the angles triturated by the trampling of horses' feet and the whole loosely compacted by a horse roller will, if laid on clay or a clay loam, break to pieces in the spring or a wet time, and the stones, like plums in an over-fluid porridge, will sink, and the porridge will be on top. Long continued experience of the fact last above stated has made Mr. Owen a strenuous advocate of Telford foundations. And the man who is going to build such a road and does not put it on a foot or more of carefully placed and thoroughly wedged Telford foundation, or on at least four inches of properly made macadam road, is not doing justice to his employer. On either of the above-mentioned foundations a clay-filled road will not break through, but the stones will wear upon one another.

It is painful, also, to differ as to "the only real argument to be used in favor of a steam roller." No one, I think, can watch the action of the driving wheels of a steam roller without noticing that on uncompacted stones the wheels draw the stones, so that those passed over by the driving wheels present a different appearance from those passed over by the steering wheel, which has only a rolling motion. I think this drawing action of a driving wheel is very effective in reducing the volume of void spaces which should be filled with binding material. Mr. Owen's contention that a patch on a macadam road shows premeditated negligence or ignorance may be a slightly extreme statement, but with trap roads patching is not as necessary as when softer stone is used. When softer stone or gravel is used, however, patching is an economical and almost necessary mode of keeping the road in good surface, and it should not be neglected with the hardest road when depressions of comparatively small area appear from any cause. EDWARD P. NORTH.

THE PROPOSED WATER-WORKS CRIB IN CHICAGO.

BOSTON, MASS., July 7, 1890.

To the Editor of THE ENGINEERING AND BUILDING RECORD:

SIR: The Chicago Water Works system is at present being extended by the building of an additional tunnel four miles into Lake Michigan. At its terminus, in 40 feet of water, a huge crib, estimated to cost about $300,000, is to be built up to above the water surface, and provided with a lighthouse and keeper's residence. Public reports do not state the reasons for having such a structure, built simply for the purpose of guarding the intake. It would be of much interest to know why this large expense is being incurred. Other cities are dependent upon lake water for their domestic supply, and if such artificial islands are really necessary in every case, the reason should be well known. Are any of the readers of your valuable paper able to throw some light thereon? B. W. H.

Questions and Answers.

All questions relating to building construction, paving, sewerage, water supply, or kindred subjects, will be welcomed in this column provided they relate to matters of general interest and are not such as should properly be referred to a consulting engineer. Answers will be carefully prepared and a proof of both question and answer mailed to the inquirer as early as proper consideration will permit. They will be published for the benefit of other readers as soon as convenient. The full name and address should be given, not necessarily for publication, but as a guarantee of good faith, and to facilitate further correspondence in case the question is not sufficiently explicit.

Inquiries of the Editor, in order to secure prompt attention, should *not be written on the same piece of paper as a communication* to the *Publishing Department.* Letters renewing subscriptions are sent to a clerk in the publishing office, and matter for the Editor, if in the same enclosure, is likely to be overlooked unless it is on a separate piece of paper, so that it may be promptly sent to the Editor.

PUBLICATION ON CONSTRUCTION OF CANAL LOCKS AND GATES.

WILLIAM J. SILVER, of Salt Lake City, Utah, writes: "In regard to the inquiry (page 346, Vol. XXI.) on the construction of lock and waste gates, the past files of the *Engineer*, London, have quite a number of examples of large size and recent construction. Last year there was a description of some large sluice gates raised by water power at the Lough Erne drainage, Ireland, and in the issue of May 9, 1890, is a description of sluice gates 30 feet wide, 10 feet lift, raised by hand gear, on the Manchester ship canal. Given the fall available, and the weight of the gate it is a plain matter to arrange gearing for a turbine to lift it."

DOMESTIC PLUMBING HEATING LIGHTING & VENTILATION ENGINEERING

PLUMBING IN THE UNION TRUST COMPANY'S BUILDING, NEW YORK.

PART II.*—DISTRIBUTION DRUMS, SEWER VENTILATION AND PIPE SUPPORTS.

THE supply of hot and cold water to all parts of the building is controlled entirely from the distribution drums in the cellar, shown in Fig. 5. They are of galvanized steel, about five feet long. *v* is for hot water under tank pressure and *b* and *c* for cold water under tank and street pressure, respectively. Tank water is received through the 4-inch pipe *n* and its 2-inch branch *o*. Water under street pressure is received through a 2-inch branch *q* from a 4-inch pipe *p* to the suction tank C, Fig. 2 (page 77). Live or exhaust steam is delivered through a ¾-inch pipe I to the 2½-inch pipe *a*† and, after heating the water in the drum *v*, escapes through a ½-inch pipe *s*.

The pipe A is a hot water 1-inch supply to two slop sinks and B is a 1½-inch supply to all other slop sinks. C and D are 1-inch supply pipes to the president's and directors' rooms. F is a ¾-inch and E and G are ½-inch hot-water return-circulation pipes from the tops of the lines B, C and D and connect above its valve with the sediment pipe *m* of the drum *v*. The pipes H J K and L are 1-inch tank cold water supplies to different lines of wash basins. M is a 1½-inch supply pipe to a group of wash basins and urinals, N is a 1½-inch supply pipe to a group of basins, urinals and slop sinks, and O P Q and R are 1-inch supply pipes to lines of wash basins. S is a 1-inch supply pipe to the directors' room. T is a 1-inch supply pipe to the president's room. U. is a 1½-inch cold-water supply pipe under street pressure to a basement toilet room and V is a 1-inch supply pipe to the same. W is a 1½-inch supply to another basement toilet room. Y is a 1½-inch supply pipe to the elevator tank. Z and *d* are 1-inch supply pipes to front and rear cellar sinks; *j* is a 1½-inch by-pass connecting the drums *b* and *c*, the valve (*k*) of which is usually closed to keep the two systems separate, but may be opened to admit tank water to the drum *c* if the street water is turned off. The lines of pipe, W and U, are generally supplied by street pressure, the valves *w* and *u* being open and the valves *x* and *y* closed. By reversing these valves, however, the supply is under tank pressure.

All the rising lines may be emptied through their valves *i i*, etc., into the drip pipe *g g* that discharges into the trap of a 5-inch rain water leader *z*. The drums *v*, *b* and *c* may also be emptied by branches *m m m*, through the pipe *g*; *t t*, etc., are pipe legs supporting the drums; *f f*, etc., are pipe hangers supporting the horizontal lines from the iron floor beams; *p* is the 4-inch pump delivery pipe to the roof tank.

Figure 6 shows the method of supporting stacks of cast-iron pipes from the iron floor beams by the welded iron strap S, carefully fitted just under the hubs.

Figure 7 shows the special fresh-air inlet at the main sewer trap. Each of the main house sewers C C has a branch A to a double Y connection D at the sidewalk grating and any dirt or other obstruction can be very readily removed through its cleaning hole at B and another at E in the double Y connection F with the main sewer.

The plumbing in this building was done by Byrne & Tucker, of New York City.

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* Part I., Roof, Suction and Drip Tanks and Pump Connections were illustrated in the issue of July 5.

† The pipe *a* and connections are similar to pipe *a* of Fig. 1, page 11, in the description of "Plumbing in the Mechanics' Bank Building."

WATER HAMMER IN STEAM PIPES.

WHAT is known as water hammer action is familiar to every one who has had to do with the use of steam for heating purposes. The astounding noise, the violent shocks, the excessive vibrations which are set up if a little steam is formed and is then condensed in the pipes, are well known. Striking instances of water hammer action are supplied when marine boilers are blown off or when scumming takes place, so that steam passes into the sea. It is common for a large ship to shake from stem to stern at such times. Cabin doors will open and shut, crockery will go adrift, and the noise made by the water fighting its way into the vacuum and the steam trying to get out, being condensed in the act, echoes through the ship. Scumming is known to sometimes be positively dangerous from the way in which it shakes the boilers, bringing the scale off the tubes in flakes upon the furnace crowns where it adheres in such quantity that the sheets are liable to become red hot and come down.

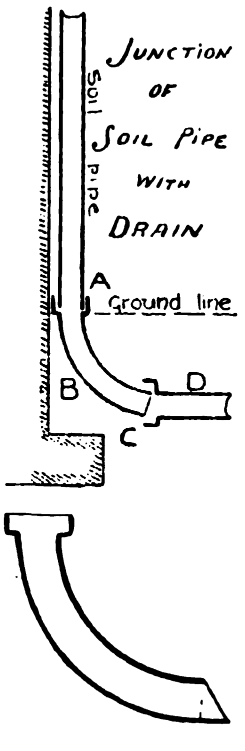
According to an article in the London *Engineer*, a curious experiment was tried several years since by an English engineer. He took a large funnel fitted with a stop-cock and screwed the pipe into the top of a boiler containing steam of about 40 pounds pressure. He then filled up the funnel with cold water and opened the stop-cock. It would naturally have been predicted that the steam would have blown all the water out of the funnel. It did nothing of the kind. On the contrary, the water rushed into the boiler. As a result of this and several other experiments a boiler feeder was designed and patented and worked with tolerable success. It was found, however, that it was not certain in its action, and, the injector coming into high favor at the time, the inventor spent no more money on his ingenious idea. The inrush of the water was due to the fact that the steam condensed in the long pipe of the funnel and "water hammer" action then drove the water into the boiler. Practically just below the cold water there was always a vacuum, into which the water was driven by its own weight and the pressure of the air.

JUNCTION OF SOIL-PIPE WITH EARTHEN DRAIN.

A CORRESPONDENT of the London *Builder*, in a recent communication to that journal, says:

"Vertical soil pipes frequently discharge their fluid from great heights. At the foot of the soil-pipe the vertical stream is diverted to a nearly horizontal direction by means of the earthenware *bend* which unites the vertical soil-pipe with the underground drain-pipe.

"Great care is generally exercised by the architect, clerk of works, and builder, to make a good joint where the plumber's soil-pipe joins the earthenware bend. But the danger of leakage is much greater at the joint of this earthenware bend with the drain into which it discharges. I believe in the vast majority of cases if this last-named joint were examined a few years after the pipes have been in use, it would be found to be discharging a large percentage of the sewage into the foundations; and in this way converting the sites of single dwellings and of whole towns into concealed cesspools!



"I speak from experience, many cases having come under my own observation.

"This evil is not necessarily due to downright carelessness, though the more carefully drains are laid, the less they will settle and shift afterwards. Let it be assumed the drain has been so well bedded that the pipe, D, remains stationary without settling in the least degree, and let the pipe-bend be bedded on clay, at B, with considerable care. Still the impact of the continually-repeated discharges of fluid, descending from a considerable height upon B, compresses the bedding of clay, and eventually forces the bend so far backward as to dislocate the joint of bend with D, discharging a large percentage of each flush from the water-closet through the joint at C into the foundations.

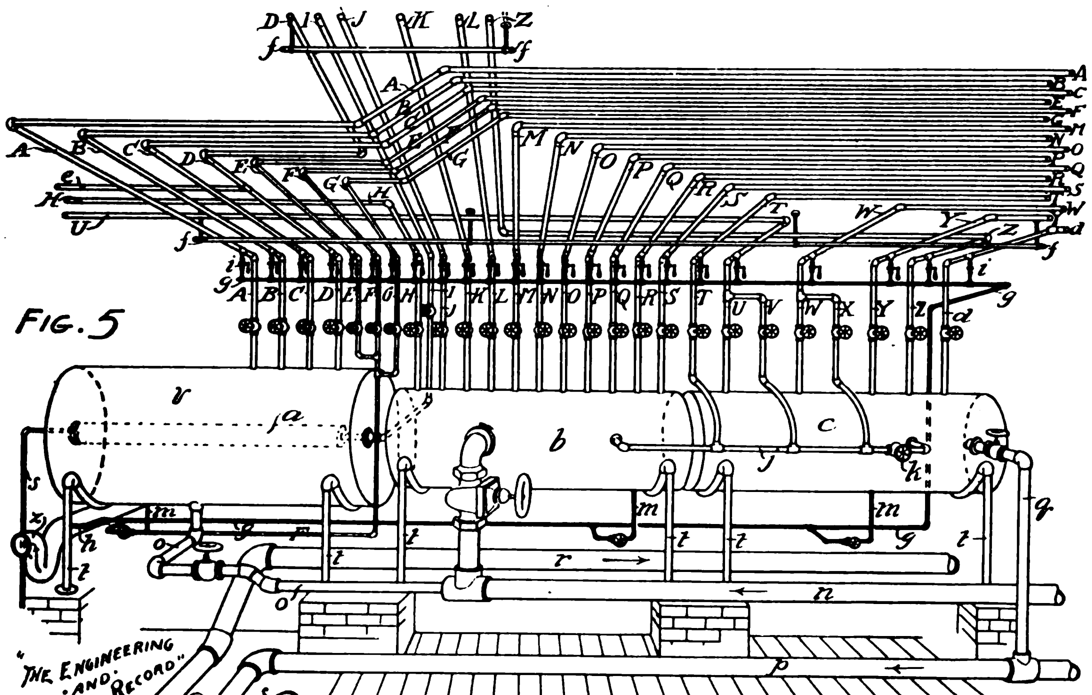
"I have seen gable walls split from foundation to coping from having their foundations sapped in this filthy fashion.

"Thanks to this heel of Achilles-Sanitarius, now, in 1890, in every large town, I believe there are thousands of dwellings, including those of the higher classes, standing thus on their own cesspools.

"How can this be remedied?

"I suggest the absolute necessity for bedding the upper end of pipe D, and the whole of the bend, *on solid concrete of considerable horizontal spread or area*. I also suggest that drain-pipe makers form the outfall ends of bends, not *square*, as usual and as here dotted, but to a slight *bevel*, as per firm line on sketch, giving the pipe, so to speak, a slightly longer underlip than is now customary. And I also suggest that the architect or clerk of works and the surveyor for the local sanitary authority should henceforth personally *examine* the joint C of *old as well as new* drains; and I think if a general examination of such joints were instituted a vast danger to public health would be exposed in such hideous repulsiveness as to hasten a general overhaul and repair of such open joints as are

FIG. 5


D I J K L Z
f f
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The Engineering and Building Record

PLUMBING IN THE UNION TRUST CO'S BUILDING, N.Y.

PLUMBING IN THE UNION TRUST CO'S BUILDING NEW YORK

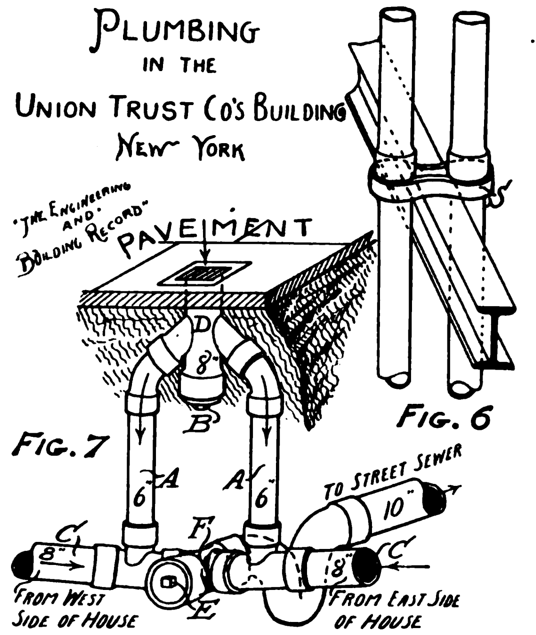


FIG. 7

FIG. 6

now secretly vomiting death and corruption wholesale amongst us."

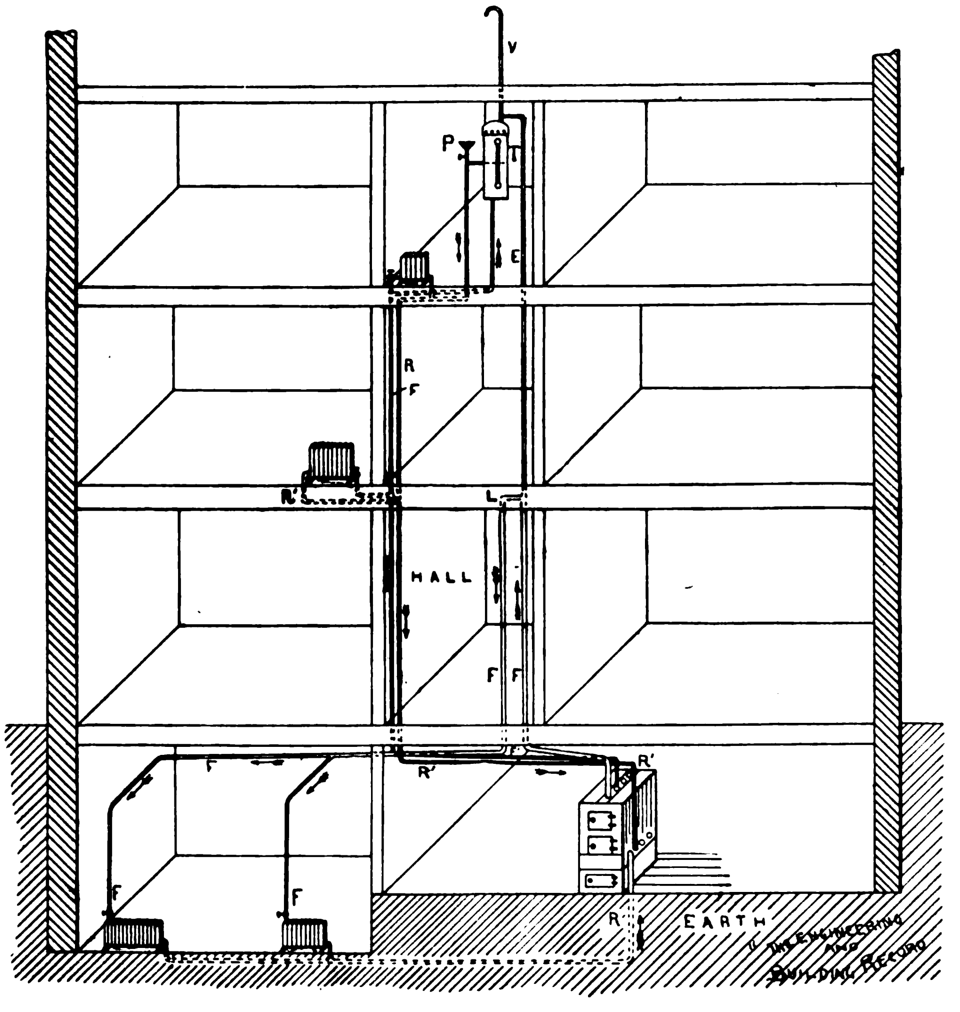
[Such work as is here referred to is not permitted in cities of the United States which enforce their plumbing regulations, though it often exists elsewhere. Iron bends should be insisted on, properly calked and supported, and exposed to view and readily accessible.]

HOT-WATER RADIATORS BELOW BOILER LEVEL.

AS SHOWING how to get circulation in hot-water radiators placed below the level of the boiler, the accompanying diagram illustrating the method by which the problem was solved in a large building recently fitted up in New York City, applied to one of the Boynton Furnace Company's hot-water boilers, will be interesting. The illustration represents a sectional perspective.

It will be noted that the cellar floor is considerably lower at the left than at the right, and in that portion it was desired to place several radiators, though it was necessary that the boiler should be on the higher level. The flow pipe F from the boiler was, therefore, first carried up to the top of the first story, and then down again, forming the loop or syphon F L F, connection with the cellar floor radiators being made as shown. The flow pipe branches enter the radiators at the top and the returns R are taken off at the bottoms, the layout of the piping being readily understood. From the highest point of the loop or syphon F L F an escape pipe E was led, connecting, on the uppermost floor, with the pipe V which comes from the expansion tank T. The vent pipe V leads to the roof. Where indirect hot water heating is used, the indirect radiators being but slightly above the level of the top of the boiler, the plan of first running up some distance and then coming down with the flow pipe, as in this case, has been well recommended.

In the published diagram the pipe connections are shown, also to one of the radiators on each of the highest two floors the pipes, both flow and return, F^1 and R^1, being shown full black to avoid confusion. These pipes, as will be noted, form an independent circuit by themselves, and the expansion tank connections are so made that even with the radiators shut off there will be a steady circulation. The arrows indicate the directions of flow and make the diagram clearer. To avoid the confusion resulting from several lines of pipe running together no first-floor radiator connections have been shown. For this floor also, however, an independent circuit is used, better results being claimed for this arrangement. Water may be supplied to the system through the funnel P. The radiators in the plant under consideration have valves on the inlets only, the valve disks, moreover, being perforated so that even when the valves are screwed down tightly circulation is not entirely stopped.



HOT WATER RADIATORS BELOW BOILER LEVEL.

Notes and Queries

on Domestic Engineering.

Communications relating to the practical details of plumbing, heating, lighting and ventilation will be welcomed in this column. The writer's true name and address must always be given, but an assumed name may be used for publication if preferred.

RUSTING PIPE AND SEWER GAS.

A NEW YORK architect writes: "A galvanized iron leader pipe from a piazza connects with a drain to the sewer. After about three years' use it has rusted or been eaten through from the inside. The plumber says 'sewer gas.' The opening to the pipe in the gutter is about eight feet away from a bedroom window opening on to the piazza roof and always open at night, but as no ill effects have resulted to the occupant of the room, may not the destruction of the pipe be attributed to some other cause than sewer gas, and what? If not, is there in sewer gas an element of danger to galvanized iron leader pipes not harmful to human beings? The pipe has been ordered disconnected and the opening in the drain closed."

[Though not so stated, we infer that there was no trap on the rain leader, and that the air from the drain had free passage through the leader. The mixture of gases, commonly termed "sewer gas," more properly sewer air, produced by the decomposition of sewage, is made up, chemically, of some or all of the following gases, mixed with air in varying quantities and proportions dependent on the nature of the sewage and its rate of decomposition: Nitrogen, some hydro carbons (marsh gas, etc.), sulphuretted hydrogen, ammonia, sulphide of ammonia, carbonic acid, carbonic oxide, and complex organic vapors and vapor of water.

In addition to its chemical constituents the sewer air contains microbes or bacteria floating in suspension, the presence of which, from a sanitary or hygienic standpoint, far outweighs all consideration of the chemical constituents of the "sewer gas." Among the gases enumerated two or three are positive poisons if inhaled in quantity, and one or two would suffocate if breathed in large amounts. The conditions stated in the query make it improbable that the chemical constituents alone of the drain air could have seriously affected the health of the occupants of the neighboring bed-rooms or produced disease; from this cause alone the effect to be expected at most would be a general loss of vitality and a lowering of what physicians call "tone." The chemical constituents, on the other hand, would alone be active in corroding the metal of the leader pipe, the sulphur compounds offering especial advantages in this way. The microbes or bacteria carried by the drain air might be harmless to health or might be fatal according to the kind of bacteria present. If the varieties producing disease were present a single night's exposure to the air from the leader might prove fatal. If, on the other hand, the disease variety were absent no harm might result from years of exposure other than would come from air diluted with inert or comparatively weak impurities. It is apparent, therefore, that the health of the bed-room occupants and the "life" of the metal of the pipe are affected by entirely different causes, and causes not necessarily related.

The question is reduced, therefore, to determining whether the metal of the leader is affected by any of the chemical constituents of the drain air, and as to this there is no reason to doubt that the sulphur compounds would materially hasten corrosion if present in even comparatively small quantities. It is with a view, in part, to the prevention of the corrosive action of "drain air" that the avoidance of all "dead ends" in house plumbing is insisted upon, and that provision for the free circulation of air through all mains and lateral and branches is demanded. The plumber is therefore probably right in attributing the corrosion of the pipe to "sewer gas." As bearing upon this matter in a practical way there may be mentioned a statement made by J. P. Gallagher, of St. Louis, at the recent meeting of the Master Plumbers' Association in Denver. Mr. Gallagher presented a photograph of what was probably the first soil-pipe carried through a roof in his city. The pipe was put in by Mr. Gallagher himself in 1871, there being about 30 feet of it above the highest fixture, all of which was found perforated like a sieve when taken out in the spring of 1889. The pipe when put in was about ¼-inch thick. The pipe below the fixtures was of the same quality, sinks and water-closets being connected on each of four floors. This portion was intact, tending to show that the pipe through which the water passes will last much longer than the pipe carrying off the vapors.]

BATH WATER HEATER WANTED.

MORTIMER C. MERRITT, architect, of New York City writes: "Can you send me the address of the maker of a small water heater, using gas, to be placed in a bath room to heat the water for a bath?"

[In response to a similar inquiry published in this journal some months ago, correspondents wrote that the Sheldon Manufacturing Company, 14 West Twenty-third Street, New York City, or the Detroit Heating and Lighting Company, Detroit, Mich., would furnish the heater indicated.]

TRADE PUBLICATIONS.

CHAIN BLOCKS.

A REPORT on the efficiency of chain blocks, made by Prof. Robert H. Thurston for the Yale and Towne Manufacturing Company, of Stamford, Conn., has just been issued in pamphlet form. In connection with it are given, also, descriptions and illustrations of Weston's "Triplex" spur gear block, and of the "Direct" differential pulley block made by the above company. Tables of prices, capacities, weights, etc., are added.

IRON ROOF TRUSSES AND IRON BUILDINGS.

Owing to the increasing demand for information regarding iron roof trusses and iron buildings the Indiana Bridge Company, of Muncie, Ind., have prepared and issued a special catalogue devoted to this branch of structural iron work. It is profusely illustrated, showing various types of roof trusses and designs for building frames, and gives explanatory particulars with each set of illustrations.

CORRUGATED SHEET METAL.

Corrugated and other sheet metal building material is treated of in an interesting manner in the latest catalogue of the Cincinnati Corrugating Company, of Cincinnati, O. The various applications of corrugated sheet metal are illustrated by numerous engravings, and data of general and trade interest are given.

CONTRACTING NEWS DEPARTMENT.

A WEEKLY RECORD

OF SPECIAL INTEREST TO CONTRACTORS, BUILDERS AND MANUFACTURERS OF ENGINEERING AND BUILDING SUPPLIES.

CONTRACTING INTELLIGENCE

Our readers will oblige us by notes, clippings, or any information which will put us in the way of obtaining early and reliable news for our "Contracting Intelligence." *Information of importance sent to us exclusively, and not elsewhere published will be liberally paid for.*

For works for which proposals are requested see also the "Proposal Columns," pages i-ii-x-95.

WATER.

For Additional Water Items see Proposal Columns

Hempstead, L. I.—The Hempstead Township Water Company has been incorporated. The capital stock is $20,000. The trustees are John Lockwood, John C. Lockwood and George W. Lockwood, of Jamaica; D. D. Williams, of Haverstraw; Frank G. Lockwood and Paul Campaignac, of Brooklyn, and Samuel A. Souther, of Bay Shore.

Springfield, Mass.—On July 7 the Common Council voted to issue bonds for $125,000 for improving the water supply.

Norwich, Conn.—At a special Corporation meeting, held on July 7, a resolution was passed directing the trustees to employ a competent engineer to make survey and submit estimate of cost for repairing the bank of the Canaswacta Creek, so as to prevent another overflow. The report is to be submitted at an adjourned meeting to be held on July 28.

Toledo, O.—A number of water main extensions have been ordered in this city.

Sioux City, Iowa.—A press report from this place says that "steps have been taken toward the building of new water-works that will draw the supply from the Missouri River."

Wheeling, W. Va.—There is talk of erecting a fountain on Chapline Street, in this city, to be supplied by running a pipe to a spring at the head of Fourteenth Street.

Cleveland, O.—At a meeting of the Board of Water-Works Trustees, held July 7, bids for wrought-iron pipe to be used in the tunnel at the foot of St. Clair Street, were received from the Cleveland Steam Boiler Works for $24,940, Smith & Teachout $22,498, and the Variety Iron Works for $19,522, to whom the contract was awarded.

Yoakum, Tex.—It is proposed to construct a system of water works at this place. Address M. G Ranney, City Clerk, as above.

Chicago, Ill.—The Common Council has authorized the Union Stock Company to construct a water tunnel not exceeding six feet in internal diameter, from a point in Lake Michigan not more than a mile from the west shore of the lake to the stockyard, for the purpose of supplying water to the stockyard and Transit Company

Brooklyn, N. Y.—The Board of Aldermen has authorized an expenditure of $65,000, or so much of this sum as may be necessary, for the construction of a water standpipe on the ground of the Prospect Height Reservoir; also an appropriation of $19,000 to defray the cost of the new water-works extension.

Boston, Mass.—At a meeting of the Board of Aldermen, held on July 7, a petition was received from the Water Board asking for an appropriation of from $100,000 to $150,000 for the extension of its water mains. The communication stated that unless this sum was appropriated the Board would be compelled to stop necessary work.

Gouverneur, N. Y.—Plans are being prepared for the construction of a system of water-works at this place. Address C. N. Reynolds, City Clerk, as above.

Muskegon, Mich.—For information concerning work here in charge of Chester B. Davis, of Chicago, see our Proposal Columns.

Madison, N. J.—The Common Council has decided to locate the water-works at Union Hill, and $60,000 in bonds will be issued for that purpose.

Ludington, Mich.—C. G. Wing, President The Ludington Water Supply Company, writes: "We are about to project an intake pipe 20 inches in size into Lake Michigan as a source of water supply."

Bar Harbor, Me.—The Eden Water Company has consulted with M. M. Tidd, the Boston engineer, in the matter of constructing a new system of water-works for this place.

Washington, R. I.—The contract for furnishing 50 car loads of 18-inch pipe for water-works at this place, and for about 15,000 feet of sewers at Valley Falls and Lonsdale, has been awarded to Henry A. Warner, of New Haven, Conn.

Water-Works.—See our Proposal Columns for information regarding water-works and water-works furnishings at the following places: Coshockton, O.; Somerset, Ky; Hinton, W. Va.; Mohawk, N. Y.; Saulte Ste Marie, Ontario, Can.

SEWERAGE.

For Additional Sewerage Items see Proposal Columns

Boston, Mass.—The Common Council of this place has authorized the appointment of a special committee and employment of an expert engineer to locate a sewage pumping station and irrigation field.

Galion, Ohio.—J. B. Weddell, City Civil Engineer, writes that proposals will shortly be advertised for constructing about 9,000 feet of pipe sewers.

Chicago, Ill.—The Drainage Commission of this city has authorized Chief Engineer Cooley to employ a number of assistants, and it is expected that work on the new scheme will begin at once.

Syracuse, N. Y.—The following bids for furnishing cement sewer pipe for Burnet Park have been opened: Martin V. Sullivan, $878.95; Elson J. Stearns, $857.25. The contract was awarded to Elson J. Stearns.

New Orleans, La.—A bill likely to become a law of Louisiana seeks to create a drainage system for this city by establishing a Commission of Public Works, with the Mayor at the head, which shall have power to adopt and carry out a comprehensive sewerage scheme, levying a tax of one mill on the dollar for two years for the purpose and borrowing not more than $100,000. The City Engineer is to be chief engineer of the commission.

Davenport, Iowa.—A considerable number of gutters are ordered constructed in this city.

Sewers.—See our Proposal Columns for information regarding sewers and sewer construction at the following places: Key West, Fla.; Gardner, Mass.; Brookline, Mass.; Fredonia, N. Y.; Pittsburg, Pa.; Albany, N. Y.

BRIDGES AND IRON STRUCTURES.

For Additional Bridge Items see Proposal Columns.

Granby, Conn.—The contract for the new bridge at Craig Mills, with abutments, has been let to John Forsayth, of Mechanicsville.

Toronto, Can.—The Grand Trunk Railway has agreed to build two 18-foot culverts over the conduit pipes at the Beach. Chief Engineer Hobson and City Engineer Haskins have held a conference regarding same.

Atlanta, Ga.—The County Commissioners have adopted a resolution looking to the bridging of the railroad crossings at Bellwood and Collins.

Foreman, N. D.—The following bids for building a bridge over Wild Rice River were received by Charles Afdem, County Auditor July 7: Charles Watkins, Ransom City, N. D., $145; F. H. Skaarer, Cayuga, N. D., $115; Gilbert Thompson, Ransom City, $161.

New York City.—The Secretary of War has notified Mayor Grant, of this city, that the Third Avenue bridge over Harlem River must be removed or altered by January 1, 1892.

Mt. Vernon, O.—The following bids for the construction of numerous iron bridges were received by the Board of County Commissioners, June 30: Milwaukee Bridge Co., Milwaukee, Wis., west end High Street, Mt. Vernon, $9,625; Jackson Ford, Morris Township, $2,075; Brackit Bridge Co., Cincinnati, O., $9,426, $2,088; King Bridge Co., Cleveland, O., $9,957, $2,233; Youngstown Bridge Co., Youngstown, O., $9,600, $2,125; Variety Iron Works, Cleveland, O., $9,763, $2,100; Vermont Construction Co., St. Albans, Vt., $9,750, $2,150; Chicago Bridge Co., Chicago, Ill., $9,670, $2,120; Columbus Bridge Co., Columbus, O., $9,900; Penn Bridge Co., Beaver Falls, Pa., $9,900, $2,250; Mt. Vernon Bridge Co., Mt. Vernon, O., $9,550, $2,050; Queen City Bridge Co., Cincinnati, O., $9,933, $2,400; Berlin Iron Bridge Co., East Berlin, Conn., $9,673, $2,063; Lane Bridge Works, Chicago, Ill., $9,700, $2,200; Massillon Bridge Co., Massillon, O., $9,973, $2,180; Wrought Iron Bridge Co., Canton, O., $9,700, $2,100; Missouri Valley Bridge Co., Attica, Ind., $9,773, $2,000.

Hackensack, N. J.—The Board of Freeholders of Bergen County have ordered a new bridge built across the Passaic River at Paterson and the rebuilding of another. The building of several other bridges in the county is under consideration.

Brooklyn, N. Y.—The Board of Supervisors on July 3 awarded the contract for the construction of the Meeker Avenue bridge to the King Iron Bridge Company, Cleveland (the lowest bidders), at $25,250.

Salinas City, Cal.—The following bids for the construction of a bridge over the Carmelo River, were received by T. J. Riodan, County Clerk, July 1: San Francisco Bridge Co., San Francisco, Cal., $7,400; Pacific Bridge Co., San Francisco, Cal., two bids, $8,565 and $9,195; Healey, Tibbett & Co., San Francisco., Cal., three bids, $8,092, $8,200, $6,995; King Iron Bridge Co., Cleveland, Ohio, four bids, $7,040, $6,330, $4,870, $3,400; Randell, Hunt & Co., San Francisco, Cal., four bids, $8,171, $8,620, $8,808, $9,180; San Jose Imp. Co., San Jose, Cal., two bids, $8,160, $6,675.

There is a project on hand to build a railroad bridge across Behring Strait.

Bridges.—See our Proposal Columns for information regarding bridge construction at the following places: St. Louis, Mo.; Boston, Mass.; Wheeling, W. Va.; Marietta, Ga.

The Contracting News Department of **THE ENGINEERING AND BUILDING RECORD** is edited with a view of giving space to no item that does not indicate where professional services or supplies may be needed in the near future, the prices bid for work or supplies, and the correction of false or misleading reports in some papers, that may subject readers to needless trouble and expense in going after something that does not exist.

STREET-WORK AND PAVING.

Utica, N. Y.—The contract to pave Gilbert Street with Sicilian rock asphalt was awarded to Patrick Griffin for $2.25 per yard.

Trenton, N. J.—The controversy in regard to paying for the Olden Avenue bridge in this city has been ended by the Board of Freeholders voting to issue $60,000 of county bonds to meet the claim.

Brooklyn, N. Y.—The following bids for paving Hamburg Avenue with cobblestone pavement, were opened July 3 by John P. Adams: Thomas McDonald, per running foot, $3.27; Henry Mogk, per running foot, $3.19; Dennis Norton, per running foot, $2.70; John Hickey, per running foot, $2.65.

New Brunswick, N. J.—The City Council of this place has voted to invite bids for macadamizing Hamilton Street.

Omaha, Neb.—Petitions have been presented to the Common Council of this place for paving a large number of streets.

Memphis, Tenn.—Several streets have been ordered paved in this city. J. G. Fogarty has been given the contract for paving Manassas Street at the following figures: Tishomingo gravel, 59½ cents per yard; grading, 25 cents per yard; guttering, $1.69½ per yard.

Davenport, Iowa.—The City Council of this place has adopted a resolution reciting that the streets of this city, especially such as have thereon street railway tracks, are in unusually bad order and can be readily put into passable condition, and giving the Street Committee general directions "to at once better the condition of such streets." There are also a number of specific improvements ordered.

Brooklyn, N. Y.—The following bids for paving various streets with granite blocks, were opened July 2 by John P. Adams Commissioner City Works: Charles Hart, per square yard, $2.50; improvement, linear feet, 18c.; new curb, linear feet, 50c.; new bridge, square feet, granite, 75c.; new bridge, square feet, cobble, 50c.; reflagging, square feet, 4c.; widening Warren Street, per running foot, 60c.; widening Water Street, per running foot, 60c.

William Kelly, per square yard, $2.49; improvement, linear feet, 18c.; new curb, linear feet, 45c.; new bridge, square feet, granite, 70c.; new bridge, square feet, cobble, 45c.; reflagging, square feet, 3c.; widening Warren Street, per running foot, 55c.; widening Water Street, per running foot, 55c.

Thomas Monahan, per square yard, $2.47; improvement, linear feet, 15c.; new curb, linear feet, 45c.; new bridge, square feet, granite, 73c.; new bridge, square feet, cobble, 43c.; reflagging, square feet, 3c.; widening Warren Street, per running foot, 45c.; widening Water Street, per running foot, 45c.

John H. O'Rourke, per square yard, $2.39; improvement, linear feet, 33c.; new curb, linear feet, 55c.; new bridge, square feet, granite, 70c.; new bridge, square feet, cobble, 50c.; reflagging, square feet, 5c.; widening Warren Street, per running foot, 35c.; widening Water Street, per running foot, 50c.

Toledo, O.—The following bids were opened at the engineer's office. The lowest bidder on Bancroft Street paving, from Ashland Avenue to Cherry, is on the Medina stone, Medina curb, H. P. Streicher, $36,415.50; Berea curb, $35,692.50; the same bidder is lowest on cedar block, $20,768, and fire brick, $28,628.02. On asphalt the Warren Scharf Co. is lowest, being $42,133.10. On Bancroft, from Monroe to Ashland Avenue, the Warren Scharf Co. bids, asphalt, $51,621.50; Medina stone, Claflin & Miller, $45,583.19; fire brick, H. P. Streicher, $36,213.15; cedar block, same, $27,227.15; Page Street, turnpiking, Leith Bros., $212.70; Monroe Street, grading, M. M. Goulden, $47.49; French Street, turnpiking, M. T. Ryan, $135; Ash Street, paving, Claflin & Miller, $265; Woodville Street, planking, Leith Bros., $5,528.42; Mulberry Street, boulder, Miller, $843.38; macadam, Ryan, $586.85; Parkwood, Medina curb, cedar block paving, H. P. Streicher, $4,029.24; Berea curb, Wm. McMahon, $3,877.46.

Norfolk, Va.—The following bids for furnishing 3,000 tons (2,000 pounds), more or less, of second-class granite paving blocks, were received by Adam Tredwell, Chairman Board of Street Commissioners, June 25: Greystone Granite and Construction Co., Greystone, N. C., $3.85 per ton; P Linehan, Raleigh, N. C., $3.94 per ton; Winnsboro Granite Co., Charleston, S. C., $7.15 per ton. Contract awarded Greystone Granite and Construction Co.

Amsterdam, N. Y.—The following bids for the construction of about 3,000 yards of brick pavement on concrete foundation were received by F. E. Crane, City Engineer: John C. Miller, $2.49½ per square yard; Hotaling & Brate, $2.50 per square yard. The contract was awarded to John C. Miller.

DES MOINES, IOWA.—Contracts for paving in this city have been let as follows: J. B. McGorrisk, paving with brick, Grand Avenue, $1.49; Fourth Street, $1.50; Fourteanth Street, $1.50; Fifteenth Street, $1.51. Cement curbing, King & Kennedy, 45½ cents; Fred Stehm, 46½ cents. Extra grading, J. A. Bryan, at 19 cents per yard.

PINE BLUFF, ARK.—There is a project on hand to pave certain streets at this place with vitrified brick.

FLUSHING, L. I.—The question of bonding this place in the sum of $40,000 for the purpose of paving the streets with macadam is being discussed by the Board of Trustees. Particulars can be had by addressing Judge Clinton B. Smith, Village Clerk, as above.

RAILROADS, CANALS, ETC.

ALBANY, N. Y.—The following bids for doing work on certain State canals were received by Edward Hannan, Superintendent of Public Works, July 8:

FOR LENGTHENING LOCKS ON ERIE, OSWEGO AND BLACK RIVER CANALS.

BIDDERS.	Erie, Lock 40.	Erie, Lock 41.	Erie, Lock 42.	Erie, Lock 43.	Erie, Lock 46.	Oswego, Lock 8.	Oswego, Lock 12.	Black River, Lock 1.
Willis S. Nelson, Fulton	....	....	....	....	$33,072.75	$36,664.20	$44,808.70	....
William Patrick, Phoenix	....	....	$33 739.25	$31,412 00	....	31,731.70	37,936 70	....
Frank A. Barrett, Boonville	....	....	....	....	....	....	....	$8,943 50
J. W. Berry & Co., Utica	....	....	....	....	22,979.75	....	....	9,214.00
Costello & Nagle, Elmira	$40,464 37	$37,997 72	....	38,066 22	27 883.33	....	....	....
Hughes Brothers, Syracuse	31,486.75	29,422.05	32.884.55	31.562.05	22,390.25	34,893.45	37,245.70	7,881.00
Casey, Murray & Co., Elmira	33,372.25	32,212.00	32,415.80	31.377.50	....	....	....	....
J. W. Brummelkamp, Syracuse	....	....	37,772.50	....	24,396.75	....	....	....
Flood & Sherrill, Sandy Hill	35.211.25	32.521.50	35,294.00	34,064.00	....	....	....	....
Frank A. Barrett & Peter Phillips, Boonville,	....	....	....	....	23,030 75	....	....	....
John F. Thomas, Ilion	34,248.30	32,725.80	33,301.30	33,410.80	....	....	....	....
Shanahan Brothers & Co, Tribes Hill	33.424.25	30,596.00	Informal.	....	....	....	....	....
G. V. Rapp & A. E. Shaper, Canajoharie	....	....	39,252.25	37,083.75	....	....	....	....

For Fultonville Bridge. — Substructure: Joseph P. Montz, Sandy Hill, $4,037.25; Flood & Sherrill, Sandy Hill, $3,701.75; Shanahan Bros. & Co., Tribes Hill, $3,760.25; Isaac Thomas, Fultonville, $3,532.25; P. J. McCaffrey, Utica, $4,955.25; Hughes Bros., Syracuse, $4,298.75. Superstructure: Rochester Bridge Works, Rochester, $4,359; Groton Bridge Manufacturing Co., Groton, $5,468; W. H. Shepard & Sons, Havana, $5,410; King Iron Bridge Co., Cleveland, O., $4,600.

Dredging Round Shoals.—E. M. Payne, Albany, 29 3/10c.; P. J. Brummelkamp, Syracuse, 13c.; P. W. Myers, Albany, 16¾c.

Dredging Van Buren Bar.—E. M. Payne, Albany, 31⅜c.; P. J. Brummelkamp, Syracuse, 20c.; P. W. Myers, Albany, 17c.

Machinery for Locks Nos. 40, 41, 42 and 43, Erie Canal.—N. and W. H. Wemple, Fultonville, $1,100 per lock.

THE Pottstown Passenger Railway Company of this city has been chartered, with a capital of $18,000. The company will construct a railway the entire length of High Street, a distance of nearly three miles. The officers are George N. Malsberger, President; Calvin Fegely, Secretary; William S. Ellis, Livingston Taylor, J. Allen Healy, Jacob C. Sotter and George N. Malsberger. It is understood that the company will build an electric railway.

BROOKLYN, N. Y.—It is reported that a syndicate has been formed to build a cable road in this city through Montague Street from Wall Street ferry to Court Street, and that work will begin at once. The men named as interested in the scheme are William H. Male, Henry J. Cullen, E. G. Blackford, ex-Assemblyman Hotchkiss, R. A. C. Smith and George H. Prentice.

THE Chicago and St. Louis Railway has been incorporated; capital, $3,000,000. The company will build a line between Chicago and East St. Louis.

NEWARK, N. J.—The Passaic River Extension Railroad Co. has been incorporated, with a capital of $20,000. The object of the company is to construct an extension of the Manufacturers' Extension Railroad to a point in the line of the Newark and New York Railroad branch of the Jersey Central Railroad.

STROUDSBURG, PA. — The Pennsylvania Mutual Railroad Company has been incorporated; capital, $3,000,000. The company will construct a road through Monroe and Lackawanna Counties, a distance of 50 miles. The line will be opened at the Delaware River near this city.

MADISON, WIS.—The North Wisconsin and Lake Superior Company has been incorporated. It is organized with a capital of $2,500,000 for the purpose of building a line of road from Oshkosh to Keweenaw Bay, Barago County, Mich. The length of the road is to be 200 miles. The incorporators are George Beyer, O. A. Ellis, W. P. Cook, W. H. Young, W. K. Smith, E. G. Murden and F. F. Wheeler, all of Oconto.

The Menominee River, Oconto and Southern has also been organized. It proposes to build a line 65 miles long from Marinette to a junction with the above mentioned road at Seymour, Wis. The capital is $750,000. The incorporators are identical with those of the North Wisconsin and Lake Superior.

ASBURY PARK, N. J.—The Ocean Grove and Shark River R. R. Co. has been incorporated; capital, $75,000. The company will construct a two mile street railway from Main Street and Cookman Avenue to the Public Road from Asbury Park to Belmar. The incorporators are Howard L. Chandler, of Philadelphia; W. L. G. Thomas, of Wilmington; James Middledith, of Plainfield; Edward M. Fielder, of Ocean Grove, and others.

DULUTH, MINN.—It is reported that the Duluth and Iron Range will build a branch from Tower to sections 10, 9 and 8, township 62, range 14, in which they have very valuable iron properties. The road will start at Soudan and skirt Stuntz and Armstrong Bays.

AUGUSTA, GA.—The City Council of this place has authorized the substitution of electricity for horses on the Augusta and Louisville Railroad lines.

ELECTRIC RAILWAYS.—New electric railways will be established and improvements will be made to those already built at the following places: Youngstown, O.; Troy, N. Y.; Saratoga, N. Y.; Williamsport, Pa.; Ottawa, Can.; Boston, Mass.; Albia, N. Y.; Grand Rapids, Mich.

GAS AND ELECTRIC-LIGHTING.

DAVENPORT, IA.—The City Council of this place has directed its Committee on Light to advertise for "the most practicable and cheapest plan to light the city with arc lights, and to offer a premium of $100 for the best and $50 for the next best plan received.

CHICAGO, ILL.—A press report in regard to natural gas for this city says, that contracts have been let for laying the pipe through Indiana, and that the work will be done by November 1.

PITTSBURG, PA.—It is reported that the stockholders of the Westinghouse Electric Company have voted to transfer their stock to the Westinghouse Electric and Manufacturing Company, and that the stock of the latter company has been increased from $5,000,000 to $10,000,000.

BIDS OPENED.

ALBERT LEA, MINN.—The bids for the building of the Albert Lea Lutheran High School have been opened, but were so much higher than the estimates of the architect that none were accepted.

NEW YORK CITY.—Bids were opened by the Department of Docks July 9, for building wooden pier, with appurtenances, including sewer boxes and a dumping board at the foot of East 110th Street: W. W. Hegeman, class 1, for pier, $24,400; class 2, for dumping board, $3,700; Terron & Jenks, class 1, for pier, $31,440; class 2, for dumping board, $5,500; J. Gielier, class 1, for pier, $27,300; class 2, for dumping board, $2,400.

MILWAUKEE, WIS.—The following bids for constructing a tunnel 3,000 feet long were received June 30, as follows: Shailer & Schinglau, Chicago, Ill., $121,643; W. Forristal, $128,667.50; J. O'Neill, $132,876; Thomas R. Bentley, $141,989; John J. Crilley, $191,200. The contract was awarded to Shailer & Schinglau. The contract for the crib was awarded to John O'Neill, for $34,000. The other bidders were: C. H. Sharke, $38,000; William Forristal, $34,500; Shailer & Schinglau, $40,000.

MINNEAPOLIS, MINN.—The contract for the superstructure of the Y. M. C. A. building has been let to James Carlisle & Sons, for $79,884.

WATERBURY, CONN.—The bids for erecting the new Bank Street school house were as follows: Carpenter work, Henry A. Lawlor, $22,490; Tracy Bros., $15,675; Charles O'Connor, $16,150; William M. Hurlburt, $17,729. Mason work, A. I. & G. S. Chatfield, $26,055; James F. Gaffney, $25,900; John W. Gaffney, $30,250; Patrick Thompson, $28,000. H. A. Lawlor bid for the whole contract $50,350, James F. Gaffney, $42,430, Patrick Thompson, $50,500. The contracts have been awarded to Tracy Bros. and James F. Gaffney.

ZANESVILLE, O.—Rocket & Sons have received the contract for heating by hot water the residence of Henry Werner.

MILWAUKEE, WIS.—The Board of Public Works have awarded to Messrs. Rundle, Spence & Co. the contract for furnishing 1,000 feet of iron pipe at 20½ cents per foot.

THE Editor of THE ENGINEERING AND BUILDING RECORD is always glad to receive items of news for the Contracting News Department. But such items are not considered news except when the prices and particulars of the award of a contract **are** given.

The announcement that —— has sold —— to —— without giving the *prices* and particulars concerns only the buyer and seller. Such notices are always excluded, except in the case where a certain firm is stated to have taken a certain contract, the execution of which would require that they should buy certain materials. Such an item would be used if deemed of more than local interest, because it would suggest to some readers the possibility of their making a sale or securing a subcontract.

GOVERNMENT WORK.

WASHINGTON, D. C.—The following proposals for furnishing and delivering iron girders and beams were received June 20: A. & P. Roberts & Co., Philadelphia, riveted trussed girders, per pound, 3.55c.; riveted plate girders, per pound, 3.55c.; connected beams, per pound, 3.55c.; Dearborn Foundry Co., Chicago, Ill., 3.65c., 3.3c., 3.8c.; New Jersey Steel and Iron Co., Trenton, N. J., 3.31c., 3.23c., 3.45c.; Pottsville Iron and Steel Co., Pottsville, Pa., 3.15c., 3.15c., 3.38c.; Carnegie, Phipps & Co. Limited, Pittsburg, Pa., 3.45c., 3.18c., 3.45c.; King Iron Bridge and M'f'g Co., Cleveland, O., 3.25c., 3.25c.; The Phœnix Iron Co., Philadelphia, Pa., 3.19c., 3.15c., 3.45c.; John M. Cornell, New York, N. Y., 3.8c., 3.4c., 3.4c. The contract was awarded to The Phœnix Iron Co.

EVANSVILLE, IND.—Charles Pearce & Co., of Indiana, have been awarded the contract, at $79,660, for the construction of the U. S. Marine Hospital Building.

DETROIT, MICH.—Patrick Dee was the lowest bidder for the construction of the basement and area walls of the new U. S. Court House and Post Office building. His bid was $111,573.

BROOKLYN, N. Y.—The following bids for dredging work at the Navy Yard were received at this city at the Navy Department: W. H. Beard, $20,700; P. S. Ross, Jersey City, $23,850; Atlantic Dredging Company, $21,600. Mr. Beard's bid being the lowest, his bid has been accepted.

WASHINGTON, D. C.—The following proposals for furnishing and delivering rolled iron beams were received June 20 by Bernard R. Green, Superintendent: A. & P. Roberts & Co., 3.45c. per pound; J. M. Cornell, 3.39c.; Pottsville Iron and Steel Company, 3.45c.; New Jersey Steel and Iron Company, 3.42c.; Carnegie, Phipps & Co., 3.45c., beveled ends; 3.15c., square ends; 2.25c., angles; Phœnix Iron Company, 3.45c., beveled ends; 3.15c., square ends; 2.05c., angles. The contract was awarded to John M. Cornell.

NEW CORPORATIONS.

THE A. J. McDonald Manufacturing Company at Chicago, to manufacture railway safety gates; capital stock, $50,000. Incorporators: A. J. McDonald, O. S. Dickson and Isaac T. Dyer.

THE Naperville Stone Company at Naperville, Ill., to quarry stone; capital stock, $50,000. Incorporators: B. B. Bocker, Alvin Scott, Jr., and H. H. Goodrich.

THE Electro Speaking Tube Construction Company at Chicago, to manufacture electrical goods, introduce speaking tubes, etc.; capital stock, $80,000. Incorporators: E. T. Orne, Warren Oral and Richard Robins.

SPRINGFIELD, ILL.—The following articles of incorporation were taken out July 7: United States Filter Manufacturing Company, Chicago; to manufacture filters; capital stock, $100,000; incorporators, Herman Vollmer, Horace L. Brand, William H. Bullen. Cyclone Crusher Company, Chicago; to manufacture mining machinery; capital, $200,000; incorporators, Henry W. Hinsdale, Henry Colberg, Horace J. Clark. Pan-American Engineering and Construction Company, Chicago; to promote engineering and agricultural works and projects; capital, $500,000; incorporators, William A. Stiles, Harry B. Waterman, I. J. Gill. Grand Marais Copper Mining Company; to mine minerals; capital, $2,000,000; incorporators, Phillip D. Armour, Jr., Henry P. Darlington, and Alfred R. Crion.

SPRINGFIELD, ILL.—Columbia White Lead Company, Chicago, to manufacture white lead, paints and colors; capital, $1,000,000; incorporators, James Warner Middleton, Milton A. Fair, William Brace.

Mississippi Valley Development Company, East Cape Girardeau, to operate water-works and electric light plants, for construction and operation of tramways and horse power and dummy roads, and to do mining business; capital stock, $50,000; incorporators, George H. Crumb, Lawson H. Watts, Dennis W. Wilson Copeland.

MIDDLETOWN, N. Y.—The Middletown and Port Jervis Bluestone Company has been incorporated, with a capital of $50,000. The company's quarries are at Oakland, Sullivan County.

INDUSTRIAL.

SYRACUSE, N. Y.—The Pierce, Butler & Pierce Manufacturing Company, Steam and Mechanical Engineers and Contractors, 118 Clinton Street, Syracuse, N. Y. (main office), has opened offices at New York City, 60 Barclay Street, and at Boston, 237 Franklin Street; Chicago, 96 Lake Street.

SAN FRANCISCO, CAL.—The new City Hall Commissioners, at a meeting held July 4, authorized the secretary to advertise for bids for building the city prison; also for cement stone pavements and granite curbs around the City Hall reservation.

SPARTA, MICH.—At a meeting held on July 7, to vote on the question of bonding the village for $4,000 for a public building, 127 votes were cast in favor of, and 5 against, the proposed building.

PROPOSALS.

(Continued from page x.)

CITY OF NEW BRUNSWICK, N. J.

Notice to Contractors.

SEALED PROPOSALS WILL BE RECEIVED by the undersigned, Clerk of the Common Council of the City of New Brunswick, N. J., until 12 o'clock noon, WEDNESDAY, July 23, 1890, for laying a 12-inch **MACADAMIZED PAVEMENT** on Livingston Avenue, in said city, from George Street to Comstock Street (about 20,000 square yards of pavement). The work to be done under the authority of and in conformity with Chapter No. 148 of the Public Laws of the State of New Jersey, passed 1889.

All bids must be made upon the blank forms furnished by the City Surveyor, at whose office, No. 1 Paterson Block, the form of contract and specifications may be seen, and other necessary information as to excavation, etc., obtained.

The Common Council reserves the right to reject any or all bids.

H. B. COOK, City Clerk.

New Brunswick, N. J., July 3, 1980.

Notice to Sewer Contractors.

GLOVERSVILLE, N. Y., June 26, 1890.

SEALED PROPOSALS FOR THE CONstruction of **SEWER EXTENSIONS** and sewer appurtenances, and for furnishing material for the same in the CITY OF GLOVERSVILLE, N. Y., will be received at the office of the City Clerk, and shall be addressed to Chairman of Committee on Sewers, and marked "Bids for Sewer Extensions."

No bids will be received after 6 o'clock P. M. July 21, 1890.

The work will comprise in general the following quantities:

10-inch vitrified pipe, about	1,050 feet.
8 " " " "	7,290 "
6 " " " "	1,750 "
4 " " " "	4,800 "
Manholes .... "	26
Lampholes .... "	33

Every proposal shall be signed by the bidder, and accompanied by cash or a certified check to the amount of two hundred dollars ($200), made payable to the City Chamberlain of the City of Gloversville, N. Y., conditioned upon the execution of the required contract and required bond for the faithful performance of the terms of the contract in case of award. The checks of unsuccessful bidders will be returned to them immediately after the contract is awarded or all bids are rejected.

Specifications can be had on application to F. H. WILMARTH, City Clerk. Plans can be seen at the office of the City Engineer.

The Common Council reserves the right to reject any or all bids.

EUGENE MEAD,
Chairman Committee on Sewers.
F. E. ABBOTT,
City Engineer. 6

JULY 10, 1890.

SEALED PROPOSALS WILL BE RECEIVED at the office of the Supervising Architect, Treasury Department, Washington, D. C., until 2 o'clock P. M. on the 6th day of August, 1890, for all the **LABOR AND MATERIALS** required in the erection and completion of the U. S. Post-Office building at LOWELL, MASS., (approaches and heating apparatus not included) in accordance with the drawings and specification copies of which may be had on application at this office or the office of the Superintendent. Each bid must be accompanied by a certified check for $500. The Department will reject all bids received after the time fixed for opening the same; also, bids which do not comply strictly with all the requirements of this invitation. Proposals must be sealed and indorsed "Proposals for the Erection and Completion (except Heating Apparatus and Approaches) of the U. S. Post-Office building at Lowell, Mass.," and addressed to JAS. H. WINDRIM, Supervising Architect. 7

JUNE 28, 1890.

SEALED PROPOSALS WILL BE RECEIVED at the office of the Supervising Architect, Treasury Department, Washington, D. C., until 2 o'clock P. M. on the 23d day of July, 1890, for the Iron Stairways and **IRON WORK** of Interior Finish for the U. S. Court-House and Post-Office building at PITTSBURG, PA., in accordance with drawings and specification, copies of which may be had on application at this office or the office of the Superintendent. Each bid must be accompanied by a certified check for $300. The Department will reject all bids received after the time fixed for opening the same; also, all bids which do not comply strictly with the requirements of this invitation. Proposals must be sealed and indorsed "Proposal for Iron Stairways and Iron Work of Interior Finish for the U. S. Court-House and Post-Office building at Pittsburg, Pa.," and addressed to JAS. H. WINDRIM, Supervising Architect. 6

PROPOSALS FOR MILITARY SUPPLIES. Office of the Quartermaster, U. S. Military Academy, West Point, N. Y., July 9, 1890. Sealed proposals, in duplicate, subject to the usual conditions, will be received at this office until 12 o'clock, noon, on the 8th day of August, 1890, for Gas Coal, Anthracite Coal, Hardwood, Charcoal, Building Materials, Paints, Plumbing Materials, Gas and Steam Fittings, Pulleys, Belting, Arch Plates for Steam Boilers, Fire Brick, Fire Clay, Stationery, Printing Materials, Office Furniture, Brooms, Soap, Brushes, Range Parts, and other miscellaneous stores specified on schedules to be had upon application here. Preference will be given to articles of domestic production or manufacture, conditions of quality and price (including in the price of foreign productions or manufactures the duty thereon) being equal. Inclose proposals in envelope marked "Proposals for Military Supplies," and addressed to the undersigned, CHAS. W. WILLIAMS, Captain and A. Q. M., U. S. A. 9

PROPOSALS.

PROPOSALS FOR PLUMBING, ETC.— Depot Quartermaster's Office, David's Island, N. Y. H., July 1, 1890.—Sealed proposals, in triplicate, will be received until 11.30 A. M., WEDNESDAY, July 30, 1890, and opened immediately thereafter, for supplying and fitting up **BATH-TUBS, WATER-CLOSETS** and **URINALS** in basement of 1888 Brick Barrack at this place. Plans, specifications, general instructions to bidders and blank forms of proposals will be furnished to bidders on application to this office. The right to reject any or all bids is reserved to the United States. Captain J. McE. HYDE, Assistant Quartermaster, U. S. Army, Depot Quartermaster. 8

PROPOSALS FOR SERVICE CONNECtions.—Office of Post Quartermaster, Fort Keogh, Mont., July 5, 1890. Sealed proposals in triplicate, subject to the usual conditions, will be received at this office until 12 o'clock noon, on the 5th day of August, 1890, and then opened, for furnishing all the labor required in making **SERVICE CONNECTIONS** with water mains at this post. Specifications, instructions to bidders, and blank forms of proposals will be furnished on application to this office. M. C. MARTIN, 1st Lieut. & R. Q. M. 22d Infantry; A. A. Q. M., U. S. A. 9

NOTICE TO BIDDERS.

SEALED PROPOSALS ADDRESSED TO the Board of Public Works, MUSKEGON, MICH., will be received up to 5 o'clock P. M. MONDAY, the 21st day of July, 1890, for furnishing materials and labor, and constructing the following works:

A. An inlet crib, a 30-inch inlet pipe, about 3,600 feet long and a 24-inch inlet pipe, about 750 feet long, in and under Lake Michigan, together with their connections.

B. Constructing shore receiving wells.

C. Grading about the pumping station and constructing docks.

D. Furnishing and erecting pumping engines, boilers, their appurtenances and connections.

E. Constructing a pumping station and suction pipe tunnel.

F. Furnishing about 2,300 feet 24-inch, 5,000 feet 16-inch, 800 feet 6-inch, iron pipe with special castings.

G. Furnishing valves and hydrants.

H. Laying pipes and setting valves and hydrants.

Proposals will be received for doing the whole or any part of the above work, and the right is reserved to reject any or all of them.

Accompanying each bid, must be a certified check payable to the city of Muskegon, Mich., as a guarantee to be forfeited if the bidder fails to enter into and complete the contract awarded to him; the amount to be $500 except for the bid on the lake work, in which case it will be $2,500.

Plans and specifications may be seen at the office of the Board of Public Works, Muskegon, or of the Engineer.

By order of the Board of Public Works.

A. V. MANN,
Prest. B. of P. Works.
CHESTER B. DAVIS, Engineer,
Rookery Building, Chicago, Ill.

SEWERS, Albany, N. Y.—Proposals are wanted, no date specified, for laying vitrified stoneware pipe sewers in certain streets at this place. Address the Street Commissioner, as above.

BRIDGE, Marietta, Ga.—Bids will be received by J. M. Stone until July 28 for the construction of a bridge across Soap's Creek.

IRON PIPE, Jersey City, N. J.—Proposals will be received until July 17, for furnishing and delivering on the proposed site at Snake Hill a new fire pump and about 1,000 lineal feet of 8, 6 and 4 inch iron water main and necessary specials. Address John Boyd, Clerk Board of Chosen Freeholders.

PAVING, Chattanooga, Tenn. — Proposals are wanted, no date specified, for furnishing material and labor in preparing foundation and laying Trinidad asphalt paving blocks. Also for supplying curbing and granite blocks and other necessary material and labor. Address Southern Pavement Company, Fort Payne, Ala.

PAVING, Brooklyn, N. Y.—Proposals are wanted until July 18, for paving, curbing, etc., with bluestone curb and Belgian block pavement, various streets at this place. Address John P. Adams, Commissioner of City Works, as above.

WRECK, Apia, Samoa.—Proposals are wanted until August 15, for the removal of the wreck on the reef in Apia harbor. Address W. Blacklock, Trustee, as above.

STREET LIGHTING, Binghamton, N. Y. — Proposals will be received by the Common Council for lighting the city with electricity from July 14. Address for further information, W. J. Flannigan, City Clerk.

WATER POWER CANAL, Sault St. Marie, Ontario, Canada —Proposals will be received until July 21, for the construction of a 10,000 horse-power canal. Address for further particulars, Albert Carney, Secretary Sault St. Marie Water, Light and Power Company, as above.

WATER-WORKS SUPPLIES, Mohawk, N. Y.— The Board of Water Commissioners will receive bids until July 16, for water-works supplies.

BUILDING, Xenia, O.—Proposals will be received at the office of the Financial Officer of the Ohio Soldiers' and Sailors' Orphans' Home until August 11, for furnishing the material and doing the work of building one double cottage. Address J. D. Clark, Financial Officer, as above.

DREDGING, New York City. — Proposals are wanted until July 23, for dredging for a new pier at foot of West Forty-ninth Street; Canal Street dumping board; dumping board at West Nineteenth Street pier; dumping boards at Piers 12 and 44, slip between Piers 51 and 52, dumping boards at foot of East Seventeenth Street and foot of East Twenty-second Street. Address the Department of Docks, Pier A, North River, as above.

PROPOSALS.

PAVEMENT, Columbus, O.—Proposals will be received by the Committee on Improving State House Grounds until July 14, for all the necessary excavation and grading and for the laying of 1,200 square feet of pavement suitable for heavy hauling on the east approach to the State House building. For the necessary excavation, grading and laying of 21,600 square feet of suitable pavement for walks and light driving on the present gravel walks; and also for the necessary grading, excavation and laying of 46,400 square feet of pavement, being the present asphalt walks and drives Address Morton L. Hawkins, Adjutant General's Department.

PIER, New York City.—Proposals are wanted until July 23, for removing certain portions of, and for repairing the outer 140 feet of the old wooden pier, and for building complete the inner length of the pier at the foot of East Twenty-fourth Street, East River. Address the Department of Docks, Pier A, North River, as above.

BUILDING, New York City.—Proposals are wanted until July 23, for repairing and altering Engine House No. 33, at Great Jones Street; also Engine House No. 25, at Fifth Street. Address Headquarters, Fire Department, Sixty-seventh Street, as above.

PIPE, ETC., New York City.—Proposals are wanted until July 15, for furnishing steam pipe, steam jacket kettles, steam fittings, etc., for use at the Penitentiary on Blackwell's Island. Address Department of Public Charities and Correction, 66 Third Avenue, as above.

CANAL WORK, Morrisburgh, Ontaria, Can.— Proposals will be received until July 23, for the construction of a lift lock, weirs, etc., at this place, and the deepening and enlargement of the Rapids Plat Canal. Address, for further particulars, A. P. Bradley, Department of Railways and Canals.

HOSPITAL, Columbus, O.—Proposals will be received at this office until August 5, for furnishing the materials and performing the labor necessary for the construction of a Veterinary Hospital at the Ohio State University in this city. Address Alexis Cope, Secretary Ohio State University.

PIER DREDGING, ETC., New York City.—Proposals are wanted until July 16, for repairing Pier, New 27, North River, near the foot of West Twenty-seventh Street, North River; also for dredging at West Forty-sixth Street pier and at West Fifty-first Street pier on the North River; also for preparing and building a wooden pier and approach at the foot of West Forty-ninth Street, North River. Address Department of Docks, Pier "A," North River.

WATER MAINS, New York City.— Proposals are wanted until July 17, for relaying water mains in Gerard Avenue, One Hundred and Sixty-first, One Hundred and Fifty-sixth, One Hundred and Fifty-fifth, One Hundred and Thirtieth Streets and Boulevard. Address Department of Public Works, 31 Chambers Street, as above.

PIER, New York City.—Proposals are wanted until July 18, for preparing for and building a new wooden pier and approach at the foot of West Fifty-second Street, North River. Address Department of Docks, Pier "A," North River.

Building Intelligence.

NEW YORK.

102–6 Wooster st, br flat and store; cost, $50,000; o, D L Enestein.

82d st and Riverside Drive, 9 br dwells; cost, $90,000 all; o, A C Squier; a Rose & Stone.

116th st, w 8th av, 2 br flats; cost, $40,000 all; o, J & J Walker; a, A Spence.

57 South 5th av, br store and factory; cost, $25,000; o, Sarah K Pupin; a, A J Tinble.

226–32 E 26th st, 4 br flats; cost, $68,000 all; o, M Grosner; a, W Grane.

85th st, w West End av, 5 br dwells; cost, $90,000 all; o, P M Stewart; a, R S Townsend.

77th st, e Lexington av, br stable; cost, $18,000; o, E J O'Connor; a, J McIntire.

23 Spring st, br store; cost, $16,000; o, Catherine H Mottnach; a, B W Berger.

127 Bleeker st, br factory and store; cost, $35,000; o, O Sampten and J Solomon; a, F Wendell.

237 W 18th st, br flat; cost, $18,000; o, C Natale; a, A Huttira.

48th st e of 10th av, br flat; cost, $15,000; o, A Moore; a, G Keister.

Tremont av and Ostdorp st, fr dwell; cost, $9,000; o, Church of St Thomas Aquinas; a, J S O'Meara.

67th st w of 8th av, br stable; cost, $12,000; o, T M Leonard; a, R S Townsend.

67th st w of 8th av, br stable; cost, $12,000; o, M M Belding; a, R S Townsend.

115–117 E 125th st, 2 br stores and flats; cost, $75,000; o, H L Morris; a, A Spence.

70 Christopher st, br store and flats; cost, $25,000; o, P Goerlitz and J Goerlitz, a, F Baylies.

72 Christopher st, br store and flats; cost, $25,000; o and a, same as above.

145th st and Convent av, 2 br flats; cost, $70,000; o, J Striefler; a, W A O'Hea.

BUILDING INTELLIGENCE.

NEW YORK.—Continued.

Madison av and 83d st, br flat; cost, $110,000; o, J Weber; a, Weber & Drosset.

153 E 76th st, br school; cost, $16,000; o, Rev F Tetreau; a, M J T Mahony.

5 St Mark's pl, br st and flat; cost, $18,000; o, J Fox; a, Kentzer & Rohe.

136 W 12th st, br flat; cost, $22,000; o, D Rosenbaum; a, W C Frohm.

96th st and Amsterdam av, 3 br flats and stores; cost, $78,000; o, J Casey; a, A B Ogden & Son.

96th st e of Amsterdam av, 3 br flats; cost, $60,000; o and a, same as above.

99th st w of 8th av, 2 br flats; cost, $40,000; o, S Manson; a, J H Valentine.

210–214 W 4th st, br flat; cost, $96,000; o, P Goerlitz and J Goerlitz; a, F Baylies.

639 E 154th st, br flat; cost, $16,500; o, G Dunnser; a, A F A Schmitt.

BROOKLYN.

Locust av s of Beaver st, stable and storage; cost, $15,000; o, W Ulmer; a, F Under.

Jefferson av, w of Sturtevant av, 3 br and stone dwells; cost, $12,600; o, W C Bush; a, J E Dwyer.

N 10th st and Bulkhead av, grain elevator; cost, $40,000; o, L M Palmer; a, P H Gill.

11th st, e of 8th av, 5 br and stone dwells; cost, $25,000; o and b, W Brown; a, W M Coats.

Cor Green and Sumner avs, br and stone store and flat; cost, $20,000; o and b, T B Bryant; a; I D Reynolds & Son.

Pier 36, E. R. foot Harrison st, Kelsey stores, fr freight shed; cost, $22,000; o, W Coverly; a, R P Staats.

Cor Harman st and Irving av, 3 fr stores and flats; cost, $15,000; o and b, B Guensche; a, same as above.

26th st, w of 3d av, br moulding mill; cost, $15,000; o, C E Rogers; a, D Ryan.

Noble st, w of West st, br jute mill; cost, $175,000; o, Am Mfg Co; a, Drew, Baldwin & Co; b, Berton & Nickel.

Fulton st, w of Schenectady av, br office and flats; cost, $10,500; o, J T Story; a, W H Gaylor; b, S Parks.

Cor n 1st and Berry sts, br brewery; cost, $40,000; o, Paul Weidman; a, F Under.

Cor Norman av and Gurney st, fr store and flat; cost, $7,000; o and b, M McCabe; a, J F Conlon.

Siegel st, bet Graham av and Humboldt st, 3 fr tens; cost, $27,000; o, Ettinger & Co; a, H Smith.

Cor Bedford av and Nu st, br bakery and storage; cost, $15,000; o, C Freedman; a, C Rentz.

Adams st, s of Myrtle av, br theatre; cost, $40,000; o, Hyde & Behman; a, J De Lar-Hayes.

Cor Broadway and Covert st, 4 br stores and flats; cost, $50,000; o, P Johnson; a, F Holtnesberg.

ALTERATIONS—BROOKLYN.

Cor Bedford av and Hancock st, br extension; cost, $13,500; o, Moller; a, W H Gaylor; b, T Gibbons.

MISCELLANEOUS.

AUSTIN, ILL. — Addition to Methodis Church; cost, $10,000; a, W L Carroll.

BINGHAMTON, N. Y. — Nothing over $7,000 to report.

CANTON, O.—Nothing over $7,000 in value to report.

CHARLESTON, S. C. — Nothing over $7,000 in value to report.

CINCINNATI, O.—60 W 4th st, alteration of 5-story store; cost, $7,000; o, Geo Rendigs; contr, Jas Griffith's Sons.

S w cor 5th and Vine sts, 8-story store and office bldg, steel, brick and freestone; cost, $150,000; o, J T Carew; a, Jas W McLaughlin; contr, Wm Schuberth, Jr.

149–151 w 5th st, 4-story br store and flats; cost, $10,000; o, T J and J J Emery; a, Jos G Steinkamp.

100 Laurel st, 3½-story br dwell; cost, $8,500; o, Dr Gus Bruhl; a, E F Baude.

A library building will be erected here at a cost of $200,000. Address J T Carew, President Young Men's Mercantile Library Association, as above.

BUILDING INTELLIGENCE.

CHICAGO, ILL.—Sedgwick north of North, br flats; cost, $14,000; o, Wm Waller; a, John Tilton.

Ray av, 18 br flats; cost, $12,000; o, R W Lambourne; a, J L Merriam.

Ellis av, br store and dwell; cost, $30,000; o, W S Walker; a, Patton & Fisher.

Wentworth av and 56th, br store and flats; cost, $22,000; a, L G Hallberg.

Superior nr Western av, br and s flats; cost, $65,000; o, Chas Steinbrecher; a, J H Huber.

Michigan av nr 16th, converting St. Paul's Church to a theatre; cost, $60,000; a, J H Wagner.

Ashland and Washburne avs, hall; cost, some $40,000; o, Turner Society, Vorwaertz.

Lawndale, Chicago, s and br church, St. Melchisedeck's; cost, $40,000; o, Archbishop of Chicago, a, Joe Speyer.

59th and Indiana av, addn to School; cost, $50,000; o, Chicago Industrial School; a, J J Egan.

Vernon and 45th, s church, St. Elizabeth's; cost, $75,000; o, Archbishop of Chicago; a, same as above.

292 Sedgwick, br store and flats; cost, $13,000; o, Wm Nadler; a, Schaub & Berlin; b, Wm Walk.

262–64 N Carpenter, br flats; cost, $12,000; o, J H Moe; a, Lutken & Thieslen; b, Jens Olsen & Son.

2638–42 Wabash av, br factory; cost, $35,000; o, Cheap Edison Co; a, S S Beman; b, Geo H Fox.

174 W 19th, br store and flats; cost, $8,000; o, Jos Ketzka; a, F Layer; b, F C Layes & Co.

Madison st and Michigan av, br and s business and office bldg; cost, $125,000; o, Western Banknote Engraving Co; a, C S Frost; b, Geo A Fuller.

Deversey and Franklin, br dwell; cost, $22,000; o, P J McGenness; a, C F McAfee; b, Jas Bloomfield.

1224 Wrightwood, br dwell; cost, $8,000; o, R M Heldcock; a, A M F Colton; b, G Messersmith.

2007–09 Surf, br dwell; cost, $16,000; o, Gustave Hoffman; a, E R Krause; b, H Mueller & Bro.

19–21 Sidney av, br dwell; cost, $23,000; o, Jno G Neumeister; a, Aug Fredler; b, J W Hersey.

31st near Dashiel, parish school of St. Catherine's Church; cost, $15,000; o, Archbishop of Chicago; a, J F & J P Doerr.

31st and Bonfield, br store and flats; cost, $18,000; o and b, Hy Sweet; a, R G Pentecost.

947 W 21st, br st and flats; cost, $8,000; o, N C Brueschabor; a, E Mehler; b, Wm Schwerin.

353–55 W North av, br store and flats; cost, $16,000, o and a, Wm Ohlhaber; b, Lutz & Thompson.

24–26 Francisco, br flats; cost, $12,000; o, Coon & Lester; a and b, Hammond & Chapin.

96 Wabash av, br addn to store; cost, $12,000; o, Jno B Drake; a, J M Van Osdel & Co; b, Thos Nicholson.

3400–02 Michigan av, s and br dwells; cost, $100,000; o, E Mandel; a, L B Dixon; b, Geo H Fox.

Monroe and La Salle, 12-story store and office bldg; cost, $1,000,000; o, W C T U Women's Christian Temperance Union; a, Burnham & Root; b, Geo A Fuller & Co.

516 Marchfield av, br flats; cost, $8,000; o, Aug Breicha; a, Anton Charvat; b, Jos Strand.

Cottage Grove and South Chicago avs, br st and flats; cost, $14,000; o and b, E D Murrey; a, W D Coles.

Jackson av nr 56th, br dwells; cost, $12,000; o, Wm Singer; a, M L Beers; b, C Christiansen.

6545–49 Gale, br flats; cost, $17,000; o and a, E Rich.

4311–13 Wabash av, br flats; cost, $10,000; o and a, Chas Mertens; b, F Faulmann.

2825 Prairie av, br and s dwell; cost, $25,000; o, Chauncey Keep; a, Chas H Frost; b, J C Robinson.

145 buildings costing less than $7,000 each.

BUILDING INTELLIGENCE.

DENVER, COL.—Sherman av, bet Colfax and 16th, br addn; cost, $5,000; o, T W Hur.

Arapahoe, bet 15th and 16th, br addn; cost, $7,300; o, James Mears.

Glenarm, bet 13th and 14th, br and st addn; cost, $16,000; o, Denver Athletic Club; a, Varian & Sterver.

Berkley, br dwell; cost, $7,000; o, F W Lomax; a, as above.

DETROIT, MICH.—151 E High st, 2-story br residence and barn; cost, $8,000; o, Dr H D Wheeler.

South side Ferry av, bet Beaubein and Antoine sts, 2-story br residence; cost, $7,000; o, Robt J Wilson; a, E A Walsh & Son; b, not let.

DENNISON, TEX. — Commercial college bldg, 4-story pressed br, s and terra cotta, bldg, 75x120, to be steam heated and have electric lights; cost, $60,000; o, Commercial College Company; a, Bristol, Thornbury & Bristol, of Dennison, Sherman and Dallas, Tex; b, not let.

ENGLEWOOD, ILL.—10 story hotel; cost, $400,000; a, J J Kouhn.

FINDLAY, O.—Main and College sts, br business block and flats; cost, $8,600; o, Mrs Goodwin; a, Geo J Horn; b, not let.

FLUSHING, L. I.—Proposals will soon be wanted for the erection of a $45,000 public school building at this place. For details, address Dr E A Goodridge, President Board of Education.

GALVESTON, TEX.—Strand and 21st sts, 3-story br bank bldg; cost, $30,000; o, Adone & Lobit; a, W J Clayton & Co; b, Barnes & Paliser.

IOWA CITY, IOWA.—The State University Y M C A will erect a $25,000 bldg at this place.

JERSEY CITY, N. J.—Henderson st, br bldg; cost, $15,000; o, J D Carscellen.

Bay st, br bldg; cost, $9,000; o, W Dohrman.

Cubberly place, 6 fr bldgs; cost, $9,000; o, J D Condict.

Jersey av, br bldg; cost, $26,000; o, Walter Rae.

Varick st, br bldg; cost, $7,000; o, J Kelleher.

JANESVILLE, WIS. — Fr dwell; cost, $7,000; o, Mrs A P Burnham; a, Conover & Porter, Madison, Wis.

LOWELL, MASS.—The Old Lowell National Bank is to expend $20,000 in fitting up new banking rooms in the Bowditch Building. C F Foss & Co., contractors.

LEAMINGTON, ONT.—2-story br schoolhouse; cost, $10,000; o, Board of Education; a, Albert E French, Detroit, Mich; b, not let.

MILWAUKEE, WIS. — Milwaukee and Menonwall sts, gas house; cost, $12,000; o, Milwaukee Gas Light Co; a, Bartlett Hayward; b, Jas Graham.

Cor 3d and North avs, storehouse; cost, $16,000; o, P Cudahy; a, Crane & Barkhausen; b, same as above.

Grove and Washington sts, storehouse; cost, $16,331; o and a, same as above; b, Drake & Bond.

Grand av and 20th st, res; cost, $75,000; o, Fred Pabst; a, Ferry & Clas; b, Val Mand.

2d and Galena streets, brewhouse; cost; $100,000; o, Schlitz Brewing Co; a, Wolf & Lehle; b, A Howinghauser.

Grove and Mineral sts, business block; cost, $9,000; o, Henry Marks; a, J Pauler; b, J. Stoll.

S e cor Broadway and Mason st, business block; cost, $41,000; o, A Hathway; a, H Russell; b, Geo Posson.

MINNEAPOLIS, MINN.—The John Orth Brewing Co will make $300,000 worth of improvements in their brewery and new buildings will be erected.

MERIDEN, CONN.—Nothing over $7,000 in value to report.

MT. CLEMENS, MICH.—6-story br hotel and bath house; cost, $150,000; o, Media Bath Co; a, N J Gibbs; b, not let.

BUILDING INTELLIGENCE.

NEWPORT, ARK.—Plans have been prepared for an $8,000 hotel at this place. Address architect T Harding, Little Rock, Ark.

OMAHA, NEB.—A $40,000 store and office bldg will be erected here. Address Cleeves Bros., architects, as above.

PATERSON, N. J.—A $9,000 dwelling will be erected here. Address Architect M Houman, as above

It is reported that the Paterson Sanitary Company, recently organized here to dispose of the city garbage, will soon let contracts for a building to contain its works.

PEORIA, ILL —5-story br hotel; cost, $90,000; o, I H Frank; a, N J Gibbs, Mount Clemens, Mich; b, not let.

PHILADELPHIA, PA.—The contract for the erection of the intermediate buildings of the Deaf and Dumb Asylum was awarded to Charles McCaull for $130,000.

PROVIDENCE, R. I.—Melrose st, fr dwell; o, Annie V Heuston.

Cranston and High sts, bus block; cost, $30,000; o, C E Souther and others; b, Whitaker & Smith.

Broadway, 2 fr dwells; cost, $8,000, o, Jane and Isabella Dewsnap; a, John Davidson.

Potters av, bus block; cost, $20,000; o, Hearn & Braikch; a, Geo W Cady; b, N B Horton.

POTTSVILLE, PA.—Pike st, Pt Carbon, remodeling; cost, $8,700; o, Robt Allison; a, W D Hill; b, D Gellinger.

760 Mahntongo, remodeling; cost, $7,500; o, G J Wadlinger; a, Bertolet; b, Sailor.

SALT LAKE CITY, UTAH.—12th, East and 3d sts, 2-story br dwell; cost, $8,000; o, Chas Baldwin; a, W E Ware.

SIOUX FALLS, S. D.—Architect W L Dow has prepared plans for the erection of a $25,000 bank and office building at this place.

SPRINGFIELD, O.—Nothing over $7,000 in value to report.

ST. LOUIS, MO.—Bell and Vandeventer avs; br dwell; cost, $11,000; o, I De Figuaredo and others; b, Goesse & Remmerse.

Lewis Park and Taylor av, br dwell; cost, $7,000; o, Dr Whipple; b, W E Clayton.

Bell and Grand avs, br dwell; cost, $17,000; o and b, J Bizant.

12th st and Clark av, br city hall; cost, $1,150,000; o, City of St Louis; a, Eckel & Mann; b, sub-let.

S w cor 4th and Morgan sts, br store; cost, $30,000; o, Jno Meier; b, sub-let.

The contract for the foundation, excavation and pile driving for the new City Hall in this city has been awarded to W F Hopkins, at $79,732.

ST. PAUL, MINN.—Rice nr Front, 2 story br dwell; cost, $7,000; o, Frank Heines.

Dayton nr Kent, 2-story br dwell; cost, $8,000; o, J W Miller.

Mound nr Thorn 2-story br dwell; cost, $28,000; o, J F Eisinmenger.

Iglehart nr Mackubin, 2 2-story s dwells; cost, $16,000; o, Deeks & Witbeck.

12th nr Cedar, 2-story br dwell; cost, $10,000; o, J A Berkey.

Victoria nr Dayton, 2-story br dwell; cost, $10,000; o, A S Phinney.

SALT LAKE CITY, UTAH.—6 West st, 2 story br warehouse; cost, $40,000; a, Carroll & Kern.

TOPEKA, KAN.—Nothing over $7,000 in value to report.

WORCESTER, MASS.—Br factory for envelopes; cost, $15,000; o, W H Hill; a, Fuller & Delano.

Cambridge, br factory for carpets; cost, $20,000; o, Chas Compton; a, same as above; b, J G Vandrencil.

Wachusett, fr dwell; cost, $7,000; o, F E Williamson; a, Barker & Nourse; b, not let.

BUILDING INTELLIGENCE.

WASHINGTON, D. C.—1341–43 F st, 2 br dwells; cost, $8,000; o and b, Jos Robbins.

2231–41 I st, 6 br dwells; cost, $40,000; o, Albert Gleason; a, O Von Nerta; b, Bright, Humphreys & Co.

2021 H st, br dwell; cost, $10,500; o, A R S Foote; a, A B Bibb; b, Alex Miller.

1501 11th st, br dwell; cost $8,000; o and b, Robt L Warring; a, B S Simmons.

1219 16th st, 3-story br bldg; cost, $18,000; o, T O Evans; a, Chas E Emonston.

1333 R I av, 3-story br bldg; cost, $7,000; o, J Tourney; a, Louis Leibhart.

607–11 Mass av, 3 2-story br bldgs; cost, $10,500; o, Carrier & Koman.

1114 14th st, 3-story br bldg; cost, $12,000; o, A K Humphrey; a, R I Fleming; b, C C Martin.

1423–37 W st, 7 2-story br bldgs; cost, $30,000; o, A T Varnell; a, W L Conley; b, Ward & Co.

1702 16th st, 3-story br bldg; cost, $9,000; o, M N Shafer; a, Jos B Williamson.

1815–19 14th st, 3 2-story br bldgs; cost, $7,000; o and a, Rorse & Baker.

307–19 F st, 7 2-story br bldgs; cost, $7,000; o, C F Smithson; a, P N Dwyer; b, C F Evenston.

825–27–29 C st, 3 2-story bldgs; o, Mary Atkins; a, Jos Johnson; b, O Donnelly.

2418–20 K st, 2 2–story br bldgs; cost, $7,000; o and b, J H Grant; a, N R Grimm.

2d, bet D and E sts, 9 2–story br bldgs; cost, $26,000; o, A J Fisher; a, as above.

920 Massachusetts av, 3-story br bldg; cost, $10,000; o, W B Downing; a, as above.

Water, bet 32d and 33d sts, 3-story br bldg; cost, $14,000; o, Weaver Kingla & Co; a, as above.

1417 G st, 3-story br bldg; cost, $16,000; o, I S Kimball; a, C C Martin.

923–25–27 20th st, 3 2-story br bldgs; cost, $10,000; o, A P Fardon; a, as above.

Trinidad av, 13 2-story br bldgs; cost, $7,800; o, E E Ramy; a, G R Arrington.

Florida av, 10 2-story br bldgs; cost, $25,000; o, G S Wormley; a, C S Bunt.

N Capitol and N st, 5 2–story br bldgs; cost, $15,000; o, Ed Waltz; a, as above.

1436 to 42 V st, 4 2–story br bldgs; cost, $7,500; o, Theo Frebus; a, Gus Frebus; b, E T Jones.

247 permits less than $7,000 in value.

1228 22d st, 4 story br bldg; cost, $15,000; o, W B Moses & Son; a, Jno H Howlett.

1626 Rhode Island av, 3-story br bldg; cost, $45,000; o, A C Barney; a, Barry, Simpson & Andrews; b, C A Langley.

2023 H st, 3-story br bldg; cost, $8,000; o, Jos Hunter; a, Jos H Byram.

804–8 6th st, 3 2-story br bldgs; cost, $7,000; o and b, J F Cullinan; a, P N Dwyer.

1525 P st, 3-story br bldg; cost, $9,700; o and a, J R Brooks.

Pennsylvania av bet 3d and 4th sts, 3-story br bldg; cost, $30,000; o, National Cap. Bank; a, A P Clark; b, Jas Parsons.

Wyoming av, 3-story br bldg; cost, $12,000; o, L M Saunders; a, R Stead; b, F Pelling.

1701 2d st, 3-story br bldg; cost, $75,000; o, G S Fraser; a, Hornblower & Marshall,

2123–29 L st, 4 2-story br bldgs; cost, $12,000; o and a, G Dearing.

1916 N st, 3-story br bldg; cost, $11,000; o, Wm Wall; a, T F Schneider; b, Emmet & Co.

Jackson and Pierce st, 3-story br bldg; cost, $12,000; o and b, W F Kirby; a, A P Clark.

WIKES BARRE, PA.—Nothing over $7,000 in value to report.

YONKERS, N. Y.—A $30,000 church will be erected here. Address Architect E A Quick, as above.

A brick and stone building will be erected here at a cost of $10,000. Address Architect E A Quick, as above.

A $12,000 building will be erected here. Address E A Quick, architect, as above.

YOUNGSTOWN, O.—Nothing over $7,000 in value to report.

THE ENGINEERING & BUILDING RECORD

AND

THE SANITARY ENGINEER.

A JOURNAL FOR THE ARCHITECT, ENGINEER, MECHANIC, AND MUNICIPAL OFFICER.

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THE VENTILATION OF STEAMSHIP FIREROOMS.

EXTRAORDINARILY high temperatures in steamship firerooms—going considerably beyond 100° Fahr.—have come to be looked upon so much as matters of course that they have apparently ceased to attract general attention, and little effort seems to be made by those in authority to bring about a better state of affairs. It is fair to say that the conditions under which the firemen work in the stoke-holes of some of the fast Atlantic steamers pass altogether beyond popular appreciation, the mere statement of temperatures, ranging from 120 to 140 degrees, affording no adequate measure of the suffering which these men go through.

On one of the latest steamers of an Atlantic coast line, a temperature of 138 degrees is said to have been recorded in the fireroom by a thermometer held directly underneath the ventilator. On another one 140 degrees are said to have been noted, and the average for a large number is placed at 125 degrees. During the summer time the heat of the tropics is sometimes added to that of the firerooms, making the conditions almost unendurable.

Short fireroom watches, with comparatively long intermissions,. seem to be about the only expedients which have been tried to any extent to relieve the hard-worked men. One notable exception is found in the new steamer Majestic, of the White Star Line, which is said to have such excellent arrangements for ventilating the fireroom that the temperature rarely rises above 105 degrees, and is often lower. The whole secret of the success in maintaining a fairly comfortable temperature in this case is found in the rational application of blowers, which have been put in, and could be used with equal success in other vessels, at comparatively trifling expense. Figures ranging from $500 to $600 have been given as the price of making life seem worth living, by these means, in the stoke-hole of almost any steamer, and these should commend themselves to the attention of those having the power to act. It has been well pointed out that, with the now available means of driving air about, there ought to be no difficulty in keeping up a mild tornado in every stoke-hole, and in subjecting a stoker to no more risk than a farm laborer is exposed to on a warm day in summer. It is to be hoped that the good example set in the case of the Majestic will not be without a generally beneficial influence. The problem to be solved is not a difficult one, and the question of expense is so trifling that it should scarcely call for consideration.

SMOKE NUISANCE IN WESTERN CITIES.

EVERY now and then the question of smoke prevention comes up for discussion in some of the larger western cities like Chicago, St. Louis and Cincinnati, and suggestions are offered designed to bring about an abatement of the smoke nuisance. Thus far, however, all the remedies proposed have proved ineffectual. Quite recently the subject was discussed at length by the Chicago Commercial Club, and the conclusion apparently was reached that the establishment of a large central plant for generating steam, like that of the New York Steam Company, would prove a satisfactory partial solution of the problem, since, after all, manufacturing establishments using steam for various purposes were responsible for a large portion of the smoke. The situation, briefly stated, was about this:

Each building in the manufacturing and business district has its own boiler and chimney belching forth unconsumed carbon. Each uses soft coal because it costs but about half of what anthracite costs. It is hopeless, it was held, to try to force the whole business community with the weak machinery of an ordinance and an irresolute administration to substitute an expensive for a cheap fuel. If the generation of steam were concentrated at a few points in great steam producing batteries; if instead of a large number of scattered boilers there were half a dozen batteries of boilers of from 10,000 to 20,000 horse-power, each generating steam and distributing it through pipes, the smoke nuisance would cease. Where the works were on so large a scale self-feeding furnaces could be profitably used. Small boilers could not stand the expense. The quantity of steam now used could be produced with about half the present amount of coal, and this saving would enable a company to sell steam much cheaper than people could produce it for themselves by the present methods.

All this sounds very well. As a matter of fact, however, high-pressure steam distribution in cities from central stations is not an unqualified success. The steam produced at such stations, as experience has well shown, is not sold at such low figures as seems to be taken for granted; and, finally, it is not likely that steam users would, or could, be forced to buy their steam supply from such steam companies. The solution of the difficulty is to be found simply in strengthening what has been characterized above as the weak machinery of an ordinance, specifying smoke prevention. If the smoke rules were made sufficiently stringent, and their enforcement looked after, ways and means to avert the evil would be forthcoming. Even if there were no attempt at enforcing the substitution of an expensive fuel for a cheap one good results might be attained.

Careless and unskillful firing lies at the root of much of the smoke evil. Conscientious management in fire-rooms and the adoption of rationally-designed furnaces—not one of the many quack devices with which the market is now flooded and for which all sorts of impossible things are claimed—would accomplish much in overcoming the constantly increasing smoke trouble. Central steam distribution, however, would not prove an unalloyed blessing, if indeed a blessing at all. Rather, if we may judge by New York's experience, it would be the greater nuisance.

STEAM AS A FIRE EXTINGUISHER.

THE use of steam as a means of extinguishing fire is not new, and its advantages in point of convenience and, for that matter, of efficiency over many other commonly practiced methods have frequently been given prominence. There have, however, been cases where the method has failed completely, and much damage and disappointment has resulted, leading eventually to serious questioning whether steam really deserved all the praises bestowed upon it as a fire extinguisher. It will, therefore, not be amiss to direct attention to the very important circumstance that the conditions essential to the success of the method are occasionally wholly ignored, and, in cases of failure to act efficiently, the causes are generally not difficult to find.

The prime requisite of success is that the space in which the fire is burning should be inclosed so that free access of air is cut off, and steam under pressure and in ample quantity can be let into the apartment. It must be borne in mind that the efficiency of the steam in extinguishing fire is due simply to the fact that the vapor displaces the air and, with it, the supporter of combustion, atmospheric oxygen. If this circumstance were given due thought there would be less disappointment and fewer heavy losses where steam jets are depended upon for fire protection. A few years ago, we believe, reports of experience in Germany with the steam jet method recorded decidedly unsatisfactory results, and inquiries were frequent as to the exact conditions under which it was practiced in mills in this country where it was known to have rendered excellent service. The whole secret of success, however, if such it can be called, is in the correct application of the simple principle we have stated.

OPENING OF THE NEW CROTON AQUEDUCT.

The new Croton Aqueduct began to discharge water into the Central Park reservoir, New York, at some time between 5 and 6 o'clock Tuesday morning, July 15, at the rate of about 40,000,000 gallons per day, which was afterward largely increased. There was no formal ceremony attending the opening of the gates at the One Hundred and Thirty-fifth Street gate-house, though the operation virtually marked the completion of one of the great engineering works of the age. It was generally expected that Mayor Grant would open the gates in the Central Park gate-house at about 2 o'clock in the afternoon, but there was a misunderstanding somewhere. As a matter of fact the Central Park reservoir gates have been opened for the last few months, and when Mayor Grant arrived he found the water from the new source already rushing out of the pipes.

The Central Park reservoir holds 1,000,000,000 gallons of water. The dividing wall of masonry which separates the east basin from the west will be three feet under the surface when this capacity is reached. That partition has not been out of sight since 1877.

On Wednesday there was a break at Shaft No. 24, just above the Harlem River, allowing a daily escape of water of about 250,000 gallons. This, however, will not seriously interfere with the filling of the reservoirs. When this has been accomplished the flow of water will be shut off and the necessary repairs carried out. The place where the break occurred was known to be weak, and was in any event to have been strengthened before permanent use.

There appears no reason to doubt that the aqueduct will furnish the supply as had been expected from this time on. The progress of work on the aqueduct for the five years occupied by it, as well as its engineering and construction features, have been fully described in this journal.

NEW YORK DEPARTMENT OF PUBLIC WORKS.

The report of Commissioner Gilroy, of the Department of Public Works of New York City, for the quarter ending June 30, shows that during the three months the rainfall in the Croton and Bronx watersheds was 12.9 inches and that no stored water was drawn, and that the Croton Aqueduct furnished a steady supply of 95,000,000 and the Bronx River conduit one of 18,000,000 gallons of water per day. Water mains were laid in new streets 37,321 feet, and 64 stop cocks and 103 fire hydrants were put in. There were 705 new water meters placed, making 21,053 in use in all.

There were 106,367 square yards of new granite block pavement laid on up-town streets and in replacing old pavement, with 1,500 yards of trap blocks and 11,206 yards of asphalt pavement. Work is now in progress on 13 repaving contracts, covering 456,000 square yards.

There were 7,256 excavations made in the streets by individuals and private corporations for laying and repairing gas and steam mains and electric subways. The total expenditures of the Department for the quarter were $1,189,563.

OCEAN STEAMER LANDING AT LIVERPOOL.

A plan is proposed by Joseph Boult, C. E., to enable passengers on ocean steamers to disembark at Liverpool without the inconvenience of going ashore on tenders or waiting for the vessel to get into its dock. The proposal, as summarized by the London *Architect*, is to form a new harbor at the extreme north end of the Liverpool dock estate by projecting a breakwater from a point near the Seaforth Battery to a point about 300 yards from the Canada entrance. The greatest width of the harbor inclosed by the breakwater would be 400 yards, while the entrance at the south end would be 250 yards wide. Inside the breakwater Mr. Boult would moor a pontoon stage of sufficient length for four steamers, each 600 feet long, to lie alongside. On the top of the breakwater he proposes that a railway shall run in connection with the London and Northwestern, the Midland and the Lancashire and Yorkshire lines, which run down to the docks. With the help of floating shields he would provide comparatively smooth water, even in stormy weather; while, if necessary, the present depth of 25 feet at low-water spring tides might be increased at moderate expense. Thus steamships could disembark their passengers at any state of the tide, and the passengers could, by means of floating roadways, reach the trains awaiting them at the breakwater, and the vessels, having landed passengers and mails, would be in good position for being taken into the Langton, Alexander, or other north docks, which are just behind the proposed new harbor.

THE VYRNWY AQUEDUCT UNDER THE WEAVER.

According to the *Journal of Gas Lighting* one of the heaviest undertakings in main laying ever accomplished is the line of pipe aqueduct from the Vyrnwy to Liverpool. This is ultimately to comprise a triple line of 42-inch pipe, but only one line is actually being laid, except at the Weaver crossing, where all three have been laid at one operation to save future interference with the channel. The river is crossed by three 32-inch riveted steel pipes ⅝-inch thick; the flange joints being made with an india rubber ring and a washer of seven pound milled lead, secured with 1¼-inch compressed fluid steel bolts. At the point where the mains cross the channel is 100 feet wide and 15 feet deep, and the pipes had to be laid at a depth of 21 feet. Accordingly a trench was excavated, chiefly by grabs worked by steam cranes on barges, and the ends sheet-piled so as to receive the ends of the pipes in little docks. The three lines of piping, 108 feet long, were connected together with collars and plates; and, in addition, a rectangular cast-iron frame was fastened near to each end for a temporary purpose to be presently described. The trench being ready and the pipes floated into position over it, their ends covered by temporary blank flanges, and slung by chains over four winches, water was admitted in sufficient quantity to slowly sink them into their final place. The process of sinking only occupied 15 minutes. The pipes being thus laid, the next step was to drive sheet piling against the temporary cast-iron frames already mentioned, cover the pipes with concrete, and generally make good the river bed and bank. The sheet piling thus kept out the water of the river, and enabled the little docks in which the ends of the pipes lay to be pumped clear for making the shore connections.

The faculty of the new architectural department of the University of Pennsylvania will consist of William Pepper, M. D., LL. D., Provost, *ex-officio* President; Horace Jayne, M. D., Dean; Theophilus P. Chandler, Jr., architect, Director; Thomas W. Richards, A. M., Professor of Architecture, and Charles E. Dana, Professor of Art. The architects who will be regular lecturers are: Theophilus P. Chandler, Jr., Frank Furness, Wilson Eyre, Jr., Frank Miles Day, Joseph M. Wilson, Addison Hutton, John Stewardson, and J. Barr Ferree.

The American Society of Swedish Engineers has been incorporated under the general incorporation law of New York, with Henry Sellman and Gustave P. Wern, Brooklyn; Arvid Sandgren, New York, and Gustaf Leonard Backstrom and Carl Sundstrom, Philadelphia, as trustees.

It is reported that enough money has been subscribed toward building the Paris ship canal so that the Government will probably sanction the scheme.

The London County Council has abandoned the bill providing for improving the Strand. The action followed the rejection by the Parliamentary Committee of the "betterment," or special assessment feature of the measure.

OBITUARY.

James Keary, contractor and builder, died in Jersey City, N. J., July 13. He built several of the larger Catholic churches in the city.

William B. Fitch died at Kingston, N. Y., July 14, aged 67 years. He was one of the pioneers in the bluestone business, in which he was engaged nearly all his working life.

General Silas Seymour died in New York City, Wednesday, aged 73 years. He was born in Saratoga County, N. Y., and gave nearly his whole life to civil engineering. He was professionally connected with the Erie Railroad and built for it the Portage bridge over the Genessee River. He was elected State Engineer of New York in 1855, and while in office had charge of the work of enlarging the Erie Canal. During the Civil War he aided in organizing the military railroad service. Having helped General Sickles organize the Excelsior Brigade, he served for a time on his staff. After completing the Washington aqueduct and building a railroad bridge across the Potomac at Washington, he became in 1864 consulting engineer of the Union Pacific Railroad and served as such until the completion of the road in 1869. After having professional connection with other railways, in Canada as well as this country, he was again elected State Engineer of New York in 1881. He continued to practice his profession until his death and was connected with a long list of important engineering structures.

Brigadier-General Daniel T. Van Buren died suddenly Thursday at his home in Plainfield, N. J., in the 65th year of his age. He was born in Kingston, N. Y., and graduated at the West Point Military Academy in 1847. He served in the army until after the Mexican war, was professor of natural and experimental philosophy at West Point for a short time, and was assigned to duty on the coast survey in 1852, where he remained until 1855 when he resigned, studied law and was admitted to the bar in his native village, and also practiced as a civil engineer. He was Colonel of Engineers in the National Guard from 1858 to 1866. At the beginning of the war of the rebellion he became attached to the Engineer Corps, Twentieth New York, and afterward was chief of staff of Major-General Dix, successively commanding the Department of Pennsylvania, Division of the Army of the Potomac, Middle Department at Baltimore, Seventh Army Corps at Fortress Monroe, and Department of the East. From July 16, 1865, to February 9, 1866, he served as Assistant Adjutant-General on the staff of Major-General Hooker, commanding the Department of the East. March 13, 1865, he received the brevet of Brigadier-General of the United States Volunteers for faithful and meritorious services during the rebellion. He was mustered out of the service March 20, 1886, and for a time was a surveyor and engineer at Kingston. Since then he has lived at Plainfield. General Van Buren had for some time suffered from heart trouble, which had been rendered more serious by the death of his son about a year ago, and finally caused his death.

PERSONAL.

W. S. Bacot has been appointed County Engineer of Richmond County, N. J.

Julius Fix has been appointed Engineer and Superintendent of the Water-Works at Stoughton, Wis.

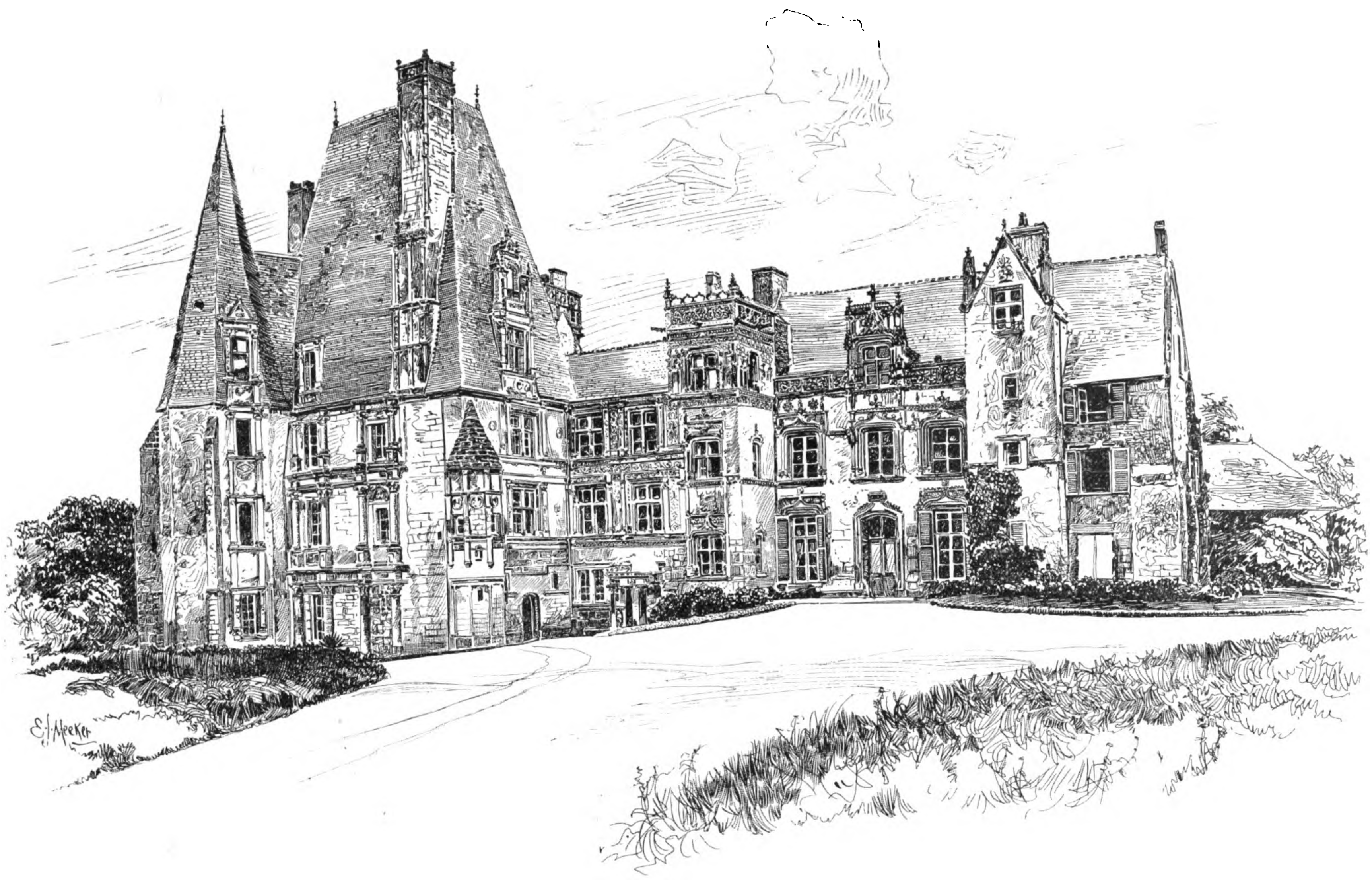
H. H. Cloud has resigned his position as Chief Engineer of the Pecos Valley Railroad.

K. Emil Hilgard, M. Am. Soc. C. E., of Cincinnati, O., leaves for Europe next month, to be absent six months.

OUR ARCHITECTURAL ILLUSTRATIONS.

CHATEAU DE FONTAINE HERSEY, NEAR BAYEUX, FRANCE.

CAREY ATHLETIC BUILDING, FOR HARVARD COLLEGE, CAMBRIDGE, MASS.
LONGFELLOW, ALDEN & HARLOW, ARCHITECTS, BOSTON, MASS.



THE ENGINEERING AND BUILDING RECORD ILLUSTRATED SERIES.

CHATEAU DE FONTAINE HERSEY, NEAR BAYEUX, FRANCE.

NEW YORK, VOLUME XXII.

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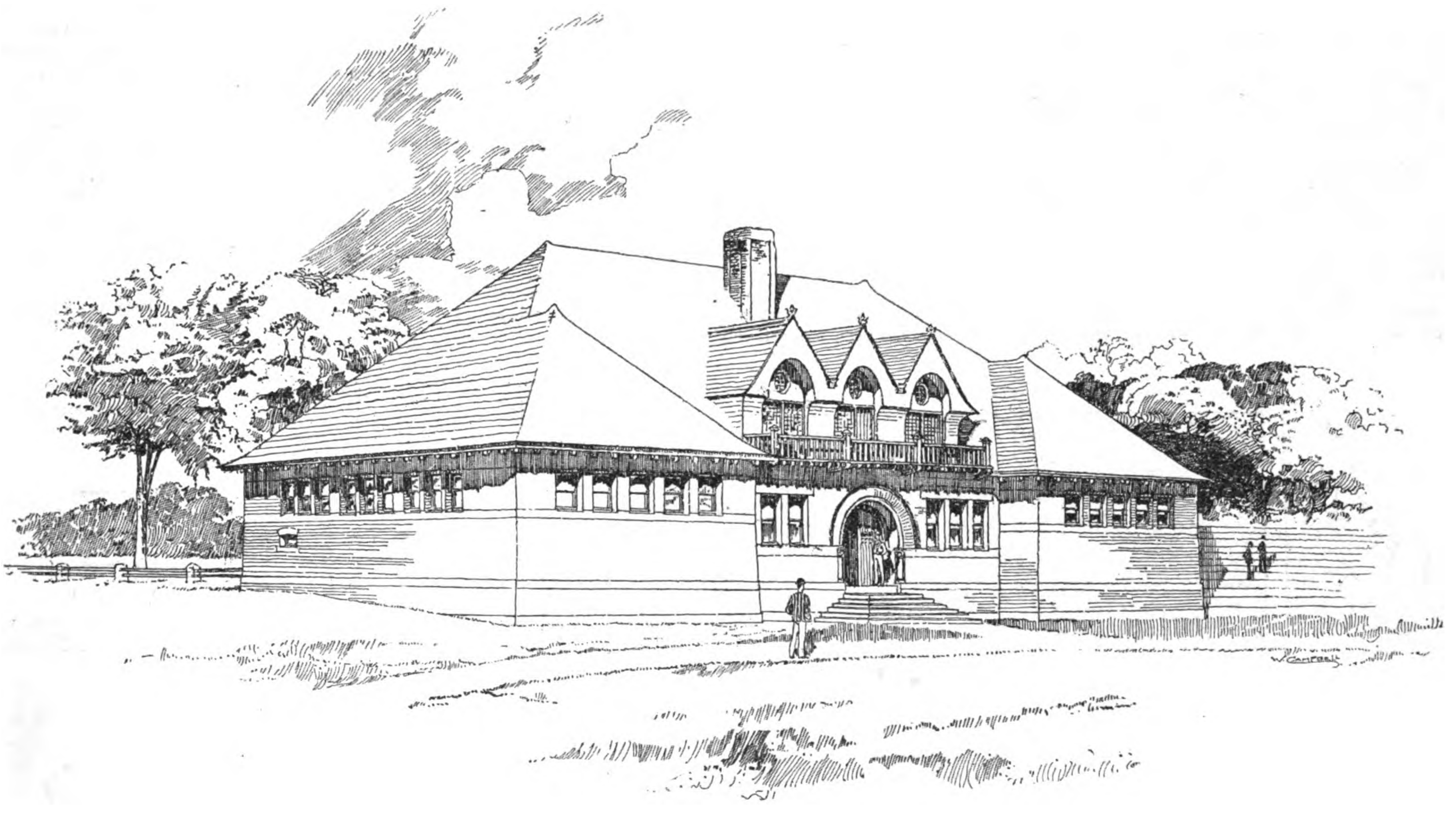
ENGINEERING SOCIETIES.

The Civil Engineers' Club of Cleveland held a meeting July 8, with President Searles in the chair, A. H. Porter Secretary, and 18 members and 3 visitors present. James Morris Wright was elected an active member.

Mr. Mordecai reported for the Committee on Affiliation of Engineering Societies that he had heard from Mr. Holloway, who had attended the meeting appointed in New York for conference, and that the attendance was very small and nothing was accomplished at that time.

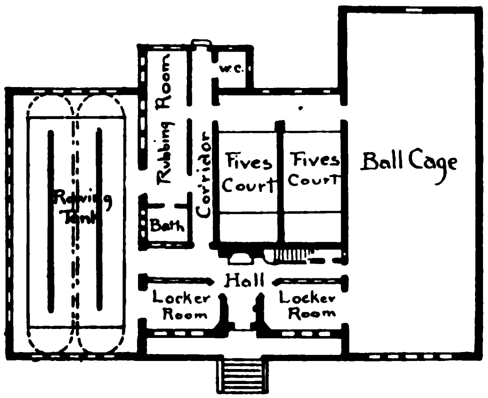
The president read a letter from C. Kirchhoff, Jr., Secretary of the American Reception Committee, stating that, owing to a change in the programme, the party of foreign iron masters and engineers will not visit Cleveland, although some individuals may be able to do so.

The amendments to the constitution of the Association of Engineering Societies, proposed by the Board of Managers and published in the December number of the *Journal*, were presented for consideration. The first and second amendments were separately discussed and finally adopted.



CAREY ATHLETIC BUILDING, FOR HARVARD COLLEGE, CAMBRIDGE, MASS.—LONGFELLOW, ALDEN & HARLOW, ARCHITECTS, BOSTON, MASS.

The paper of the evening, on "Methods of Wall Decoration," was read by C. O Arey. After noting the objections to oil colors and calcimining process he narrated his experience with other methods. The encaustic process as practiced by the ancient Greeks was found too expensive. The fresco practiced in the early renaissance was found satisfactory, with the exception that the work was liable to be injured or broken after completion by the finishing carpenters. He then tried many experiments to find a method similar to this fresco which could be applied on a dry wall, and this was accomplished by a chemical union of alum and lime, providing only mineral colors were used. This method allows one to apply on the wall a permanent finish unaffected by water, at a very moderate expense. The paper was discussed by Messrs. Barber, Hermann, Richardson, Porter and others.



First Floor Plan
Harvard Athletic Building
Cambridge, Mass.

LETTER FROM ENGLAND.

London, July 4, 1889.

The committee appointed by the London County Council to go into the question of water supply and the charges of the water companies in connection with the metropolis had a further meeting yesterday. Allen Stoneham, auditor of the metropolitan water companies and Assistant Secretary to the Board of Trade, pointed out that a meter system, if adopted in the city, would result in a very considerable curtailment of the rates of the New River Company, and that the adoption of such a system would work disadvantageously in the poorer neighborhoods. The opinion of this witness is unquestionably worth serious consideration. It is evident that a landlord who is of the sweater persuasion will immediately bring pressure to bear upon his tenants should the meter system be adopted with a view to reducing the consumption, thereby prejudicing the cause of sanitation and cleanliness.

The proceedings in the inauguration of public baths at Newport, Monmouth, by the municipal authorities were certainly uncommon. The occasion was a public ceremony when the Mayor and corporation, in robes of office, attended and made speeches to a mixed audience of ladies and gentlemen. No sooner, however, had the Mayor made his speech than he, without waiting to listen to replies, and accompanied in a surreptitious manner by the members of his corporation, disappeared, only to return in the course of a few minutes lightly attired in a costume which was suggestive of the Turkish bath. When the speeches had been concluded, to the astonishment of the audience, his worship, the Mayor, took a dive into the baths, being followed by the members of the corporation, as also by the constables on duty, the latter not having the opportunity of divesting themselves of tunics, helmets, or clothing generally. The scene must have been a very funny one, and the Mayor of Newport is to be congratulated on making a spectacle that is probably unequalled.

The urban sanitary authority at Sutton, Surrey, has just put in hand new drainage works similar to those carried out at Norwood some time since under the direction of the same engineer, John Anstie, of Westminster. The cost of the scheme, inclusive of sewering for private roads, is estimated at £30,000 ($1,240,000); the present population to be provided for 20,000 to 25,000. The system is a separate one, and the sewage is received at the outfall in tanks where it is precipitated by the International Company's system, the effluent filtered through Polarite filters and the sludge treated by filter presses. The effluent from the filters thence finds its way over about 20 acres of ground to the Pyl Brook. The gradients obtainable are very favorable owing to the natural fall in the roads.

In connection with the post office jubilee celebration, just held at Kensington, a new instrument with the by no means euphonious title of "electro-phonoscope" was exhibited. The feature of this instrument is a telephone with receivers and reflectors whereby a speaker can see the representation of the individual with whom he is communicating. A cone disk situated in the room is strongly illuminatud with incandescent lamps, and it is on this disk that the representation of the correspondent is seen. Professor Hughes, W. H. Preece, Mr. Stroh, and Martin Roberts, are the inventors and adaptors of this system.

As a memorial of his son, Henry O. Avery, the young architect who died in New York April 30, S. P. Avery will give the Avery Architectural Library to Columbia College. This will include the books collected by Henry O. Avery relating to architecture, archæology and the decorative arts, about 200 in number, and $30,000 in money, one-half to buy more books and the other as a fund to provide for rebinding, etc. The books are to be used for reference only.

Correspondence.

Communications giving information or opinions on matters of general interest to the engineer, the architect, the contractor, or the municipal officer, will be welcomed in this column. Fairness will suggest that when communications are sent simultaneously to this and other journals we should be informed of it at the time. Anonymous letters will not be noticed.

THE PROPOSED WATER-WORKS CRIB IN CHICAGO.

New York, July 12, 1890.

To the Editor of The Engineering and Building Record:

Sir: In reference to the letter of "B. W. H.," in your issue of to-day concerning the proposed water-works crib for Chicago, I send you herewith drawings and description of the lake crib used by the Toronto water-works, thinking that as an example of a submerged water intake they may be of interest. For the purpose of making a comparison I also inclose drawings and description of the lake crib in use at Cleveland.

The Toronto crib is built of white pine, is 40 feet square, 11 feet high, and is divided by inner walls into eight compartments for stone, and a center well in which the 6 foot wooden conduit B terminates. The outer and inner walls are of 12-inch by 12-inch timbers and laid with 3-inch spaces between each course. A bottom course of six 12-inch by 12-inch mudsills was laid, and upon this a close flooring of 6 inches thickness was put down. The timbers are all 40 feet long, no splicing being allowed. The water enters the center well from the top at a distance of 11 feet above the bottom and about 15 feet below the surface of the lake. The well is 9 feet 9 inches square, is protected at the top by an oak grating A, and the sides and bottom are lined with 1¼-inch tongued and grooved sheeting, carefully calked, while the outer sides next to the stone filling are closely boarded with 2-inch plank, all fastened with ⅜-inch by 6-inch wrought-iron spikes. The grating is made of strips of oak 2 inches thick and 4 inches deep, laid on edge, with 3-inch spaces between each, blocked at the ends and all fastened together with iron rods and spiked to the crib. A piece of 6-foot pipe, about 19 feet long and fitted with flanged castings at each end, is built into the north side of the crib, projecting 3 feet beyond its outer face. The courses are secured to one another by rock elm tree-nails at the angles and where the timbers intersect, and 36 bolts of 1¼-inch diameter are carried up from the bottom to the top of the crib.

This crib is free from danger of damage by storms or fire and of obstruction by ice and drift. It is not an impediment to navigation and its durability is practically unlimited. It was built in 1882 and has since been in constant, satisfactory use.

Its cost was $1,500. The water being admitted at a point above the bottom and below the surface is alike free from floating scum, drift, etc., on the surface, and from sediment or other matter sometimes found at the bottom.

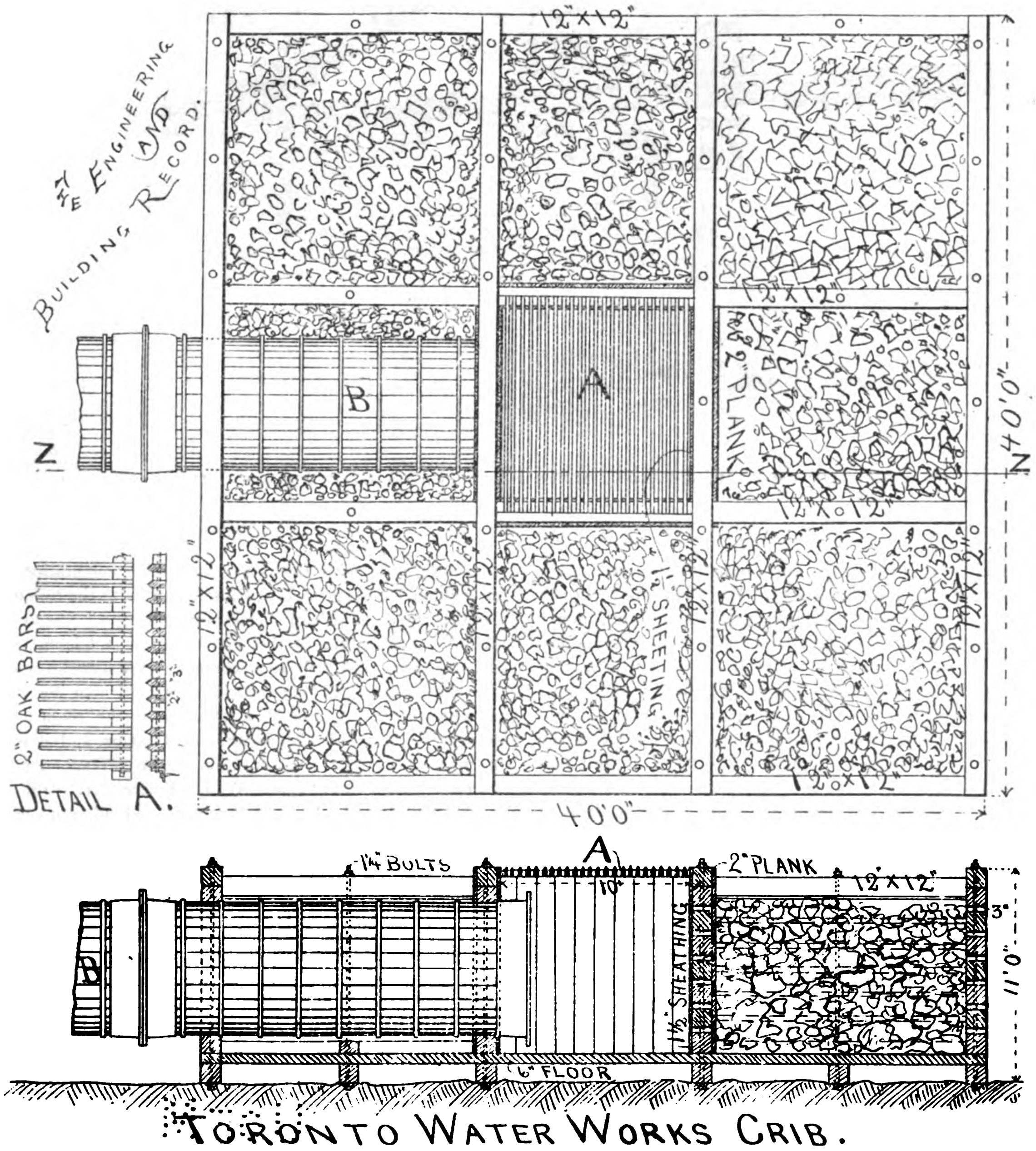
The Cleveland crib, built in 1874, at a cost of about $109,700, has a total height of 61 feet, and is pentagonal in form, each outer side measuring 54 feet. The crib is of ordinary construction, ballasted, faced with 2-inch oak plank, decked over and surmounted by a lightkeeper's dwelling and a lighthouse, 50 feet above the water. The deck is protected by a heavy wall and roof. C and D are wells to the existing and a proposed tunnel, A A A are gate wells, and O O are inlet ports. At E a section of sheeting is removed to show the crib construction. About 400 cords of stone (not shown on the drawing) are piled against the outside of the crib. A concrete mass extending to a depth of 5 feet below low water was provided for the purpose of forming a foundation for a permanent structure. to be built whenever the present one becomes unsafe from decay of the timber.

Yours respectfully,

T. J. McMinn.

Samuel Spencer, C. W. Buckholz, and G. W. Plympton, the engineering board appointed in the matter of the Brooklyn Bridge terminals, had a meeting Tuesday and organized by electing Mr. Spencer President, and Mr. Buckholz, Secretary. After a general discussion of the subject before them a resolution was adopted to the effect that they would proceed to examine such plans as had been proposed, and others that might be presented before September 1, and would give notice of hearing to all parties interested. It is announced that plans will soon be advertised for.

Paris has in the last few weeks suffered considerably from scarcity of water, and manufacturing in some sections has been seriously interfered with.



TORONTO WATER WORKS CRIB.

Questions and Answers.

All questions relating to building construction, paving, sewerage, water supply, or kindred subjects, will be welcomed in this column provided they relate to matters of general interest and are not such as should properly be referred to a consulting engineer. Answers will be carefully prepared and a proof of both question and answer mailed to the inquirer as early as proper consideration will permit. They will be published for the benefit of other readers as soon as convenient. The full name and address should be given, not necessarily for publication, but as a guarantee of good faith, and to facilitate further correspondence in case the question is not sufficiently explicit.

Inquiries of the Editor, in order to secure prompt attention, should *not be written on the same piece of paper as a communication* to the *Publishing Department.* Letters renewing subscriptions are sent to a clerk in the publishing office, and matter for the Editor, if in the same enclosure, is likely to be overlooked unless it is on a separate piece of paper, so that it may be promptly sent to the Editor.

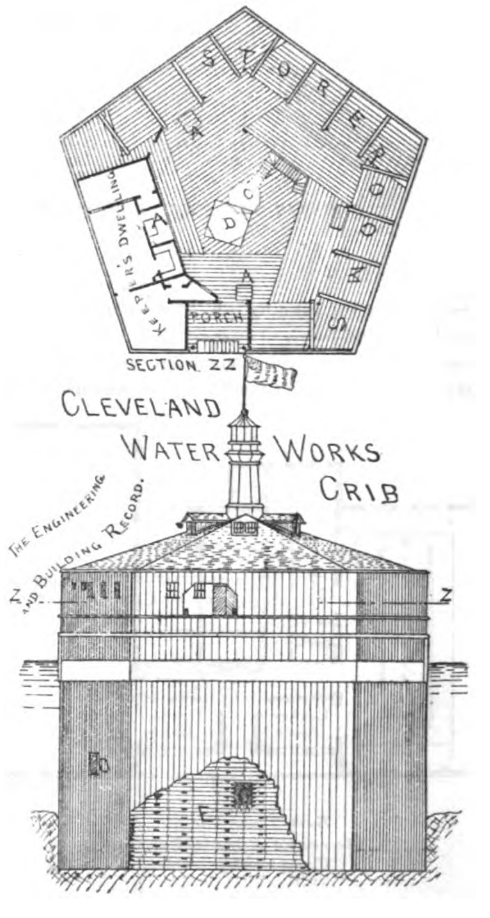
WIND VELOCITIES AND PRESSURES.

W. J. Fields New York, writes: "Can you refer me to any published table of, or data on, wind pressures for different velocities?"

[In an interesting article on the stability of chimneys, published in *The Locomotive* several years ago, is a convenient table of wind velocities and pressures, which is appended. It is proper to remark here that the relation between the velocity of the wind and its pressure against flat or curved surfaces opposed to it, is not very well understood. Proper experiments to exactly determine it have never been made. The pressure is generally supposed to increase as the square of the velocity when the opposing surface is at right angles to the direction of the wind. In such cases Smeaton's rule is to divide the square of the velocity in miles per hour, by 200; the quotient will be the pressure in pounds per square foot.

Table of Wind Velocities and Pressures.

Velocity in miles per hour.	Velocity in feet per second.	Pressure in lbs. per square foot.	Remarks.—Character of wind, etc.
1	1.467	.005	Hardly perceptible
2	2 933	.02	Pleasant
3	4.400	.045	
4	5.867	.08	
5	7.33	.125	
10	14.67	.5	
12½	18.33	.781	Fresh breeze.
15	22.	1.125	
20	29.33	2	
25	36.67	3.125	Brisk wind.
30	44.	4.5	Strong wind.
40	58.67	8	High wind.
50	73.33	12.5	Storm.
60	88.	18.	Violent storm.
80	117.8	32.	Hurricane.
100	146.7	50.	Violent hurricane, uprooting large trees.


STOREROOMS
KEEPER'S DWELLING
PORCH
C
D
A
SECTION ZZ
CLEVELAND WATER WORKS CRIB
THE ENGINEERING AND BUILDING RECORD.
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NEW DISINFECTING APPARATUS OF THE LOUISIANA QUARANTINE STATION.

The fundamental principle of the new disinfecting apparatus of the Louisiana Quarantine Station, as described in the recently issued report of the Louisiana State Board of Health for 1888 and 1889, differs from the old one in the certain and uniform application of dry and moist heat to articles capable of carrying the germs of infection. The heating chamber in use during the years 1886, 1887 and 1888, was so constructed as to secure the heating of surfaces only of articles to be disinfected, and even this superficial heat could be applied but irregularly. The construction of the new plant was undertaken with a view to correct these dangerous weak points.

Chambers capable of generating heat under pressure, and steam tight, would secure uniformity of temperature throughout their contents, and penetration of heat into the substance of articles sought to be disinfected, each, essential requirements for absolute success. The form of apparatus possessing these requisite properties was the subject of much study and experimentation.

The plant now consists of three cylindrical steel chambers, and appurtenances necessary. Each cylinder, 50 feet long and 8 feet in diameter, is constructed of best quality $\frac{5}{16}$-inch steel, and is guaranteed to withstand a working pressure of 15 pounds to the square inch. The ends are spherical, and that facing the river, or front end, is movable, swinging open by means of a crane, when closed being secured and tightly shut by means of quickly operated screw bolts. The three cylinders rest upon saddles, are six feet apart, and are parallel with each other. For economy in steam, and for maintaining for some time the highest degree of heat attained within, they are covered exteriorly with 1¼ inches of Russian hair felt, a layer of paper, and an outer envelope of canvas, the latter well painted. At a point 50 feet in front of each cylinder commences a double, iron, elevated track which, by a movable section, continues into and throughout the length of each cylinder, being suspended from the top. On this track rolls a truck 48 feet in length, and from this truck are suspended 30 clothes racks of 5 bars each. Above the racks is a continuous canvas cover to prevent the dripping of condensed water upon clothing placed on the racks, and beneath is a wire netting to catch any falling article. The interior of each cylinder contains an arrangement for the employment of moist and dry heat, separately and together. Along the bottom are laid 10 sections of a cast-iron box, each section 5 feet in length, about 6 inches wide and 7 inches high. Through flanged ends these sections are bolted firmly together, end to end, making one continuous box, or as it is technically termed, a manifold. This manifold is divided by a horizontal partition into two compartments. On each side of the upper compartment are 120 circular openings, each 1½ inches in diameter, and distant from centers 5 inches. Into each of these openings on one side of the manifold is screwed, by means of a collar and nut, one end of a steam pipe, 24 feet long, bent circularly around the inner periphery of the cylinder, the distal end being brought over and screwed into the opposite opening, thus forming an interrupted coil of 120 pipes. Through this upper compartment dry steam enters from the boiler into the heating coil, the lower compartment of the manifield receiving the condensed water, which eventually passes out through exhaust pipes. This arrangement furnishes dry heat in the cylinder. Moist heat is admitted through a perforated steam pipe lying along the bottom of the cylinder and communicating with the steam boiler. The cylinders are provided with thermometers at each end, pressure gauges, drain-cocks and blow-off valves, the latter being set at 7 pounds pressure. The necessary heat is supplied by a 40 horse-power steam boiler, at 85 to 100 pounds pressure. The whole apparatus is covered by a shed 108 feet long and 60 feet wide, exclusive of boiler and engine-room. This shed immediately adjoins the steamship wharf, 108 feet long and 48 feet wide, at the outer edge of which there is 24 feet depth of water, and 10 feet beyond this there is 30 feet depth, permitting the landing thereat of the largest vessels. This wharf has recently been lengthened 288 feet by 24 feet wide for the purpose of placing a fumigating apparatus on a car, to be rolled to point of most convenient use.

Surmounting the shed is a cypress cistern, the bottom of which is 41 feet above the river surface, capable of holding 7,000 gallons of fluid. In this cistern is stored a solution of mercuric chloride, one part to 1,000 of water by weight. Pipes lead from the cistern to the outer edge of the wharf, and at that point have rubber hose attachments of sufficient length to lead to all parts of a very large vessel. The hoses terminate in hard rubber roses, of 6 inches face.

The fumigating apparatus, heretofore on a tug, but now proposed to be erected on rail cars on the wharf, consists of a reverberatory sulphur furnace, with 250 feet galvanized iron conductors, 12 inches in diameter, and a steam fan. The furnace, 24 inches wide, 48 high and 40 deep, is provided with four cast-iron pans, 30 inches long, 23 wide and 4 deep, each pan having over 1½ cubic feet capacity, or about 175 pounds sulphur. The pans are set on split brick, and are so placed that the current of air driven by the fan into the bottom passes over each pan of burning sulphur alternately, out through the top and along the conductors down into the holds of vessels.

The process of disinfection of vessels consists in placing all baggage, bedding, curtains, carpets, linen, etc., in fact all textile fabrics of vessel, crew, and passengers on the suspended clothes racks, which are then drawn into the cylinders by a windlass, and applying dry heat until the thermometers mark 185° Fahr., at which point moist heat is turned on, the temperature rapidly rises to 215 or 220, and the gauges usually record a pressure of seven pounds to the square inch, at which point the blow-off valves open, preventing any danger of explosion. The contents of the chamber are kept at this temperature and pressure for 30 minutes, the cylinders are then opened, and the goods turned over to their owners. The vessel in the meantime is washed down—cabins, forecastles, decks and holds—with the mercuric chloride solution, and fumigated by means of the furnace and fan. In the case of loaded vessels, washing the interior is omitted on account of danger to cargo. The holds are, however, thoroughly fumigated, and by a special arrangement of "cargo wells," the gas penetrates every interspace of cargo. These wells are constructed at port of departure, and consist of a long wooden box about 2 feet across, and reach from the bottom to the top of holds, the cargo being stowed around them at loading point. The conductor from the sulphur furnace is led into the well, the hatches are tightly closed, and, under pressure, the fumes of sulphur are driven into the vessel, the gas passing around every package envelope no matter how tightly packed, and chemical examination showed that in the case of sugar bags it penetrated to the depth of three fourths of an inch. The character of cargoes arriving at the station from infected ports is almost exclusively coffee and sugar, the former always, and the latter nearly always, in bags, neither offering obstacles to good and sufficient fumigation *in situ*.

A STEAMBOAT JOURNEY OVERLAND.

Under the title of "Struggles in Africa," John Thorburn has described, in an interesting little pamphlet, the successful transportation overland of a small steamboat from near Potchestroom to Delagoa Bay on the east coast of Africa.

The little vessel was of steel, 37 feet long and 8 feet 6 inches beam, drawing 22 inches of water, with twin screw propellers of 6 horse-power. Mr. Thorburn had ordered her of Edwards & Symes, of London, to navigate the Upper Vaal River above Kimberly, but after spending three years' time and £4,000 in endeavoring to clear the river of obstructions and having three times transported his boat overland between Kimberly and Potchestroom, a distance of 200 miles, he gave up the attempt to navigate the Vaal and concluded to take the vessel across country to Delagoa Bay, a distance of 600 miles. He started with five men besides himself and son, with the boat on a large wagon and a smaller tent wagon containing the boat's engines and tools and provisions, etc., all drawn by 32 oxen, and reached his destination in fourteen months with a loss of 22 oxen and three men, of whom two deserted and one committed suicide. He passed through fire and water, through swamps where the wagons sank to the axles and had to be laboriously pried out and jacked along inch by inch, over two mountain ranges, one of them 7,000 feet high, where his large wagon was capsized and all the woodwork of the boat smashed, besides having one side stove in and a seam ripped open for six feet in length. He made mallets and pounded his boat into shape again and riveted the ruptured seam and finally, after building several bridges and making several miles of road, he had the satisfaction of seeing the "Tembe," for that was her name, safely afloat on salt water. In all this he faithfully kept the Sabbath, and seemed much more disturbed by the sufferings of his oxen and the blisters on his son's hands than by any of the difficulties he encountered.

In fact, he seems to have rather enjoyed difficulties, for when he had finally accomplished his purpose, and "was making lots of money" with his little steamer in Delagoa Bay, his prosperity became unendurably monotonous and he sold out and started for the gold fields. It was, by the way, the report of these gold fields, which were to "surprise the world," which first led him to think of taking his steamboat to the east coast, and, curiously enough, his own farm in the Transvaal, which he sold on leaving for £1,500, proved to be one of the richest districts, and was resold a year later for £32,000.

In his brief preface Mr. Thorburn modestly ascribes his success to the fact "that when an Englishman undertakes an enterprise, however difficult, he never retreats nor leaves it until he has accomplished his object." While this statement may seem a little strong, we are not disposed to quarrel with it, as it serves to explain the other fact that Englishmen are excellent raw material out of which, in a generation or two, very good Americans can be made.

EXPERIMENTS ON THE WIRE ROPE OF THE SUPERGA RAILWAY.*

In wire rope traction the rope itself is naturally the most delicate and most important part, requiring to possess the minimum of weight, great strength, ductility, hardness, flexibility and homogeneity, a high limit of elasticity, and perfect manufacture. The line up to the Superga, at Turin, is worked by a rope composed of six plies of eight steel wires each, or 48 wires in all. The diameter of each wire is 0.078 inch, of each ply 0.315 inch, and of the whole rope 0.985 inch, the weight being one pound per lineal foot. The subjoined tables show the results of some tests of a 6 feet 6 inches length cut from this rope.

I.—*Breaking-Weight of the Single Wires of One Ply.*

Wire Number.	Total Load.	Equivalent Load Reduced to Tons per Sq. In.	Notes.
	lbs.		
1	1,032	94.90	Broke at 4.3 in. from top.
2	1,014	93 22	" 17.8 " bottom.
3	1,058	97.15	" bottom.
4	1,023	94.04	" 25.6 in. from bottom.
5	1,000	91.88	" 20 5 " top.
6	908	83.48	" 18.0 " bottom.
7	1,046	96.14	" 12.0 " "
8	1,060	97.41	" 4.0 " top.

Wire No. 6 appears to have been in some way injured. Taking this, however, as the average, the total breaking weight of the rope (net sectional area — 0.225 square inch) would be 19.3 tons.

II.—*Breaking Weight of Remaining Five Plies.*

	Total Load.	Equivalent Load Reduced to Tons per Square Inch.
	lbs.	
Ply No. 2	7,931	91 08
" 3	8,076	92.77
" 4	8,527	97.02
" 5	8,296	95.31
" 6	8,807	101.15

III.—*Elongation of One Wire under Increasing Loads.*
(Reduced to initial length = 1,000)

Load in Pounds.	Elongation.		
	Temporary.	Permanent.	Total.
220	1.55	....	1.55
264	1.80	...	1.86
308	2.18	0.01	2.19
352	2.49	0.02	2.51
396	2.83	0.04	2.87
440	3.13	0 09	3 22
528	3.83	0.16	3.99
616	4.52	0 40	4.92
704	5 25	0 75	6.00
792	5.95	1 25	7.20
880	6.59	2 01	8.60
908	7.38	3.65	11.03
1,003		Breaking point.	

According to the London *Builder* the famous old tower on the Town Hall buildings, Moscow, Russia, will have to be pulled down as quickly as possible, as the foundations have suddenly shown signs of giving way. Nothing has yet been settled as to the re-erection of the tower.

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* A paper by A. Galassini in *Il Politecnico*, abstracted in Excerpt Minutes of Proceedings of the Institution of Civil Engineers.

A PIER SHED AND PAVILION.

THE high value of land in New York City gives rise to many expedients for utilizing space that would elsewhere be left unoccupied, which are illustrated by the recent construction of a freight shed on Pier 26, East River, which was built one story high with a nearly flat roof designed to form the floor of a pavilion to afford a pleasant river resort.

Figure 1 is a part plan of the roof trusses, which have lateral bracing, as shown, about every sixth panel. These panels have also vertical sway bracing A A in the walls.

Figure 2 is a partial side elevation showing the wall framing.

Figure 3 is an end elevation showing, at the right, the framing at the shore end, and at the left, that at the river end of the pier.

Figure 4 is a half elevation of an intermediate roof truss and column.

The building has a plank roof and corrugated iron sheathing.

This shed and pavilion was built by the Pencoyd Bridge and Construction Company, of Pencoyd, Pa., for the contractors, R. P. & J. H. Staats, New York City.

COMPARATIVE TESTS OF AN ELECTRIC MOTOR AND A STEAM LOCOMOTIVE.*

IN February, 1889, Lincoln Moss, C. E., was detailed from the Chief Engineer's Department of the Manhattan (Elevated) Railway in New York City, by the General Manager, Col. F. K. Hain, to conduct tests to determine the efficiency of an experimental "direct" electric system of motive power as compared with the present steam locomotive performance.

The section of road chosen for the experiment was 1.76 miles long, from Twelfth to Fifty-first Street on the Ninth Avenue line. This section is on the oldest and lightest of the four lines operated by the Manhattan Railway Company; the traffic is comparatively light, as is also the rolling stock; the cars weigh 12 tons each, empty, and the locomotives 16 to 19 tons, in working order. The track was in good condition, but was not up to the present standard, as the replacing of the old 50-pound rails and 5-inch ties with the standard 90-pound rails and 6 by 8-inch ties would have interfered with the electrical conductors.

The trial trains were made up of empty cars of the new standard type, which weigh 29,500 pounds each, empty; at first two were pulled, then three, and finally four; these four empty cars weighed a trifle less than the four-car trains, loaded, which are run on this line in regular service.

After the experiments with the electric system were concluded, a steam locomotive was detailed from regular service to pull the same train over the same section and under the same conditions, as far as possible, to determine the relative efficiency.

There were four generating dynamos, nominally 50 horse-power each; they could be worked in parallel or in series by means of a switch.

The current was conveyed from the dynamos to the railway structure conductors by two insulated copper cables strung on poles; at the structure the cables were divided to connect with the three positive conductors on the east, center and west tracks.

The positive conductors were of very fine copper, ⅝-inch round rods, bolted to the wooden guard timbers by insulated clamps.

The negative conductors were made up of the east line rails of each track; they were connected by ordinary angle splice bars and bolts, and also were connected electrically by copper wires at each joint, riveted in the flanges.

The positive conductors of the east and west tracks were cross connected at intervals of about 200 feet.

The circuit was closed through the motor on the track by a device which had copper leaved brushes which slid over the positive conductors, and the current after passing through the motor dynamo and its connections was returned through the driving wheels into the rails, passing thence back to the generating dynamos. Another copper brush was provided on the opposite side of the motor to bridge gaps in the positive conductors on the switches

The four driving wheels of the motor were 48 inches diameter, 6 feet between centers, and coupled to obtain the maximum tractive force; on the rear axle were two carefully cut steel gears, driven by two steel pinions keyed on the shaft of the dynamo; on this shaft were the armature and commutator revolving between the field magnets; the brushes were movable and could be reversed to change the direction of rotation, but not when under headway. The exact weight of the motor was unknown; it was known to be 10 tons, and probably weighed more. The motor dynamo was said to possess 120 horse-power.

The train consisted of four empty cars, weighing 29,500 pounds each, as before described. This train weighed somewhat less than a fairly loaded four-car train, such as is run on this line during the busy hours of the day, and the test was an attempt to imitate the run of such a train, stopping at all the stations on the way. In the absence of any other brake aside from the motor brake, all the car brakes were manned to make the stops quickly.

The average power generated was 176.8 horse-power, while the amount recovered on the track was 26.7, making the average efficiency .151 and the average loss $84\frac{9}{10}$ per cent.

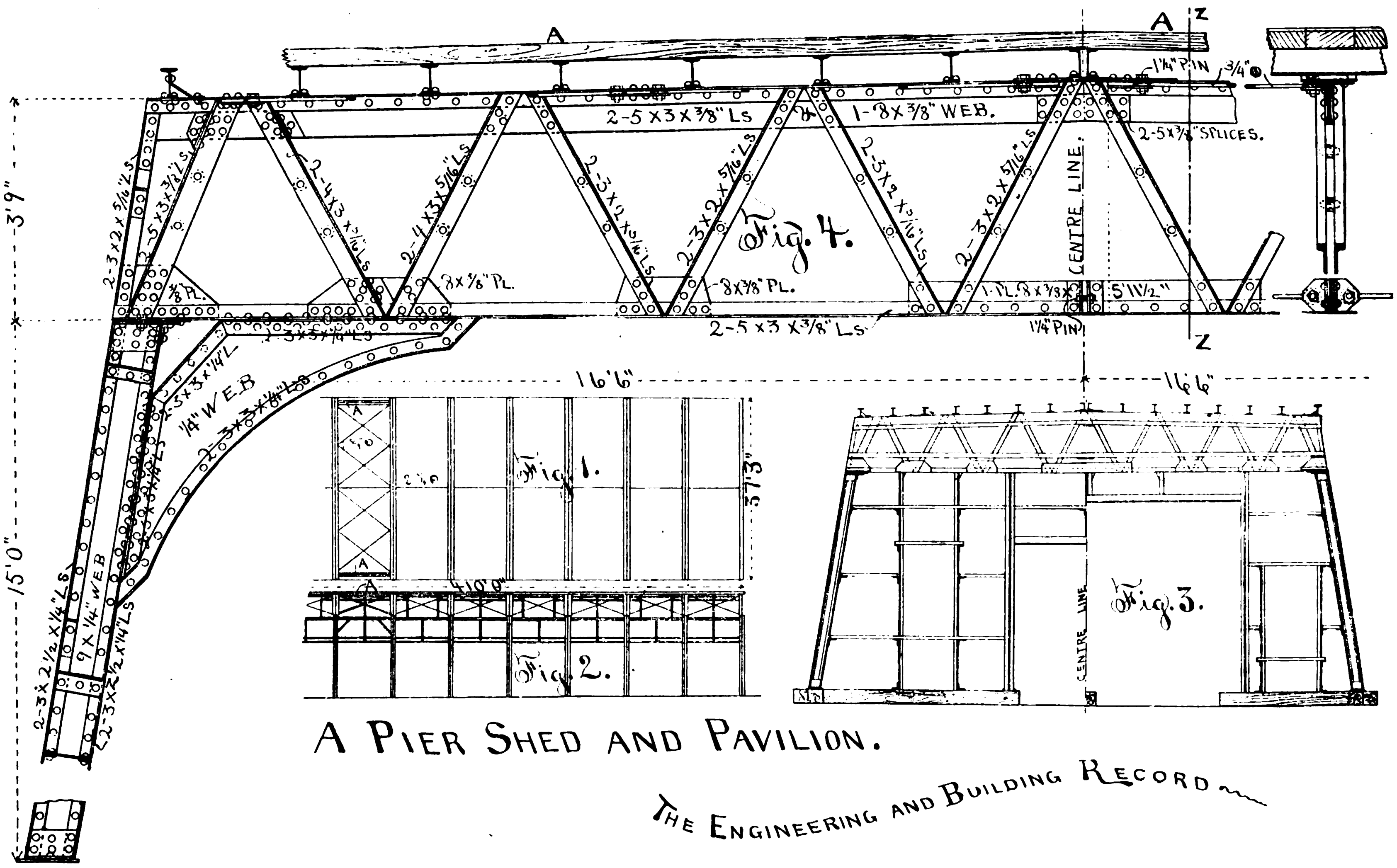
The net horse-power was calculated by formula.

$$\frac{\text{Pull of Motor in lbs. by Velocity of Train, Feet per min.}}{33{,}000} = \text{Net Horse-power.}$$

The power expended by the prime mover never went back to zero, even when the train and motor were standing at a station, at which time there was a constant average expenditure of 43 horse-power. Of this about two horse-power is lost in the engine itself, and the rest is consumed in friction, local currents, current waste, resistance and leakage. This shows nearly 24 per cent. of the total average expenditure.

The greatest power of the engine was exerted when the train was being started. For this reason it was claimed at one time that better running time could be made with electric motors than with steam locomotives, which exert the least horse-power in starting, although the steam is admitted to the cylinders at nearly full stroke. The fallacy of this belief becomes apparent by referring to some of the diagrams accompanying the paper. The net horse-power actually exerted upon the train is least when the train is being started. the dynamometer shows a low initial pull, with a characteristic falling back, and the speed line invariably shows a hollow curve of acceleration in place of the full curve which would indicate a rapid acceleration of speed, and a correspondingly great exertion of power against the resistance of the train. From a consideration of these facts, we may inquire, where was the great loss in starting, notably at Thirtieth Street station, where the driving engine indicated 395 horse-power, while at the same time, but 7 6 horse-power was being exerted to pull the train, showing less than 2 per cent. of the power of the engine transmitted to the train at that instant? The chief losses are due to several facts in the operation of electric motors.

First.—The general economy and efficiency are greatest when a certain ratio of speed exists between the generator and the motor armatures. Usually this ratio is as 2:1, the motor armature revolving but half as rapidly as the generator's armature. This is principally due to the necessity of keeping the counter electro-motive force, or the current set up by the motor itself from being driven, at a certain intensity. Of course, as the motor is simply a dynamo reversed in direction, any revolution given to its armature, whether by a current from another dynamo or by power applied to it by a belt, will generate a new or counter current, opposed to the original driving power. When the motor is just beginning to move, this counter current is small and increases as the armature revolves faster. The effect of the increase of this counter electromotive force is to diminish both the volts and the amperes, as well as the current waste, which is greatest when the motor armature is just beginning to move. The counter current could be increased till it equaled the driving force. The golden mean can only be obtained in a



A PIER SHED AND PAVILION.

THE ENGINEERING AND BUILDING RECORD

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* From a paper by Lincoln Moss, read at the Cresson, Pa., meeting of the American Society of Civil Engineers.

motor running at a fixed speed, with relation to the generator.

Second.—The economy is greatest, other things being equal, when the load is lightest.

Third.—When a motor is being started, there is no counter current, and it is necessary to increase the resistance by rheostats, shunts, or resistance coils, or by varying the strength of the field, and these methods increase the current waste in accordance with Joule's law of current waste ($C^2 \times R =$ current waste) "C" being the current in amperes, and "R" being the resistance in ohms. In a system where a stationary motor is to be driven at a constant speed under an unchanging load, it is possible to adjust the various relations of size, speed, counter electro-motive force, etc., so as to reclaim a very good proportion of the force generated in the prime mover. As much as 60 or 70 per cent. has been claimed in such instances, but in an electric locomotive, the conditions are the very worst for economical results, by reason of the everchanging speeds and loads, and the complication of conditions; and the heavier the load to be handled and the greater the speed demanded, the more difficult and complicated the problem becomes. The most safe and reliable method of regulation is doubtless the rheostat or resistance coil. Some have used shifting commutator brushes; others have used shunts to vary the strength of the magnetic field, and in the case before us various devices were used experimentally, and the best and most reliable only were adopted.

Devices that would answer for a 10 horse-power electric street car at ordinary speeds would not answer the purpose on a 120 horse-power motor handling far greater loads with much larger variation in speeds. One effect of introducing a resistance into the circuit is to increase the horse-power, the formula for which is:

$$\frac{E \times C}{746} = \frac{\text{volts} \times \text{ampères}}{746} = \text{horse-power.}$$

The volts measuring the pressure, and the ampères the current, the current being supplied by the generators at nearly constant pressure or voltage, it becomes necessary to increase the power in starting, either by increasing E or C. It is also necessary to use a resistance to prevent burning out of the commutators and connections. At the instant of starting, much current is being used, a great deal of heat is developed by current waste and resistance, and as the counter current is practically 0, it is imperative, both for economy and safety, to increase the power by increasing the pressure (E) instead of the current (C), which is done according to Ohm's law, by introducing a resistance into the circuit.

The action of an electric motor bears some resemblance to that of a steam locomotive. In the latter, in starting, the distribution of the steam is the most wasteful, and the average pressure on the pistons is the greatest, when "notched up" so as to expand the steam more economically, the economy is very much improved, and the average pressure falls comparatively low, but, although low, it is applied so much more rapidly that a greater horse-power is developed. So in an electric locomotive, the electrical pressure is greatest when starting, because of the "resistance" introduced, and the current used is greatest, owing to the absence of counter electro-motive force; but as the speed increases and the resistance is cut out and the counter current increases, the electrical pressure becomes less, and also the current used, for it is evident that if the speed of the motor was increased enough the new or counter current generated by the driven motor acting as a generator would equal the current derived from the generating dynamo, and no work would be done by the motor; so that when the motor is working rapidly, and the impulses are of low pressure and quantity, the efficiency is the greatest, although it seems like a strange kind of efficiency which depends upon the development of an opposing force.

Of course the heavier the load, or the steeper the grade to ascend, the greater is the "resistance" required in order to increase the horse-power, and as the speed of ascent on a grade is below the normal, the counter current is small and the current waste is greater, as more current is used, so that we might expect to find at Thirtieth Street, which is at the foot of the $1\frac{86}{100}$ per cent. grade, the greatest waste of power and the least efficiency. On this occasion the rear end of the train was on the down grade. When the current was switched into the dynamo to start the train, the resistance was immediately felt at the power station, the dynamos and driving engine slackened their speed about 10 per cent.

At first, in these experiments a current of low potential was used, but as the loads were increased and the usual stops and starts made with the load, it became necessary to increase the power. This was done by increasing the speed of the engine from 80 to 100 revolutions per minute, the effect of which was to increase the potential by revolving the dynamo armatures faster. While the current used was not deadly, it was strong enough to knock a man off his feet, and as it was exposed not only in the conductors but also in the wheels, side-rods and other mechanism about the motor, in practice, it would have been imperative to use a pressure in the neighborhood of that prescribed by the London Board of Trade, 300 volts.

To obtain a given horse-power by a low potential current would mean the use of more current and larger conductors for the horse-power. If we reduce the volts, the ampères must be increased, and the ampères are the current divided by the resistance or $C = \frac{E}{R}$. We should also recollect that the current waste is equal to the square of the current multiplied by the resistance, or $C^2 \times R$, so that the economy of high tension currents is apparent, a point well understood by electric light companies. Of course the higher the E M F the better must the insulation be, just as high pressure engines and boilers require better construction. Had the voltage been kept at the original low E M F, the economy would not have been as good as that reached.

High speed of armature is an important requisite, and as yet no means have been found practical to apply the motor armature to the driving axle direct. Direct action and elimination of gearing and intermediate contrivances is the best for all engines, whether stationary, locomotive or marine, and the electric motor was undoubtedly at a disadvantage in being compelled to use gearing to reduce the speed; especially should we expect quite a loss in friction, because the pitch lines of the gear wheels and pinions were constantly varying as the axles moved up or down in the pedestals. This motor originally was built with V friction gearing, which was found to be unreliable and useless owing to the oscillations. The loss due to varying counter current and current waste is of course common to all electric motors, from whatever source the current is derived. Some inventions have been made to obviate this great source of waste, by keeping a constant rate of armature speed and using variable intermediate gearing, and other inventions have been made with this purpose in view; but spur gearing remains still the standard. The objectionable use of resistance is done away with on storage battery motors by grouping the cells which represent about two horse-power each, into series, so that the operator may switch only one set or all into the circuit, and thus obtain a current of variable intensity and pressure. If but one motor on a direct system circuit was in use, it would be possible to apply the same principle to the direct system, but in practice there would be a number of motors on a section at once. Some would be just starting and calling for much current and high potential; others might be in full speed and calling for a current of lower pressure and quantity, so that it would be impossible to suit all the varying conditions at once. A great many trials were made under varying conditions, and one interesting fact among others developed, is, that the economy with light trains at higher speeds becomes poorer, apparently contrary to the general principle that the economy of stationary electric motors increases with the speed and the reduction of the load, and many believed that a better showing would be made with such tests. It is true that tests made with light trains of two or three empty cars run at a high speed, but making no stops, showed much better results, but such conditions are not at all practical in operating elevated or other railways. It is true that a lightly loaded stationary motor, running at a nearly constant high rate of speed, will show maximum economy, but in the case before us, where the motor was changing its speed continually, and stopping and starting, the rule will not apply.

It being evident that the electric motor had not sufficient power to handle an average train under working conditions, and that the generating machinery was not powerful enough, it was considered advisable, in order to secure an accurate comparison with a steam locomotive, to detail one to pull the same train of cars over the same track, using hand brakes and reducing the running time to that of the electric motor. A number of tests were made on two occasions, some at slow speed, some on schedule time, and one run was made to ascertain the best performance of the engine, which, incidentally, propelled the train at an average net speed of 16⅔ miles an hour, making all the stops.

The locomotive, No. 67, was by no means the best on the line, and was not in the best condition, as it had a few days before been equipped with new brasses all around, and newly planed valve faces, all of which require plenty of time and oil to bring their services to a good fit and polish.

The cylinders were 11-inch bore by 14-inch stroke. The four drivers were 36¾ inches diameter. The concentrated working weight on drivers was 23,900 pounds. The total working weight was 37,900 pounds. The maximum boiler pressure was 140 pounds per square inch.

The same corps of observers made the test, using the same instruments and methods.

The average indicated horse-power was 25.92; the average net horse-power was 21.95, making the efficiency of the prime mover .85.

The net speed and net horse-power are both lower than in the electric motor test, as the speed was three-tenths of a mile per hour less.

In order to arrive at a conclusion respecting the relative economy of the two systems of motive power, the writer assumes the most tangible measure to be the cost of producing one net horse-power at the draw bar. Under actual working conditions the locomotives develop on the average one indicated horse-power per hour with 6 pounds of good broken anthracite coal, which costs about $4.20 per long ton on board the engines of this line. In a short time this expense will be largely reduced by the new coaling plant at the Harlem River. This coal is very good, averages a pound per lump, and generates 7 pounds of steam per pound of coal, in the average locomotive boiler. The city charge for croton water is $1 per 1,000 cubic feet.

The machinery used in the electric plant was of an economical type, but could have been better still by investing more money in the plant. Assuming that the engine was compounded and used high pressure steam, and assuming that the plant could have been located on the water front so as to obtain condensing water, and assuming that an inferior coal was burned, a high average figure would be the development of one indicated horse-power per hour with three pounds of coal. Assuming that the inferior small coal would cost, after unloading, trimming, storing, rehandling and delivering at furnaces, $3.30 per long ton, and assuming an hourly consumption of steam of 20 pounds per horse power, with an efficiency of .15 from the prive mover, the cost of one net horse-power by electricity would be:

Let $x = \frac{\text{I. H.-P.}}{\text{N. H.-P.}} =$ indicated horse-power required to produce one net horse-power at the draw-bar of motor;
" $a =$ pounds of coal burned per indicated horse-power hour;
" $b =$ pounds of water evaporated per pound of coal burned;
" $c =$ total cost of coal per pound at the furnace;
" $d =$ cost of water per pound:

then $x\,a\,c =$ cost of coal, and $x\,a\,b\,d =$ cost of water, which are, respectively, $ .03 and $ .001, making the total cost per net horse-power hour $3\frac{1}{10}$ cents. In the case of the locomotive ($x\,a\,c = \$\ .012$) + ($x\,a\,b\,d = \$\ .001$), = total cost per net horse-power hour, $1\frac{8}{10}$ cents.

The ratio of cost by locomotive to electric motor is $1:2\frac{88}{100}$.

This is entirely exclusive of extra force at generating stations and additional repairs, and there could be no reduction in the working force on board the motors, whether steam or electric.

The foregoing estimate can only hold good with reference to the electric motor at a speed of $9\frac{4}{10}$ miles per hour, for beyond that the ratio of indicated to net horse-power rapidly increases. Carrying out the curve of apparent increase of indicated horse-power per ton of train from 12 to 15 miles per hour, it seems very fair to assume an expenditure of nine indicated horse-power per ton of train at that speed, which would bring the ratio of cost up to 1:4.7—by applying the previous method.

The question may be asked, what would have been the efficiency, if, instead of one train being run on the trial section, a number of trains had been run? The line resistance and other demands for power when no train was being moved would probably have remained the same, namely, 43 horse-power; this constant loss would have been divided among, at most, four trains on this section, which would reduce the average horse-power per train, at the low speed of 9.4 miles per hour, to 162.5 horse-power, while the net horse-power required would remain 26.7 giving an efficiency of $16\frac{4}{10}$ per cent., but, on the other hand, the evidence goes to show that if the speed was brought up to the regular average of 15 net miles per hour, the efficiency would have shrunk to about 8 or 9 per cent., and this would again be reduced by lowering the potential of the current to a safe limit.

A conservative estimate, based on these facts, would be that the cost of direct electric propulsion would be four times that of steam locomotion.

ALGÆ GROWTH IN RESERVOIRS.

IN the course of a paper on algæ growth in reservoirs, recently presented to the New England Water-Works Association, F. F. Forbes, Superintendent of the Brookline, Mass., Water-Works, stated that about five years ago Brookline built a high service system, and the water for this was stored in an iron tank 50 feet in diameter and 30 feet high.

The same growth appeared here which had caused so much trouble in the low service reservoir, although no water from the reservoir was pumped into the tank. The frequent change of water, which was unavoidable in a tank of such small capacity, increased the growth, and it was even worse than in the low service reservoir. Three years ago the tank was roofed over, excluding all sunlight, since which time no green algæ has been found, and the water has been free from taste and smell.

There is a class of plants, however, which thrive as well in complete darkness as in sunlight; but such plants are not able to make their own food, and are wholly dependent on food made by other plants. Water which contains vegetable solutions in sufficient quantities with certain organic matter, might develop a very extensive growth in total darkness.

In the Brookline filtering gallery and high service tank there is a slight growth of crenothrex, a plant of this kind, but in too small amount to do injury; and it is very doubtful whether waters which contain no more vegetable matter in solution than those furnished by Newton, Waltham, Hyde Park and Brookline will ever be troubled by plants of this kind.

Where it is necessary to store ground water, it should be in covered reservoirs or tanks, and in planning new works where water is obtained from such sources this feature should receive prominence.

NEW ENGLAND WATER-WORKS ASSOCIATION SKETCHES.

No. XIV.

(Continued from page 85.)

STAND-PIPE CONNECTION AT MARBLEHEAD WATER-WORKS.

THE accompanying illustration, showing details of the stand-pipe connection at the Marblehead, Mass., Water-works, was contributed to the Portland convention of the New England Water-works Association by F. L. Fuller, C. E., of Boston, Mass.

Two sections and a plan are given, explaining all the main features of the arrangement. The supply-main to the stand-pipe enters the latter through the bottom. There is a free flow of water from the stand-pipe through the check valve N, shown in the plan, and by partially closing the gate M an increased pressure can be obtained through the town while pumping.

SPECIFICATIONS FOR CAST-IRON COATED WATER-PIPE.

IN the course of a discussion on water-pipe tests and standard sizes of pipe at the Chicago meeting of the American Water-Works Association, Thomas W. Yardley, on request, submitted the set of specifications for cast-iron coated water-pipe given below, and first presented to the American Institute of Mining Engineers at the Washington meeting in February, 1890.

Mr. Yardley briefly explained that in many years experience as a maker and purchaser of cast-iron coated pipe he never met with any standard form of specifications for such. Each water–works company employing a hydraulic engineer has, under his direction, prepared complete specifications for the particular conditions required, but one cannot find that any two are alike, and each foundry, in bidding for the supply of such pipe, makes the price to cover the conditions required. The specifications given, he thought, would be found useful to water-works companies and others requiring pipe of this kind, the conditions being all reasonable and capable of being carried out by makers without additional cost and with advantage to purchaser.

Section 1 gives the kind of pipe, with its general characteristics.

Section 2 specifies that neutral pig iron shall be used, since such iron possesses the strength required and is uniform in shrinkage.

Section 5, requiring makers to give the brands of pig iron used in the cupola, is intended to guard against the use of cinder iron. The characteristics of the ores used in blast furnaces give to each its reputation, and the furnaces using cinder are all well known.

Section 7, providing that the shell of each pipe shall be measured for thickness throughout its entire length, enables the inspector to determine whether there are thin places near the middle of the pipe, where such imperfections are most likely to occur. An inexpensive instrument adapted to such measurement has been devised.

Section 8 provides for a test bar, from which to determine the transverse strength of the iron. This bar is convenient in form, can be made with very little cost to the maker, and will give the most satisfactory test of the strength of the iron under the conditions to which the pipe will be subjected in service.

Section 11, requiring that all pipe shall be stripped immediately, if taken from the pit before cooling, is very important, for the reason that when pipe is taken from the pit hot a deposit of loam is frequently left in spots on the outside, and wherever this occurs the cooling is irregular and the shrinking strains are unequal. The weakness thus produced may not show under the subsequent hydraulic test, but may be developed after the pipe has been subjected to rough treatment in railroad and other transportation into the trenches.

SPECIFICATIONS FOR CAST-IRON COATED WATER PIPE.

SECTION 1. The pipe shall be of the usual kind known as "Hub and Spigot;" each pipe shall be twelve (12) feet in length from the bottom of the hub to the end of the spigot; the form and dimensions of hub and spigot ends shall be as marked on and shown by drawings to be furnished or approved by purchaser.

SEC. 2. The metal shall be of the best quality for the purpose, made from what is commercially known as "Neutral" pig iron, which shall have been made from iron ores without the admixture of cinder, and when cast into pipe the metal shall be tough, and of such density and texture as will permit its being easily cut and drilled by hand.

SEC. 3. Each pipe shall have cast on the exterior surface of hub........in raised Roman letters, one and one-half (1½) inches long, and shall be further marked in like manner with letters and figures to designate the maker of the pipe and the year; also serial numbers shall be cast on each pipe, commencing with a number to be designated by the purchaser.

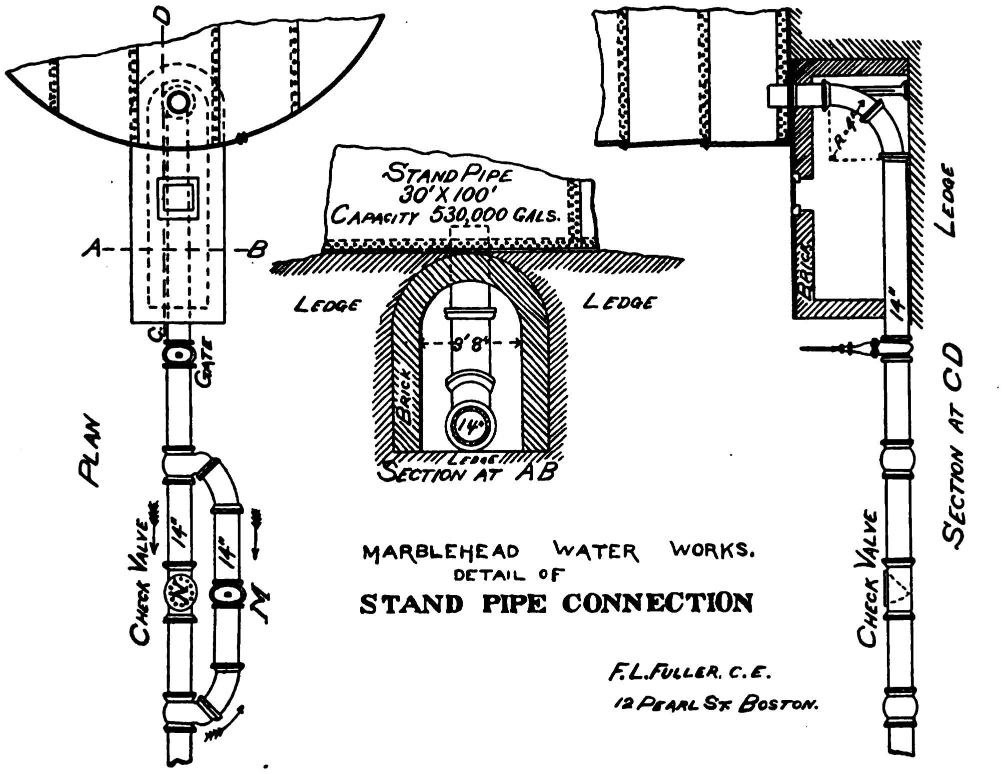
SEC. 4. The pipe shall be cast in dry sand molds, or flasks, placed vertically, and shall be of the several diameters named in the contract. The shell shall be of uniform thickness of metal, smooth and sound, without cold-shuts, lumps, swells, scales, blisters, sand holes, or other imperfections; truly cylindrical; of full diameters; and with interior and exterior surfaces concentric.

SEC. 5. Chemical analysis of the iron used shall be given whenever asked for, and a written daily report shall be furnished to the inspector, giving the brands of pig iron used in each day's melting.

SEC. 6. Each ladle of iron from which the pipes are poured shall be designated by a consecutive number, beginning with each day's work. A daily record of pipes cast shall be kept and furnished to the inspector, and must record the number of the ladle from which each pipe was poured, as well as the number on the pipe.

SEC. 7. The shell shall be of uniform thickness throughout its entire length. Should the inspector find in any one place a variation in thickness of more than ten (10) per cent. less than that specified in the contract, such pipe shall be rejected.

SEC. 8. From each ladle of melted iron there shall be cast one test bar, not less than twenty-six (26) inches long, two (2) inches wide, and one (1) inch thick. This bar shall be tested for transverse strength when loaded in the center, twenty-four (24) inches between supports (narrow sides vertical), and shall carry a center breaking-load of not less than two thousand (2,000) pounds, and show a deflection of not less than $\frac{3}{10}$ inches before breaking. This bar shall be cast as near as possible to the specified dimensions without finishing up; but correction shall be made for variation of width and thickness; and the corrected result must conform to the above requirements.


MARBLEHEAD WATER WORKS. DETAIL OF STAND PIPE CONNECTION

SEC. 9. If any test bar shows a breaking strain or deflection less than the above requirements, all pipe made from the corresponding iron shall be rejected.

SEC. 10. The maker shall furnish to the inspector in charge two wrought iron rings (male and female templates), the one showing the outside diameter of the spigot end, and the other the inside diameter of the hub end of each size of pipe; and the said pipe shall conform in diameters to the respective templates.

SEC. 11. The pipe shall be thoroughly cleaned, both inside and outside, without the use of acid or other liquid. If the pipe is stripped while above a dark blue heat, all sand must be removed from the outside immediately.

SEC. 12. When the pipe is so cleaned, it shall be heated to 300° Fahr., and immersed in a bath of coal pitch varnish of an equal temperature. When the pipe is removed from the bath this coating shall *fume freely*, and set perfectly hard within one hour from the time of removal. No pipe shall be tested by hydrostatic pressure until the varnish has become hard.

SEC. 13. When coated the pipe shall be subjected to a test by hydrostatic pressure of not less than four hundred and fifty (450) pounds per square inch for 6-inch and 8-inch; four hundred (400) pounds for 10-inch and 12-inch; three hundred and fifty (350) pounds for 16-inch and 20-inch; three hundred (300) pounds for 24-inch and 30-inch, and two hundred and fifty (250) pounds for all 36-inch diameter and upwards; and while under such pressure the pipe shall be subjected to an additional test by a series of smart blows at various points throughout its entire length with a three (3) pound hammer, attached to a handle sixteen (16) inches long. If any failure is shown in the pipe during this test it shall be rejected.

SEC. 14. The weight of each pipe must correspond as nearly as possible to the standard named. Any pipe which may fall short over five (5) per cent. of the standard weight shall be rejected, and no weight shall be allowed or paid for any pipe that shall exceed two (2) per cent. of the standard weight. These requirements shall be determined by the weight of each pipe separately.

SEC. 15. All special castings, such as "Ell's," "Tee's," "Y's," bends, crosses, etc., shall be made from the same mixture of pig-iron as has been approved for pipe, and all such castings shall be submitted to the same care in cleaning and heating, and the bath shall be used under the same conditions as for straight pipe.

SEC. 16. All appliances necessary for the inspector to carry out the requirements of these specifications shall be furnished by the maker free of cost to the purchaser.

POWER FROM HOT WATER.

RESPECTING the power, which can be stored up in a boiler charged with steam and water at high temperatures, the London *Engineer* some time ago published the following calculations in an article on the Nordenfeldt submarine boat:

If the pressure in a boiler is lowered the temperature falls, and part of the sensible heat of the water becomes converted into latent heat by evaporation. The two boilers of the Nordenfeldt boat contain about 27 tons of water. The pressure of the steam is, say, 160 pounds above the atmosphere, or 175 pounds absolute. The corresponding temperature is 371° Fahr. The engines will work well with steam of 65 pounds absolute pressure, having a temperature of 298 degrees. In falling from one of the temperatures to the other each pound of water gives out $371 - 298 - 73$ heat units. There are 60,480 pounds of water and $60{,}480 \times 73 = 4{,}415{,}040$ heat units. Each pound of steam at 65 pounds pressure will represent 904 units, so that the water will be able to supply $\frac{4415040}{904} = 4883$ pounds, nearly, of steam of 65 pounds pressure after the ship has been submerged. Assuming that the engines use 20 pounds of steam per horse-power, per hour, we have $\frac{4883}{20} = 244$ horse-power per hour.

THE Paris *Annales des Ponts et Chaussées* for February contains a description of the seaports of Holland, including the construction, equipment, etc., of docks, sea walls, canal bridges, etc., which are elaborately illustrated. The March number contains an article on filtering, in which, after consideration and analysis of conditions, the author deduces mathematical formula which he considers explanatory of many phenomena and consistent with numerous practical and experimental observations that he records

BUILDERS' AND CONTRACTORS' ENGINEERING AND PLANT.

No. XCVII.

(Continued from page 86.)

ROPES AND HITCHES.

Rules for the strength of ropes, definitions of riggers' terms and cuts of simple hitches, were published in article No. LI. of this series, page 61, Vol XIX. In continuation of the subject the following description is given of other simple hitches useful for bridge and roof erection and ordinary field work.

The illustrations are made from drawings of small models that were mounted on cards, furnished by a rigger and bridge erector.

Figure 17 is a sheep-shank, used to shorten a rope, and can be used where neither end is free.

Figures 18 and 19 are both shortening hitches, which can be used only when one end of the rope is free. They will not become undone when the strain is relieved, as a sheep-shank may.

A short bar or toggle (T, Fig. 20, 21, 22 and 23) is sometimes used in making hitches that must be very quickly undone.

Figure 20 is a shortening hitch to take up unused rope, and is made to pull out when T and T are removed.

Figure 21 is a boat knot, and is used when weights are to be carried from T. By raising the weight slightly T is loosened and may be removed and the knot then falls to pieces.

Figure 22 is a sheet bend, and is a valuable hitch for joining two ropes. It is perfectly secure, can not jam, is easily made and is undone by removing T. Care must be taken that T does not fall out accidentally through any intermission of strain in the rope.

Figure 23 is a larks-head, principally used for mooring boats. The free end must be stopped, and there is danger of the toggle falling out if not specially secured.

Figure 24 is another form of larks head that makes a secure hitch and cannot jam, but is rather difficult to tie.

Figure 25 is another form of larks-head. In the finished hitch the bight B must be drawn close. This hitch cannot come loose, and is likely to jam very tightly at B.

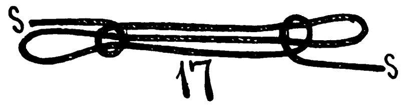
Figure 26 shows how this hitch is commenced. The bight B being first made and the free end crossed through it, carried one round turn about the ring R and brought back across the standing part at A, thus forming one-half the hitch; second half is similarly made alongside in reverse order.

Figure 27 is a dog-shank, used for joining two pieces of chain, etc.

Figure 28 is a jury-mast hitch, often used at derrick heads, where it affords secure hitches for several guys without bulky knots.

Figure 29 is a bowline hitch.

Figure 30 shows how to commence it. This is one of the most valuable hitches, and is very generally used; it is perfectly secure, cannot jam, and is quickly made and unmade.



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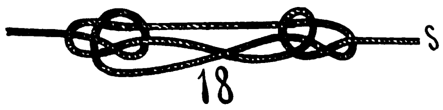

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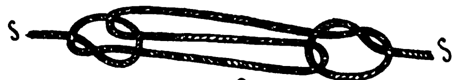

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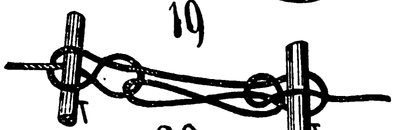

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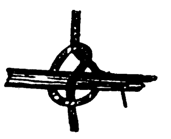

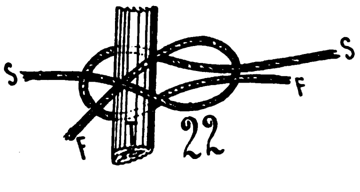

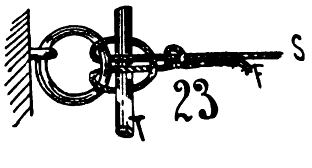

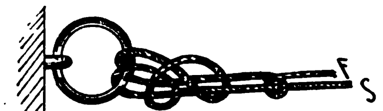

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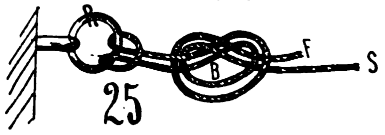

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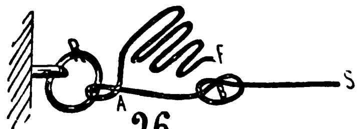

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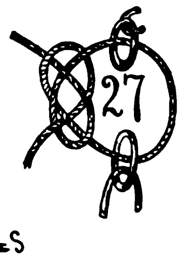

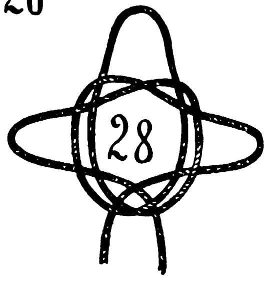

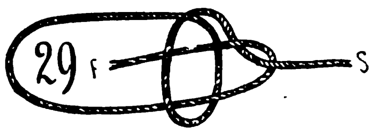

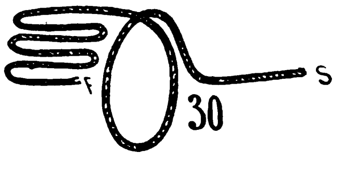

BUILDING IN EARTHQUAKE COUNTRIES.

In concluding a paper on the above subject, read a short time ago before the British Institution of Civil Engineers, the author, John Milne, says that to mitigate the effects of earthquakes it is essential to select a building site where it is known that the ground suffers but slight motion. This is generally hard, high ground. Soft ground, slopes, and scarps should be avoided.

Having obtained a site, one of two general systems of construction can be followed—namely, either to give so much rigidity to a structure that it may be likened to a steel box; or to erect a light building which has so much flexibility that it may be compared to a wicker basket. Both these structures should be light, especially their upper parts.

Buildings of the former class which, from the materials entering into their structure, are unquestionably heavy, include ordinary structures of stone or brick (by preference hollow bricks). These should rise from a deep foundation, have a free basement, walls of unusual thickness, and be well bonded and tied together. The roofs should be light. In this case the strength of the building more than outweighs the ill effects due to its weight. Such buildings are durable, and relatively safe against fire. They are suitable for all climates; but they are, in respect to all other buildings, exceedingly expensive. For this latter reason, this type of structure can only be employed for buildings of importance.

Light buildings, which have sufficient strength and flexibility to overcome effects due to their own inertia when shaken by an earthquake, include nearly all well-constructed structures of wood or iron. The former, however, are neither durable, safe against fire, nor impervious to heat and cold; but these objections may be practically overcome, and wooden buildings are cheap. Iron buildings are relatively expensive, and, without special arrangements, they are too hot in summer and too cold in winter.

A type of building which offers the same advantages as a brick or stone structure against the danger of fire, and in being suitable to resist changes of temperature, and which is also much cheaper, and at the same time safe against all ordinary earthquakes, is the barrack system so strongly recommended in Italy. The framing may be of wood or iron, while the filling-in which forms the walls, which ought to be as light as possible, may consist of hollow bricks or a concrete of light material. For this latter purpose, in Japan, a concrete might be made of the pumiceous light scoria, of which there is an abundance. Mr. Milne also calls attention to the possible employment of cylindrically-formed or drain-pipe shaped bricks, such forms being stronger than bricks of the ordinary rectangular section.

In all these buildings, whether they be of masonry, iron, wood, or built according to the barrack system, the roofs must be light, openings must be in proper positions, walls must be of moderate height. Ordinary structures of brick or stone are usually bad, while timber structures with a masonry front are worse. To resist earthquake motion, lightness and strength are essential, and, if possible, a certain elasticity. Weight, unless it is accompanied by great strength, is a quality to be avoided.

For buildings of importance, Mr. Milne suggests the use of brick. Let the buildings be placed in good situations, the brickwork well bonded and unusually thick, and let them rise from deep foundations. Roofs should be light. For ordinary buildings, unless the barrack system be adopted, Mr. Milne suggests that, for a country like Japan, frame buildings should continue to be used. To improve them, they require more diagonal bracing, lighter roofs, and some protecting covering against fire.

Mr. Henry Dyer's opinion, that Japanese structures are exceedingly ill adapted to resist earthquake motion, is one with which Mr. Milne does not concur. In 1880 and 1887 ordinary Japanese buildings resisted earthquake motion much better than ordinary European-built bungalows and framed structures with a stone or brick facing. The Japanese buildings which suffer most are the fire-proof stores which Mr. Dyer remarks, generally withstand earthquakes. Mr. Dyer states that substantially built buildings of the Imperial College of Engineering in Tokio have suffered but little. Cracks, however, have been found; and at the time of earthquakes these have been observed to open or shut, and occasionally to extend in length. Mr. Dyer's opinion is that the cracks, which chiefly occur in the dormitory and museum at the College of Engineering, were not formed by earthquakes, but by bad foundations. If the foundations had been better, possibly the cracks might not have occurred; but that does not alter Mr. Milne's opinion, which is that they were caused by earthquake movements acting upon the weaker parts of the buildings. On the 15th of February, 1887, the author's own house, which may be included in the buildings referred to by Mr Dyer, was cracked from top to bottom by an earthquake, and many stones forming the corners were displaced ¼ inch. The building is of brick, with a stone foundation, stones at the angles, and an internal wooden frame. At the workshops at Akabane, in Tokio, which buildings are referred to by Mr. Dyer as satisfactory structures, one of the chimneys was, in 1880, cracked by an earthquake, and had to be strengthened by iron bands. Mr. E. G. Holtham, when discussing an earlier paper by Mr. Milne on the same subject, remarked that in Japan timber-framed houses faced with stone are considered earthquake proof. As a matter of fact, although many such buildings exist in Japan, it has often been observed that they have been seriously damaged while other buildings have escaped. They are one of the worst types of buildings for an earthquake country.

According to statistics presented at the Chicago meeting of the American Water-Works Association in May, water-works in the United States have trebled in the last ten years, growing from 660 in 1881 to 1,900 to-day. The invested capital is $500,000,000; the annual revenue is $50,000,000; the mains are 30,000 miles long, and there are 2,000,000 taps.

THE RELATIVE ECONOMY OF STAND-PIPE AND TRESTLE TOWER FOR WATER-WORKS.

IN *The Technic*, an annual published by the Engineering Society of the University of Michigan, is a paper contributed by H. S. Crocker, of the class of 1889, which is reprinted as of interest to those who may have to decide such a question as is there discussed, and in the hope that it may serve to draw forth some expression of opinion from those who have investigated the question for themselves. Of course there are cases where all the water that a stand-pipe contains from the ground up is liable to be drawn upon, and then the question could not be raised, but perhaps more frequently only the water in the upper part of the stand-pipe is really useful, and the question then arises as to whether it is cheaper to continue the cylinder down the same size, making it strong enough not only to carry its own weight but to resist the increasing bursting pressure of the water, or to use a trestle support. From the fact that to support a given tank the cost of the trestle will approximately vary as its height, while on account of the increase of the water pressure with the height, the cylinder if extended down will increase in weight and consequent cost much more rapidly than the height, it is obvious that no general answer can be given to the question. For a small elevation it may be cheaper to extend the cylinder, while for a greater elevation it would probably be much cheaper, as Mr. Crocker has found, to use a trestle.

It is interesting in this connection to note that Chester B. Davis, of Chicago, in designing the stand-pipe for the water-works at Elgin, Ill., which is 30 feet in diameter and 115 feet high from the ground, found it cheaper to use a monolithic concrete base 20 feet high than to extend the cylinder down to the ground.

From an æsthetic point of view it may be said that if anything can more effectually disfigure a landscape than to have a bald sheet iron cylinder erected on its most conspicuous elevation it would be to have a section of the same cylinder set up in the same place on stilts.

Happily the designs for water towers submitted in our recent competition show that the bare cylinder can be readily clothed in forms of architectural beauty, and if only the upper part of the cylinder is useful then the surrounding structure readily takes the place of the supporting trestle, and with very little additional expense.

The paper is as follows:

In pursuing the investigation upon which this article is founded, the writer has carefully designed a stand-pipe and trestle-tower including all details, under assumed conditions which are applicable to most of our western cities of moderate size, so many of which have erected stand-pipes similar to the one here described. The two structures will first be considered separately, and then the results will be compared in detail.

STAND-PIPE.

The pipe designed by the writer is 120 feet in height by 20 feet in diameter, and has a capacity of 282,000 U. S. gallons. The material is wrought-iron plate of the best quality, arranged in horizontal courses of 4 feet in height, and of plates 7 feet 10¾ inches net length.

The allowable stresses which have been assumed in its design are as follows: For safe working strength, tension = f = 15,000 pounds per square inch; for safe working strength, compression = c = 12,000 pounds per square inch; for safe working strength, shear = s = 9,000 pounds per square inch.

These assumptions were thought to agree well with the best practice under like conditions. The thickness of plates, size and pitch of rivets, with their number and arrangement, were determined by the formula

$$pr = As = tdc = tf \,*$$

in which A = area of section of rivet in inches; t = thickness of plate in inches; d = diameter of rivet in inches; p = pressure in pounds per square inch, and r = radius of pipe in inches. The results are tabulated by courses, beginning at the bottom.

For the horizontal joints only one row of rivets was found to be necessary, and their distribution was as follows:

First 12 courses from bottom, ⅞-inch rivets, pitch 3¼ inches.
Second 20 " " ¾ " " 3½ "

To sustain the pipe against a wind pressure due to an assumed velocity of 90 miles per hour, 12 2-inch anchor bolts were placed at equal intervals around the circumference, and extended through the masonry. To prevent the collapsing of the upper portion of the pipe two rings, three inches in width by one-half inch in thickness, were placed around the circumference, one of them being at the top and the other four feet lower.

VERTICAL JOINTS.

	No. of Courses.	Thickness of Plate.	No. Rows Rivets (staggered)	Pitch of Rivets.	Size of Rivets.	Lap.
1st	5	⅝"	3	3¼"	1"	7½"
2d	2	9/16	3	3	⅞	7½
3d	2	½	3	3	⅞	7¼
4th	3	7/16	3	3	⅞	7¼
5th	4	⅜	3	3	⅞	7
6th	2	5/16	3	3	⅞	7
7th	2	5/16	2	2½	⅞	4½
8th	1	5/16	2	3	⅞	4½
9th	2	¼	2	2½	⅞	4¼
10th	2	¼	2	3	⅞	4¼
11th	2	3/16	2	3	⅞	4¼
12th	5	3/16	1	3	⅞	2½

The masonry is to be of coursed sandstone, with a top course of limestone, octagonal in plan, upper surface 480 square feet in area and the bottom area 644 square feet. The depth, of six feet, was figured as being amply sufficient to prevent the settling of the structure and the injurious action of the frost. Under the masonry is placed a layer of concrete one foot in depth.

The pipe is to be provided with a light ladder on the outside, and all ironwork, whether exposed to the weather or not, is to be given three coats of Ironclad paint.

The bill of materials includes everything, with the exception of transportation and profits of contractors.

BILL OF MATERIALS—STAND-PIPE.

IRON.

No.		Description.	Size.	Length.	Weight.	Price per lb.	Cost.
40		Plate Iron.	⅝"x4'	7' 10¾"	34,735	.025	
16		"	9-16"x"	"	12,568	"	
16		"	½"x"	"	10,140	"	
24		"	7-16"x"	"	14 619	"	
32		"	⅜"x"	"	16,676	"	
40		"	5-16"x"	"	17,365	"	
32		"	¼"x"	"	11,144	"	
48		"	3 16"x"	"	12,558	"	
8		"	3-16"x1'		523	"	
314	sq. ft	" (bottom).	¼" thick		3,168	"	
3	"	"	⅝" "		75	"	$3,339 28
12		Rods (upset)	2" diam	9'	1,252	.02	
361	feet.	Bar Iron.	½"x1½"		907	"	
126	"	"	½"x3"		630	"	55.78
30	"	Ls. 5"x4"x⅜"			323	.025	
63	"	" 5"x5"x7-16"			878	"	
15	"	5½"x3½"x⅜"			162	"	34.07
157	"	Gas Pipe.	½"		142	.04	5.68
70	"	Corn.,Galv.Iron	No. 20.		567	.08	45.36
		Total Iron..........			137,205		$3,480.17

MASONRY.

Description.	No Yards.	Price.	Cost.
Limestone.........	18.2	$13	$236.60
Sandstone	98.4	10	984.00
Concrete	28.0	8	224.00
	144.6		$1,444.60

Excavation.—190 cubic yards, at $0.25 per yard.... .	$47.50
Labor.—12 men 45 days, at $3 per day...............	1,620.00
Paint, 410 pounds, at $0.25....................	102.25
Total cost..........	$6,694.52

TRESTLE TOWER.

The trestle tower consists of a tank 33 feet in height by 20 feet in diameter, supported on a trestle of four inclined posts with four panels of bracing. The height of the trestle proper is 92 feet, making a total height, including the tank, of 125 feet, or the same as that of the stand-pipe. The breadth of base is 49 feet, giving a batter to the posts of one in four. The tank proper is identical with the upper 33 feet of the stand-pipe and needs no description. It has a bottom of one-quarter inch plate iron and is supported on floor timbers which rest on a system of girders, these being supported directly by the posts. The general plan and arrangement of parts composing the tower is similar to that of the trestle tower built some years since for the water-works at Princeton, N. J. Each post rests on a masonry pedestal 4 feet square on top and 7½ feet square at the bottom, with a depth of 7 feet. The posts are anchored to the foundation by one-inch rods.

The batter and width of base may seem rather excessive, but the width of base as here given is the least allowable to satisfy the condition that there shall at no time be any tension in the posts on the windward side.

In determining the stresses the same assumptions in regard to wind pressure were made as in the case of the stand-pipe. The tower is to be provided with a wrought-iron ladder and thoroughly painted.

The struts are calculated by Gordon's formula, the safe working strength for compression being assumed as 12,000 pounds per square inch.

In the case of both stand-pipe and tower 10 per cent. was added to the weight of plate iron for lap and rivets, the weight thus obtained being given in the bills of material.

BILL OF MATERIALS—TRESTLE TOWER.

IRON.

No.		Description.	Size.	Length.	Weight.	Price per lb.	Cost.
16		Plate Iron.	¼"x4'	7' 10¾"	5,572	.025	
48		" "	3/16"x4'	"	12,558	"	
8		" "	3/16"x1'	"	523	"	
314	sq.ft.	" " (bottom)	¼" thick		3,168	"	
68	" "	" "	½" "		1, 60	"	
4		" "	1"x22"	18'	5,280	"	
4		" "	7/16"x17"	12'	1,190	"	
51	feet.	" "	7/16"x22"		1,640	"	
15	sq.ft.	" "	⅜"		225	"	
25	" "	" "	¾"		750	"	$806.65
480	feet.	Ls. 4"x3"x⅜"			3,968	"	
24	"	" 4"x3"x9/16"			290	"	
942	"	" 3"x2"x¼"			3,737	"	
236	"	" 3"x2"x5/16"			1,149	"	
8	"	" 2"x2"x7/16"			19	"	
83	"	" 5"x5"x⅝"			1,621	"	
14	"	" 6"x6"x⅝"			332	"	277.90
744	"	Is. wt. 100 lbs. per yd.	12"		24,800	.035	
24	"	I—" 90 " "	9'		720	"	893.20
235	"	Bar Iron	1½"x½"		588	.02	
126	"	" "	3"x½"		630	"	
1472	"	Round Iron 1" diam			3,854	"	101.44
170	"	Gas-pipe	½"		145	.04	5.80
70	"	Cornice Galv. Iron.	No. 20.		567	.08	45.36
		Total Iron.......			74,686		$2130.35

MASONRY.

Description	No. Yds.	Price.	Cost.
Limestone....	2.4	$13.00	$31.20
Sandstone......	27.6	10.00	276.00
Concrete...	12.0	8.00	96.00
	41.4		$403 20

Excavation.—50.8 cubic yards at $0.30 per yard	$15.24
Labor.—12 men 45 days at $3 per day....	1,620.00
Paint.—375 pounds at $0 25 per pound...	93.75
Timber.—Pine, 324 feet 8"x6" at $12 per M...	22.33
Total cost.....	$4,284.87

Of course the capacity of the tank of the trestle-tower is but little more than one-fourth that of the stand-pipe, but it has the same head of pressure due to elevation and performs all the functions of the stand-pipe in the way of reducing shocks in the mains which would result from the direct pressure system. The water in the lower part of a stand pipe is thought to serve no useful purpose, and to be a source of inconvenience rather than otherwise.

The approximate cost of the stand-pipe as given by the bill of materials is $6,700, and the cost of the trestle tower $4,300. These results show at least in the present case the superiority of the trestle tower in almost every particular in point of economy.

Had a less expensive class of masonry been used the difference in cost would have been reduced somewhat, but reference to the figures will show that the cost of iron for the pipe was $3,480, while that of the tower was only $2,130, or a difference of about one-third in favor of the tower.

The labor of erection is assumed as the same in both cases, but a difference of a large per cent. either way in labor would have but small effect on the ratio existing between the costs of the two structures. For different heights of structures the differences in cost will vary, but when the trestle is used the odds will always be in its favor over a stand-pipe of equal height and size.

These results are, in the opinion of the writer, sufficient to prove that the trestle tower is to be preferred to the stand-pipe in every case where economy is a point to be considered, and as for appearance and durability the trestle tower ought certainly to hold its own.

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* The last part of this formula should be

$$\frac{t\,(p-d)\,f}{p}$$

and in this case p does not stand for pressure per square inch, but for pitch of rivets. This formula will of course be strictly correct only for those causes in which there is one rivet per inch of vertical joint. For the other causes the second and third parts of the formula, As and tdc, should be divided by the pitch of the rivets and multiplied by the number of rows.—EDITOR.

PUBLICATIONS RECEIVED.

SEVENTEENTH ANNUAL REPORT OF THE NEWPORT, [KY.] WATER-WORKS TO THE BOARD OF COUNCILMEN; for the year ending December 31, 1889; pp. 61.

THE HISTORY OF FEDERAL AND STATE AID TO HIGHER EDUCATION IN THE UNITED STATES; by Frank W. Blackman; pp. 343; Washington; Government Printing Office; 1890.

HISTORY OF EDUCATION IN ALABAMA; 1702-1889; by Willis G. Clark; pp. 281; Washington; Government Office; 1889.

ANNUAL REPORT OF THE BOARD OF HEALTH OF THE HEALTH DEPARTMENT OF THE CITY OF NEW YORK, for the year ending December 31, 1889; pp. 74.

INAUGURAL ADDRESS OF THE MAYOR, WITH THE ANNUAL REPORTS OF THE OFFICERS OF THE CITY OF QUINCY, [MASS.] for the year 1889.

INSTRUCTION IN DRAWING IN PRIMARY AND INTERMEDIATE SCHOOLS IN EUROPE AND AMERICA; a critical review of the Prang course of Form-Study and Drawing; by Dr. Arnold Dodel; with an introduction by Louis Prang; pp. 35; Boston; The Prang Educational Company.

STRUGGLES IN AFRICA AND HOW I TRANSPORTED A STEAMBOAT ON WHEELS 1,600 MILES ACROSS THE COUNTRY; by John Thorburn; pp. 46.

ANNUAL REPORT OF THE TRUSTEES OF WATER-WORKS OF THE CITY OF ZANESVILLE [O.] FOR THE YEAR ENDING MARCH 31, 1890: together with the Reports of the Secretary and Superintendent; also, By-Laws and Rules and Schedule of Water Rates; pp. 64.

MUNICIPAL ENGINEERING: by W. D. Clark; read before the Illinois Society of Engineers and Surveyors; January, 1890; pp. 11.

DOMESTIC PLUMBING HEATING LIGHTING & VENTILATION ENGINEERING

EXPANSION JOINTS IN THE UNDERGROUND PIPES OF THE NEW YORK STEAM COMPANY.

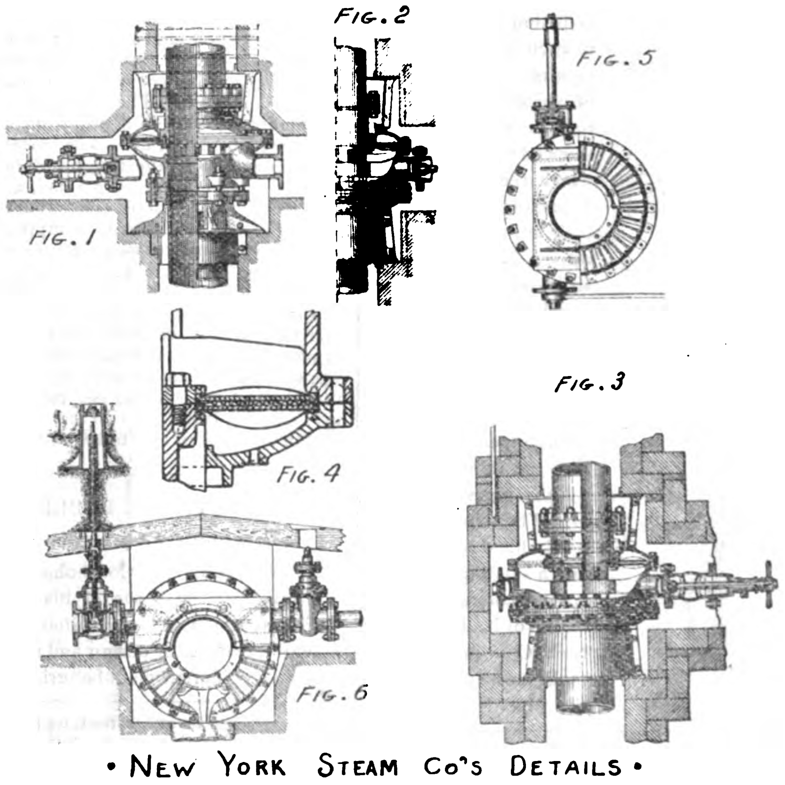
In carrying into practice the system of district steam distribution, as followed by the New York Steam Company, it was seen at an early date that the use of slip joints or stuffing boxes on underground steam pipes could not be tolerated in a crowded city, particularly at the high pressure proposed, on account of leakage and the numerous manholes required for access. Efforts were, therefore, made to develop a practicable expansion joint on the diaphragm principle, which should have no leakage. Experiments were first made with annular plates, riveted together through spacing rings alternately at their inner and outer edges. Such joints, however, were so stiff that their operation in lines of piping would probably have strained the various necessary joints in the pipes themselves. The joints became less stiff as the thickness of the diaphragms was decreased, and improvement was further made by corrugating the plates annularly, but still such joints were not satisfactory, and it was resolved to adopt diaphragms so thin as to require support to prevent rupture.

The expansion joint finally designed by Chas. E. Emery, which has been used successfully in all the work of the NewYork Steam Company, is shown in the six accompanying engravings. The joints, as described by Mr. C. E. Emery before several engineering societies, were, at an early date, called "variators," as they allowed for variation in the lengths of the pipes, and they are now generally known by this name. The single variator (Fig. 1), has but one diaphragm, the center of which is connected to the pipe by a clamp ring on a flanged sleeve, and the outer part of which is clamped between a covering plate and a bell-shaped piece diminishing to the size of the pipe, and provided with the female portion of a ball joint. The double variator has two similar diaphragms connected by a cylindrical-flanged body (Fig. 2). The outlets for consumers are taken from the variator bodies, as shown. A section of a diaphragm is illustrated in Fig. 3. The diaphragms are of sheet copper only, .04-inch thick, corrugated annularly. The inner and outer portions of the diaphragm are flat and make the joint by being clamped between the metal surfaces. The diaphragms are supported on radial plates ribbed on the back, and provided with projecting beads on their ends, resting on ledges in the castings. The supporting plates on the side towards the atmosphere are provided with heavier ribs to receive the full pressure of the steam, but plates with lighter ribs are also inserted on the other side to provide for the accidental occurrence of a vacuum in the pipes.

Each plate, therefore, forms a bridge from the inner to the outer ring, and supports the diaphragm on the corrugations. The radial length of the plates is 6 inches for all sizes of pipe. Provision is made for a movement of from 1¼ to 1½ inches for each diaphragm, but it is generally a little less in practice. As a rule, one diaphragm is provided for each 50-foot length of pipe. The greater part of the movement necessarily takes place without pressure while the pipes are being heated to 212 degrees. In regular operation the movement is only that due to the variation of temperature arising from slight changes of the working pressure, and under such circumstances the flexure is claimed to be well within the limits of elasticity of the metal. It is stated that only one of the large number of these expansion joints has ever been taken out on account of the cracking of the copper.

It may be of interest to add here that in discussing a paper on "The Distribution of Steam," presented by Mr. Emery before the British Institution of Civil Engineers, the suggestion was made to allow for expansion of the pipes by forming spring or expansion bends. In response to this Mr. Emery explained that such a system was impracticable in a street. Such a system would necessarily be underneath all other systems of pipes, and would prevent the user of any other pipes at that level for the entire width of the street. The method of offsets is commonly used by the New York Steam Company for small connections, and sometimes drainage is secured, when vertical offsets are necessary, by means of a yoke, one branch being run down under an obstruction, and carrying the water of condensation, while another is run up over the obstruction to carry the steam.

The largest pipe made with bends in the United States is, according to Mr. Emery, at Manchester, N. H., where, in making additions to the steam plant of a mill, the boilers had to be placed on one side of a canal and the engines on the other. The pipe was carried down one bank to a bridge across the canal, and back along the other bank to the engines, the offsets providing properly for expansion.



• NEW YORK STEAM CO'S DETAILS •

FIRE APPARATUS IN MILLS.

C. J. H. Woodbury, of Boston, in a paper on "Methods of Reducing the Fire Loss," read at a meeting of the American Society of Mechanical Engineers, devotes an interesting section to fire apparatus in mills. In this he says:

All methods for the prevention of fires fall so short of the ideal of immunity that there is a necessity for fire apparatus. The principle of defense of a manufactory against fire is that of self-protection by making the installation and management of the fire apparatus of such a grade as to be able to cope with the progress of any fire which can possibly occur.

Buckets of water are the most effectual fire apparatus. They should be kept full and distributed in liberal profusion in the various rooms of a mill, being placed on shelves or hung on hooks, as circumstances may require. In order to assist in keeping them for fire purposes only, they should be different from other pails used about the premises, and in some instances, each pail and the wall or column behind its position bear the same number.

It is a mistake to keep fire pails in dry rooms, as the water in the pails evaporates rapidly, and also in so doing interferes with the drying processes. The pails should be placed in some convenient situation near to the dry-room, where they will not oppose the drying process, and will also be more accessible in case of fire than when hung inside of a dry-room.

In unheated buildings the contents of fire pails can be prevented from freezing in winter by adding chloride of magnesium to the water.

Galvanized iron pails are better than wood pails, and indurated fibre makes a very satisfactory pail, especially in places around bleacheries, chemical pulp, or paper mills, where corrosive fumes rapidly injure metal pails.

There are various expedients to insure the full condition of fire pails, such as various floats, or electrical contrivances, or sealing over the top of the pail some thin sheet of impervious material; but the fact is that there is no fire apparatus so simple and effective as a full pail of water in good hands. All automatic devices are not above contingencies, and they lead to lowering the standard of personal espionage, which is the controlling principle in the administration of affairs.

Generally there is also need of casks of water to furnish a further supply to the fire-pails. Garden hose attached to a supply of water often constitute a very useful portion of the fire apparatus. Any cocks in the nozzles should be fixed in an open position by striking a heavy blow on the handle of the plug cock commonly used in such fittings.

Automatic sprinklers have proved to be a most valuable form of fire apparatus, operating with great efficiency at fires where their action was unaided by other fire apparatus, particularly at night. In mill fires the average loss for an experience of twelve years shows that in those fires where automatic sprinklers formed a part of the apparatus operating upon the fire the average loss amounted to only one-nineteenth of the averages of all other losses. If the difference between these two averages represents the amount saved by the operation of automatic sprinklers, then the total damage from the number of fires in places in which automatic sprinklers are accredited as forming a portion of the apparatus, has been reduced six and a quarter million dollars by the operation of this valuable device.

In an automatic sprinkler system, the sprinkler heads are attached to tees in pipes against the ceiling; the arrangement being such that there shall be at least a sprinkler to every one hundred feet of floor, some places requiring a still larger number of sprinklers. There should be two sources of water supply, with check valves in the pipes leading into the sprinkler system, giving it the benefit of the greater pressure without the intervention of any personal act. If one of these supplies is furnished by an elevated tank, the minimum head from the bottom of the tank to the highest sprinkler should be not less than twelve feet.

The inability to withstand freezing temperatures is a defect in automatic sprinkler systems which has not been fully remedied by invention. There are many so-called dry-pipe systems, in which the water is kept from the system until fire occurs, when the heat which releases the sprinkler is presumed to actuate devices which open the main valves admitting water to the system. Such apparatus is always complicated; these systems have sometimes proved to be inoperative at fires; and have frequently been discovered to be out of order when examined. The attempts at making a solution of low-freezing point, which should be non-combustible, and under the conditions of its use should also be non corrosive, do not appear to have been successful.

Water is sometimes removed from automatic sprinkler systems during cold weather by pumping in air to a pressure sufficient to displace the water. This method demands a great deal of attention; and in case of a fire it requires even longer to discharge the compressed air from the pipes and throw water on the fire than would be the case with the usual dry-pipe system.

The only resource for automatic sprinklers in rooms liable to temperatures below the freezing point appears to be to shut the supply-valve and slowly draw the water from the pipes late in the autumn and to admit the water in the spring. The valves should be in a place accessible at time of fire, and all persons liable to have any duties in the matter should be made acquainted with the necessity of opening such valves in time of fire.

When automatic sprinklers were first introduced there were many apprehensions that leakage, and also excessive water discharged upon small fires, would be sources of danger. Many automatic sprinklers have been made in such a manner as to impose unusual stress upon the fusible solder, which is a weak alloy ill adapted to withstand the forces due to water pressure, water hammer, and what is sometimes greater than either, the initial tension in setting up the sprinkler to make it tight. It is not surprising that such sprinklers break or leak; but among the score or more automatic sprinklers on sale it is easy to select several varieties, any one of which would impose but little risk of leakage from water pressure. The logic of figures show that this liability to damage is merely nominal in the case of well constructed sprinklers.

Although automatic sprinklers have proved to be so reliable and effective, yet, in order to provide for all possible contingencies, their introduction should not displace other forms of fire apparatus, particularly stand-pipes in the stairway towers with hydrants at each story. The hose at these hydrants should be festooned on a row of pins, or doubled on some of the reels made especially for such purposes. Stand-pipes are not recommended to be placed in rooms or on fire escapes; and inside hydrants should not be attached to the vertical pipes supplying automatic sprinklers.

Fire pumps are generally too small for the work required of them, 500 gallons per minute being the minimum capacity recommended. For a five-story mill there should be an allowance of 250 gallons per minute for an effective fire stream through a 1⅛-inch nozzle, and for lower buildings the estimate should rarely be less than 200 gallons for each stream

For stand-pipes ⅞-inch nozzles are recommended, but for yard hydrant service the diameter should never be less than 1-inch, and 1⅛. inch generally fulfills the conditions of best service.

It is important that the couplings on the hose and hydrants should fit those of the public fire department. The best diameter of hose is 2½ inches.

Pumps should be placed where they will be accessible under all circumstances; and so connected that they can be started at least once a week. They should be equipped with a relief valve, and also a pressure gauge.

Water mains about a mill yard should be of ample capacity not to cause an excessive loss by friction, their diameter being based upon a limit of velocity of ten feet per second for the maximum delivery.

The yard hydrants should be placed at a distance of 50 feet from buildings, and covered with a house which should also contain hose, nozzles, axes, bars, and spanners. Hydrant houses are made in a great variety of forms, but it is important that the doors should be high enough to avoid ice, or that the house should be placed upon slight mounds. An economical hydrant house may be built six feet square, with two adjacent sides hung on hinges, so that the doors can be swung around to the other side and be held by catches. The pins on which hose is hung should be two inches in diameter, and placed diagonally and staggered in two rows. If there is no hose cart, the reserve hose can be placed on shelves.

Stop valves in the mains should be covered by boxes four feet in height, and the direction of opening clearly marked on the hand wheel of the gate.

Notes and Queries

on Domestic Engineering.

Communications relating to the practical details of plumbing, heating, lighting and ventilation will be welcomed in this column. The writer's true name and address must always be given, but an assumed name may be used for publication if preferred.

SIZE OF VENTILATING FLUE.

William Jennings, Harrisburg, Pa., writes: "We have an opera house which we desire to ventilate. It has a ground floor, first and second galleries. Our idea is to put in a flue and take the foul air out at each of the three floors. What we desire to know is, shall the flue be of uniform size, or increase at each floor? If so, in what ratio, and in what part of the flue shall the coil of steam pipes be placed?"

[Generally speaking, a ventilating flue or shaft, as in this case, must be larger than might at first be supposed in order to satisfactorily meet the requirements of successful operation. It is usually made of practically uniform size from the bottom up.

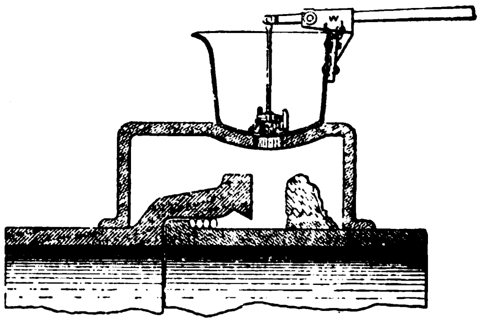
As to the location of the steam pipe coil in the shaft, it should be borne in mind that the aspirating power of the shaft depends on the height of the column of heated air as well as on the difference between the temperature in the shaft and that of the external air. It is, therefore, evident that the nearer the bottom of the shaft the heat is applied the greater will be the efficiency. The lowest point at which the coil is placed should, however, be above the entrance of the highest foul-air flue.]

LADLE FOR RUNNING LEAD JOINTS.

M. E., Jersey City, N. J., writes: "In looking over some odds and ends collected from various sources in past years, I happened upon the inclosed illustration of a combined melting pot and ladle for running lead joints in cast-iron pipes. It may be of interest to some of your practical readers engaged in pipe work.

The illustration represents a vertical section of the ladle and, at the same time, shows it mounted on a stool which is made to fit the pipe, thus simplifying the operation of casting.

It will be noticed that at the bottom of the ladle is a valve of cast-iron fitted with an asbestos face and operated by a vertical rod and pivoted lever. The latter is normally locked by a wedge W to keep the valve on its seat. When a joint is to be run the pot is placed over it and the valve is raised. The hot metal immediately flows past the valve into the joint, the light scum remaining on the surface, and the heavy dross, if there be any, lying in the bottom of the pot below the valve seat. For double joints, as in running collars on to two spigot ends, two valves are placed in the ladle at the proper distance apart for the two joints, and are raised together or separately. In case an explosion is feared from a damp joint, the handle may be lengthened by a piece of pipe, and the operator stand at a safe distance. The ladle was made by an English company in 12 sizes, varying in capacity, for single ladles, from ¼ cwt. to 3 cwt., and for double ladles from 1 cwt. to 4 cwt."



LADLE FOR RUNNING LEAD JOINTS.

[The ladle is substantially the same as that described in our issue of February 25, 1888, but the stool attachment was not shown there. We have, therefore, reproduced our correspondent's illustration. The ladle was made, and is probably still being turned out, by the Glenfield Company, Kilmarnock, Scotland.]

Novelties.

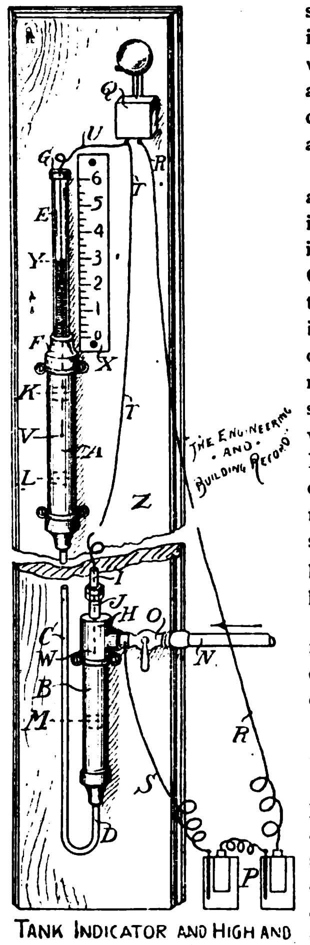
Devices are described under this head purely and strictly as news; because believed to be new and calculated to interest readers.

In no case is pay accepted, directly or indirectly, for publishing a novelty notice.

As the subjects are selected for their supposed novelty and interest merely, it will, of course, be understood that the selection does not imply indorsement.

BRACKEN'S TANK INDICATOR AND ALARM.

This device consists essentially of two 1-inch iron tubes A and B, each about 12 inches long,* connected by an ⅛-inch tube, whose leg C is 60 and D 3 inches long; the three tubes containing mercury arranged to show, by a multiplying index, the height of water in the tank, and also to close an electric circuit to operate high and low water alarms.



TANK INDICATOR AND HIGH AND LOW WATER ALARM

E is a flat glass tube, about 1 by ¼ by 10 inches, securely sealed into the tube A at F. G is simply a brass cap to exclude dust, etc. H is a tee, the upper end of which is reduced to receive the ¼-inch screwed tube J, through which the smaller tube I passes, and is vertically adjustable by jam nuts. X is a metal scale, adjustable on the panel Z that the apparatus is mounted on. When the indicator is first set up the stop-cock O is closed and enough mercury poured into the tubes to about fill the pipes B, C and D. The tube A is then partly filled with water and a small quantity of special colored oil put on top of it. If now the cock O is opened the tank pressure through the pipe N, added to the weight of mercury in the pipes B and D, will balance a larger mercury column in the pipes A and C, and a variation of one foot in the tank will cause a variation of about one inch in the top of the mercury column in the pipe A.

The apparatus is set so that when the tank water is at the lowest point the mercury will reach from W in the tube B to a point just above the bottom of the tube A. When the tank water is at the highest point the mercury will be forced down nearly to the foot of the tube B, and will rise to the point V in the tube A. For an intermediate stage the surfaces of the mercury would be at M and L, and the top of the water cushion at K and the top of the index column at Y, as shown in the illustration.

The column of water, K L, is only for filling to save mercury and separate it from the oil. When the mercury rises in the tube A it forces a certain quantity of oil up into the pipe E, and as the section of E is only about one-third that of A the oil must rise three inches for every inch the mercury rises,* thus multiplying the small variations of the mercury to a convenient size for reading. By varying the size of either the tube A or E any required length of gauge can be easily secured.

A gong Q, and electric battery P, are arranged to ring an alarm whenever high or low water is reached in the tank. One pole of the battery is connected to the gong by the wire R, and the other pole is connected to the indicator by the wire S. The gong is also connected to the indicator by wires T and U, but these wires can only be connected with S, so as to complete the circuit, when one or the other of them is in contact with the mercury. At low water the mercury rises to W in the tube B, the circuit is completed through the wire T, and the gong rings. As soon as the tank begins to fill the mercury falls in the tube B, breaking the contact at W, and stopping the gong. At the same time it rises in the tube A until, at high water, it makes a contact with wire U at V, completes the circuit through U, and the gong rings. Of course, the points V and W may readily be changed in position so as to make the alarm sound for any water levels.

This indicator is simple and direct, and is claimed to be economical and satisfactory. It was invented by W. R. Bracken, and is manufactured by Moody & Bracken, New York City.

THE SEVEN WELLS WATER-WORKS OF MADRAS.

Some portion of the town of Madras, Fort St. George, and almost every Military Institution in the Presidency town, India, was supplied for nearly a century with water of a remarkably good quality obtained from wells in a certain inclosure within the precincts of the northern limits of the city. This source of supply, says *Indian Engineering*, is well known as the "Seven Wells," and seems to depend on a bed of fine quartzose sand several miles in length (from north to south), but only 300 or 400 yards in width, its depth varying from 1 to 15 feet. The purity and wholesomeness of the water seems to depend on its being filtered through this stratum of sand, which, in some places, is covered to a considerable depth with red clay and sand. The so-called "Seven Wells" are ten in number, varying in depth from 20 to 30 feet, and are all 16 feet in diameter. The wells have never at any time shown the smallest signs of failure. Their present capacity is 140,000 gallons a day, and it is estimated that they can discharge three times that quantity should occasion arise. This estimate is supported by an old record, which says that two wells alone, when the others were choked up, have been known to yield 264,000 gallons in 24 hours. The water is lifted by *picottah*. This machine is a modification of the beam and bucket of Upper India and Bengal. It consists of a balance lever, weighted at one end, and a vertical rod and bucket at the other—worked by a man or men walking on the lever. The useful effect is about 90 per cent. It is well adapted for lifts ranging from 10 to 20 feet. The water is distributed within a radius of two miles and is conveyed in cast-iron pipes.

TRADE PUBLICATIONS.

WOOD'S WATER-TUBE STEAM BOILER.

John Wood, Jr., Conshohocken, Pa., has issued an attractive new catalogue of his water-tube safety boiler. It is fully illustrated, the various engravings showing the essential features of design and representing Wood boilers erected at different manufacturing establishments.

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* Dimensions given are suitable for a tank elevation of about 60 feet above the indicator.

* This is approximately correct, for the weight of the oil is so insignificant that it hardly affects the hydrostatic balance of the mercury column.

THE ELECTRIC LIGHTING OF FRANKFORT-ON-THE-MAIN, GERMANY.

A joint report addressed by Professor Galileo Ferraris, Dr. Kittler, W. H. Lindley, F. Upperborn, and Dr. H. F. Weber, to the Mayor of Frankfort, on the various proposals for a central electric lighting station for that city, was recently published in the *Elektrotechnische Zeitschrift*. From an abstract of it, given in the pamphlet of foreign abstracts of the British Institution of Civil Engineers, the following is reprinted:

The commission of experts was instructed to report upon (1) the comparative merits of direct and alternate current supply; (2) the question of safety, general applicability of supply and cost of working; (3) the best system to be adopted. The various points on which the Commission was asked to pronounce an opinion were stated in the form of questions, and those questions coming under the headings (1) and (2), were as far as possible experimentally investigated, and the answers given unanimously. As regards heading (3), the commission did not give a joint opinion, but the members reserved to themselves the right to give their individual opinions if the town authorities should desire this. The joint opinions are grouped as follows:

Danger.—With the apparatus properly installed and carefully handled there is no danger to members of the staff. With careless handling the danger is the same, whether the current be 2,000 volts alternating or 2,000 volts direct. The transformers are to be placed in substations, and only the 100-volt currents taken into the houses of subscribers. There is thus absolutely no danger for subscribers. By proper safety-devices it is also possible to avoid all danger with the Siemens 5 wire system, which requires 500 volts direct currents.

Alternate Current Motors.—A 25 horse-power and a 5 horse-power Ganz motor were tested. The efficiency of the larger machine varied between 82 and 83 per cent., the power varying between 15 and 35 horse-power. The smaller machine gave 78 per cent. when loaded to 5 horse-power, and when the load varied between 3 and 8 horse-power the efficiency varied between 60 and 80 per cent. There is thus only a very small difference in the efficiency between the alternate and direct current motor, and in this respect both may be considered equally applicable. The alternate current motors must be started by hand and without load, the time occupied until they work normally ranging from 30 to 45 seconds. They cannot be so safely overloaded as direct current motors. The large motors showed during starting considerable development of sparks at the commutator, the length of sparks reaching 2 inches, whilst at each start about 17 milligrams of copper were wasted from brushes and commutators. This waste is not considered to be serious, neither is the fire risk consequent upon sparking of importance. The large motor worked somewhat noisily, but the smaller motors worked sufficiently quiet for domestic use. The large motor could be gradually overloaded to 40 horse-power, or by 60 per cent. of its normal power without losing its synchronism; with a load of more than 40 horse-power, even if gradually applied, the motor pulled up. Loads up to 26 horse-power could be suddenly applied and removed without loss of speed, but a load of over 26 horse-power, suddenly applied, caused the motor to stop. In view of this behavior the commission recommends that the nominal power of the motors chosen should exceed the normal power required in each case.

Alternate Current Transformers.—The efficiency of medium size transformers was found to be from 95 to 96 per cent. at full load; 93 to 94 per cent. at half load; 90 per cent. at quarter load, and from 80 to 82 per cent. at one-eighth load. Full load has been taken as that load at which no part of the apparatus reaches a temperature higher than 80° Cent. above that of the room. To increase the average efficiency of the whole system, the commission recommends the employment of transformer substations provided with automatic apparatus for varying the number of transformers at work in each group. Such an apparatus, costing about £7, has been submitted by Messrs. Ganz & Co., and found to work safely and without sparking. The firm offers to maintain the transformers in consideration of an annual payment of 6 per cent. of their cost price.

Arc Lamps.—Alternate and direct-current arc lamps were compared, and it was found that with equal energies (including the loss in resistances required for parallel working of direct current lamps) the illumination was as 4 to 5, showing a gain of 20 per cent. in favor of the direct-current lamp. Three alternate current lamps could be run in series from a 105-volt circuit. The consumption of carbon in an alternate-current lamp exceeds that in a direct current lamp requiring the same energy by about 20 per cent.

Direct Current Transformers.—The commission is not aware that such machines have yet been practically used. The proposal to wind the primary and secondary circuits upon the same armature core must be rejected as unsafe, but there is no reason to doubt that transformers with two distinct armatures will work satisfactorily and safely. The efficiency of 82 per cent. estimated by Messrs. Schuckert & Co., in their project is attainable at or near full load.

Storage Batteries.—On this subject the commission could not agree, and the members therefore gave their opinions individually. Ferraris pronounces against them. Weber, whilst dissatisfied with their efficiency, thinks their life satisfactory, and leans to their adoption in Frankfort under the maker's guarantee. Upperborn is in favor of storage batteries, as is also Kittler, who has especially a good opinion of the "Tudor" accumulator.

Five-Wire System.—The commission rejected the five-wire project previously offered by Messrs. Siemens and Halske, but thinks the new project a considerable improvement. It has, however, not yet been practically used. Regulation and balance between the wires is obtained by small dynamos erected in nine sub-stations throughout the town. The commission objects to the complicated nature of the project which requires the laying of five wires on each side of the streets.

CONTROLLING BACK-WATER FROM SEWERS IN BUILDINGS.

In a paper on preventing back water from sewers entering buildings during rain storms, read at the Master Plumbers' recent meeting at Denver, J. P. Gallagher, of St. Louis, Mo., said: "There have been many devices invented and patented in the way of automatic back-water valves that are said to overcome the trouble. These valves are usually placed in the house drain, out of sight, and in many cases out of reach, making it very difficult to make an examination of the device after it is put in position. Much depends upon the manner in which these valves are used.

"There are other ways in which back sewer-water may be prevented from entering buildings. One way is certain to work well at all times and under all circumstances, which is to have a separate system of drainage for the storm water from that of the house drainage. This method is, of course, expensive in the first construction of the system, but it avoids all trouble from back sewerage for all times. Another way to prevent back-water from sewers damaging buildings, where the separate system of sewerage does not exist, is to use heavy iron pipe of the proper size, laid from the main sewer in the street through under the cellar bottom to the rear of the building; there run a stand-pipe of the same material to a point a few feet above the level of the street manhole. The iron drain pipe, to be lasting, should be of special extra strong, and all joints should be calked with the same care that street mains are calked. Never leave a possibility or a doubt in your mind that a joint could be defective; place in your drain at proper distances handholes with Y branches and brass screws; calk therein and place in such a position that if any stoppage should occur a wire rope could be inserted for the purpose of cleansing, with but little trouble, at any point the stoppage may occur.

"I would not recommend the common stone pipe to be used in any locality where back-water is liable to give trouble, as I do not believe that a perfect job could be made with that kind of material; and, in addition to what I have already said, I would recommend for basements, where sinks and laundry tubs are placed, a valve to be placed under each fixture, with a rubber ball, which would immediately close up the aperture of the waste pipe or water-closet in the basement the moment the drain had any back pressure applied."

The pumping engines of Parkersburg, W. Va., broke down some days ago and the city was left without a water supply. All manufacturing stopped, and water for domestic use was carted from the Ohio River.

ARCHITECTURAL COMPETITIONS.

Trenton, N. J.—Normal School.—Plans are wanted, no date specified, for a normal school building at this place. Cost, $35,000. Address the Sub-Committee on Normal School, as above.

CONTRACTING INTELLIGENCE.

For works for which proposals are requested see also the "Proposal Columns," pages i-ii-x-xi.

WATER.

For Additional Water Items see Proposal Columns

Milwaukee, Wis.—The following bids for furnishing 850 pieces of iron water-pipe were received by the Board of Public Works July 14: Dennis Long & Co., Louisville, Ky., $30.00, $24,600; R. D. Wood & Co., Philadelphia, $30.90, $25,338; Howard Harrison Iron Co., Cincinnati, $32.50, $26,650; Addyston Pipe and Steel Co., Covington, Ky., $28.45, $23,329. The contract was awarded to the Addyston Pipe and Steel Co.

For dredging a trench for laying two lines of cast-iron pipe from the crib end of the proposed tunnel to a point 5,000 feet east: C. H. Starke, Milwaukee, $13 per foot, $65,000; F. M. Knapp, Racine, Wis., $70,000. Contract awarded to C. H. Starke.

Laying the pipe: Thacher & Breyman, Toledo, O., $6 per foot, $30,000; John O'Neill, Milwaukee, $5.74, $28,700. No award made.

Salt Lake City, Utah.—At the session of the City Council, held July 8, the following bids were received for the construction of a brick conduit for water-works, quantities being: Earth excavation and backfilling, 78,000 cubic yards; earth embankment, 5,000; rock excavation, 2,000; cut stone masonry, 10; brick masonry, 11,000; concrete, 250, tunneling in rock, 300. Regan & Delany, Omaha, $112,647.00; J. F. Riley & Co., Denver, $140,995.00; Houlahan & Griffith; Pasadena, Cal., $149,268.67; J. S. Morse & Co., Salt Lake City, $149,522.00; Macdonald & D'Kay, San Bernardina, Cal., $181,620.50. The bids were all rejected, as sheet-iron pipe was substituted for all brick work.

Dayton, Wash.—The people of this place propose bonding the city for $55,000, for a system of water-works.

Astoria, Ore.—It is reported that a Chicago company will purchase a controlling interest in the local water-works plant. Improvements will be made costing from $100,000 to $150,000.

Lancaster, N. Y.—The Water Committee of the City Councils has selected a site upon which to erect the projected reservoir, and operations will begin at once.

Marysville, O.—A franchise to establish and operate a water-works plant at this place has been granted to Walter Fullington.

Lincoln, Neb.—The Lincoln Water Company will lay four miles of mains, put in 50 additional hydrants, and establish a filtering system.

Silver City, Neb.—The people of this place are discussing the water-works question.

Portland, Ore.—The Highland Park Water Company has been incorporated at this place, and a system of water-works will be established. Address E. E. Miller, as above, for particulars.

Cheney, Wash.—The water-works system at this place has been purchased by a concern with James Steel at its head, and extensive improvements will soon be made. Address the above person at this city.

Rochester, N. Y.—Engineers Tubbs and Rafter have prepared a report on additional water supply, in accordance with the instructions of the Executive Board. The immediate use of the Gates well is advised and the Board is also recommended to sink one or two wells west of the Gates well in places where there seems best prospects of striking water. The report will be formally presented to the Executive Board on July 21. The Board has advertised for sealed bids for a pumping plant with a capacity of 2,000,000 gallons a day. For complete particulars see our Proposal Columns.

Pulaski, Va.—A water-works system is proposed for this place. Information can be had of J. H. Dingee, Secretary Virginia Investment Association, 330 Walnut Street, Philadelphia, Pa.

Contracting News Department.

A WEEKLY RECORD

OF SPECIAL INTEREST TO CONTRACTORS, BUILDERS AND MANUFACTURERS OF ENGINEERING AND BUILDING SUPPLIES.

WATER.

(For Additional Items, see page 109.)

CINCINNATI, O. — Numerous new water mains have been ordered by the City Council.

HARRIMAN, TENN.—M. M. Tidd, C. E., of Boston, has made report on a water-works system for this place, which contemplates a pumping plant of 6,000,000 gallons and a reservoir. A report on a sewerage system is in process of preparation. Gen. Clinton B. Fiske, of New York, was president of the Land Company, which is largely interested in the projected improvements.

MANCHESTER, N. H.—M. M. Tidd, C. E., of Boston, is making plans for a high service system of water-works for the city, involving pumping plant and reservoir and additional mains.

CHADRON, NEB.—The City Clerk here writes: "I think there is very little probability of any extension of our system in the next year or so."

MORGANTON, N. C.—T. I. Gillam, Secretary of the Board of Water Commissioners, writes: "The city of Morganton has contracted with the Morganton Water Supply and Transfer Company for water. They will put in a plant that will furnish about 2,000,000 gallons per day of 24 hours. There will be no machinery. The water will be supplied by gravity. S. R. Collett, of Morganton, will have charge."

NORFOLK, VA.—An extended water-works system is proposed for this place. Information can be had of J. H. Dingee, Secretary Virginia Investment Association, 330 Walnut Street, Philadelphia, Pa.

NORTON, VA.—A water-works system is proposed for this place. Information can be had of J. H. Dingee, Secretary Virginia Investment Association, 330 Walnut Street, Philadelphia, Pa.

CEREDO, W. VA.—A water-works system is proposed for this place. Information can be had of J. H. Dingee, Secretary Virginia Investment Association, 330 Walnut Street, Philadelphia, Pa.

WATER-WORKS.—See our Proposal Columns for information regarding water-works and water-works furnishings at the following places: Niagara Falls, N Y.; Watkins, N. Y.; Washington, D. C.; Hinton, W. Va.; Huntington, Ind.; Fort Keogh, Mont.; Muskegon, Mich.; Rochester, N. Y.; Springfield, Mass.

SEWERAGE.

For Additional Sewerage Items see Proposal Columns

GALION, O.—About 9,000 feet of pipe sewers will be constructed in this place. See the Proposal Columns for further information.

GRAND FORK, N. D.—A special city election resulted in carrying proposition to bond the city for sewers for $50,000.

SEWERS.—See our Proposal Columns for information regarding sewers and sewer construction at the following places: Athens, Ga.; Gloversville, N. Y.; Fremont, O.; New Haven, Conn.; Trenton, N. J.; Detroit, Mich.; Gravesend, L. I.; Cleveland, O.; Key West, Fla.; Para, Brazil; District of Columbia; Boston, Mass.; Gardner, Mass.

BRIDGES AND IRON STRUCTURES.

For Additional Bridge Items see Proposal Columns

ROCHESTER, N. Y.—The Common Council has taken the first steps towards replacing the Court Street bridge with a new structure. The estimated cost of the new bridge is $160,000.

AUSTIN, TEX.—A charter was filed here July 12 for the Continental Bridge Co., of Cameron County, Tex. The capital stock is $1,000,000, and its object is to bridge the Rio Grande from near Brownsville, Tex., to or near Matamoras, for railroad trains and other transit, at the option of the corporation. Felician San Roman, of Brownsville, is president.

SEATTLE, WASH.—The following bids for the erection of a bridge over Green River were received by the Kings County Commissioners, July 7: Fred. Brooks, Seattle, 100 foot span, piles for piers driven, $594; Clinton West, Seattle, $775; Harlan & Mattall, Seattle, $850; F. P. George, Seattle, $875.

TORONTO, CANADA.—At a meeting of the Board of Public Works held July 9, the draft was submitted of a proposed agreement between the city and the railways, under which it is intended to substitute for the present wooden bridges on the line of Dundas Street an iron and steel structure costing $55,000, of which the Grand Trunk will contribute $11,000 and the Canadian Pacific, $9,000.

WILLIMANSETT, MASS.—The County Commissioners are having plans prepared by the engineer, Edward S. Shaw, of Boston, for the masonry and superstructure for a new iron bridge across the Connecticut River between Holyoke and Chicopee.

WINONA, MINN.—The contract for the construction of the new railway bridge has been let to the Union Bridge Co., of New York, work to be commenced March 1, 1891. The bridge will be used jointly by the Green Bay, Winona & St. Peter, Chicago, Burlington & Northern and the Winona & Southwestern Railway Companies.

CINCINNATI, O.—There is a project to reconstruct the McMillan Street bridge, at an estimated cost of $35,000.

WHEELING, W. Va.—The date of opening the bids for the construction of a stone bridge at this place has been postponed from July 21 to July 28. See our Proposal Columns.

DULUTH, MINN.—The City Council has decided to build a bridge over the ship canal at this place. The Hon. W. W. Billson will furnish particulars.

BIRMINGHAM, ALA.—The Smith Bridge Co., of Toledo, O., has been awarded the contract for the bridge at Twenty-first Street in Birmingham. The followings bids were received: Southern Bridge Co., superstructure, $35,846; substructure, $1,650. Milwaukee Bridge & Iron Co., superstructure and substructure, plan No. 1, $36,577; plan No. 2, $37,977. Smith Bridge Co., superstructure, $40,000; substructure, no bid. Edgewood Bridge Works, superstructure, $40,695; substructure, no bid. Chicago Bridge & Iron Works, superstructure, $43,698; substructure, no bid. Shiffler Bridge & Iron Works, superstructure, $50,500; substructure, no bid. The Southern Bridge Co. withdrew its bid and the plans of the Milwaukee Bridge & Iron Co. were not accepted.

FAIRHAVEN, WASH.—The Detroit Bridge & Iron Co., of Detroit, has been awarded the contract for building a single-track iron drawbridge for the Fairhaven & Southern Road over the Nooksack River, near here. The bridge has a weight of 335,000 pounds. Four bids were received, the contract for the iron work being awarded at 4¼ cents a pound f. o. b., Chicago.

CHICAGO, ILL.—The Kenwood Bridge Co. has been incorporated here to manufacture and sell iron and steel bridges; capital, $100,000; incorporators, F. W. Baker, Paul Willis and others.

BRIDGES.—See our Proposal Columns for information regording bridge construction at the following places: Boston, Mass.; Wheeling, W. Va.; Marietta, Ga.; Toledo, Wash.

GAS AND ELECTRIC-LIGHTING.

TRENTON, MO.—The Trenton Thomson-Houston Electric Company has been incorporated here, with a capital stock of $10,000. Incorporators, James Anderson, Robert M. Cook, and others.

MILLVALE, N. J.—This place is to have an electric lighting plant.

LAURENCE, N. Y.—The Committee on Streets has been authorized to contract for the lighting of the streets of that city, for a period not to exceed three years, beginning October 1, 1890.

LAS VEGAS, N. M.—A plant is to be established at this place by the Las Vegas Electric Light Company. About $100,000 will be the outlay. T. B. Catron will furnish details.

KANSAS CITY, MO.—Improvements will probably be made to the plant of the Gate City Electric Company.

SANGER, CAL.—This place is to have electric lights.

INDEPENDENCE, ORE.—The people of this place have decided in favor of establishing an electric light plant.

AMSTERDAM, N. Y.—The people of this place have decided in favor of electric lights and a plant will be established here at once.

TAMPA, FLA.—The Florida Electric Co. has been incorporated here and a plant will be established. J. R. Ritter can furnish particulars.

TECUMSEH, MICH.—An electric light plant is to be established at this place by the Tecumseh Electric Co., at an estimated cost of $50,000.

MORRISON, ILL.—An electric light plant is to be established at this place.

SLATER, MO.—Bonds in the sum of $7,750 have been voted here for the purpose of establishing an electric lighting plant.

WAKEFIELD, MASS.—The people of this place have decided in favor of electric light and a plant will be established by the Citizens' Gas Co.

SEATTLE, WASH.—The Seattle Electric Light Co. has been incorporated and will establish a plant at this place, to cost $500,000. J. H. McGraw will furnish particulars.

PASSAIC, N. J.—The Passaic Electric Light Company will increase the facilities of its plant and add new machinery. Two engines, 125 horse-power and 100 horse-power, 80 horse-power generator and 1,300 lights are among the contemplated additions.

LAFAYETTE, IND.—The Lafayette Electrical Manufacturing Company has been incorporated here, and will expend $50,000 on a plant. The secretary is C. G. Longyear.

WAYCROSS, GA.—An electric light plant and gas works will be established and operated at this place by the Satilla Manufacturing Company For details address M. Albertson, as above.

BATESVILLE, ARK.—An electric light plant is to be established at this place by J. W. Hamilton and others.

MARYSVILLE, O.—This place is to have electric lights.

MILLERSBURG, O.—The Millersburg Electric Light Company will establish a plant at this place. For details address P. B. Chase, Secretary, Mount Vernon, O.

ELECTRIC RAILWAYS.—New electric railways will be established and improvements will be made to those already built at the following places: Hebranville, R. I.; Milwaukee, Wis.; Syracuse, N. Y.; Cairo, Ill.; Sedalia, Mo.; Aurora, Ill.

STREET-WORK AND PAVING.

TORONTO, CAN.—Considerable street paving is to be done in this city.

AKRON, O.—Main Street to be paved with brick, one half mile of paving.

PINE BLUFF, ARK.—The Commissioners of Paving District No. 1 of this city will receive bids soon for 6,000 square yards of vitrified brick pavement concrete foundation, etc. Fred. J. H. Rickon, Little Rock, Ark., is engineer of the district.

INDUSTRIAL.

C. A. Blessing, manufacturer and dealer in plumbing material, at Philadelphia, was partially burnt out on July 4, causing a temporary suspension of business. Mr. Blessing will open a new store at 625 Arch Street, Philadelphia, for the display of his sanitary specialties.

NEW YORK CENTRAL IRON WORKS CO.—W. B. Dunning has formed a stock company of $100,000 capital for the manufacture of his patent steam and hot water heaters. It will be known as the New York Central Iron Works Company. Mr. Dunning remains at the head of the new organization as President, and will be assisted by a full corps of practical men in each department. They will continue to manufacture engines and boilers of all kinds, as well as jobbing and repairing; also furnish iron and brass castings of all kinds. It is probable that the capacity of the works will be doubled, and a large amount of new machinery put in.

SALT LAKE CITY, UTAH.—Extensive bathing houses will be established at this place, to cost $300,000.

POTTSTOWN, PA.—Jas. Dunlap is about putting some new carpet making machinery into the old railroad carpenter shop to fit it up for a carpet works. There will be $30,000 to $40,000 worth of machines put in, he says.

GOVERNMENT WORK.

OSWEGO, N. Y.—The following bids for removing and rebuilding superstructure of breakwater were received by U. S. Engineer July 17:

BIDDERS.	Ballasting, Labor only, 6,000 cubic yards.	Leveling.		Oak Timber, 295,206 feet, B. M.	Pine Timber, 858,165 feet, B. M.	Pine Plank, 202,500 feet, B. M.	Screw Bolts, 182,411 pounds.	Drift Bolts, 30,271 pounds.	Wood Screws, 2,756 pounds.	Spike, 18,217 pounds.	Mooring Cleats, each.	Total.
		Timber, 83,520 feet, B. M.	Iron, 4,442 pounds.									
James B. Donnelly, Oswego, N. Y....	$0.60 3,600 00	$33.00 2,756.16	$0.05 222.16	$38 00 11,220 11	$29.00 24,886.79	$28.00 5,670.00	$0.03⅕ 5,837.15	$0.02½ 756.78	$0.04 110.24	$0.03 546 51	$8.00 120.00	$55,725.84
F. B. Campbell, Alvah Wood, } Ithaca, N. Y.	.60 3,600.00	40 50 3,382.56	.05 222.10	48.75 14,394.22	32 25 27,675.82	31.75 6,429 38	.04¾ 8,664.52	.04¼ 1,286.51	.05$\frac{8}{10}$ 159 85	.04$\frac{4}{10}$ 801.55	4.85 72.75	66,689 26
Hoag & Pititdidier, Pittsburg, Pa......	1.50 9,000.00	35.00 2,023.20	.04 177.68	39.00 11,515.37	35 00 30,035.79	35.00 7,087.50	.04 7,296.44	04 1,210.84	.04 110.24	.04 728.68	5 00 75.00	70,160.73

BIDS OPENED.

MINNEAPOLIS, MINN.—By telegraph to THE ENGINEERING AND BUILDING RECORD, July 18, 1890—The following proposals for work on City Hall and County buildings were opened to-day. Bidders: Stone work, Libby & Libby, Maine granite, $1,115,468; Ortonville granite, $1,013,322; Bedford stone, $851,256. Mr. Leighton, Minneapolis, Ohio sandstone, $747,509. E. F. Gobel, Chicago, Ill., Ohio sandstone, $767,860; Bedford stone, $684,768. Hoglin & Morse, Ortonville granite, $999,428; Bedford stone, $865,709. Foster & Smith, Minneapolis, Minn., Bedford stone, $660,871; Ohio stone, $668,172; brown stone, $632,150

Iron Work.—H. N. Leighton, $159,059; Herzog Manufacturing Company, $138,793; Crown Iron Works, Minneapolis, Minn., $152,460; Menzle & Ferguson, Minneapolis, Minn., $181,968, Snead & Co., Louisville, Ky., $154,676; H. A. Streeter, Chicago, Ill., beams alone, $114,894; Haugh, Ketchum & Co., $154,229; Clark, Raffen & Co., Chicago, Ill., $156,775.

Fire Proofing.—Illinois Terra Cotta Lumber Company, $130,438; Pioneer Fire Proofing Construction Company, $122,997; Wright Fire Proofing Company, Chicago, Ill., $124,069; Chicago Fire Proofing Company, $128,818.

PROPOSALS.

(Continued from page x.)

HUNTINGTON, IND., WATER-WORKS.

SEALED PROPOSALS WILL BE RECEIVED until noon of TUESDAY, July 29, 1890, by The Water-Works Manufacturing Company, of Huntington, Ind., for the following items for the Huntington **WATER-WORKS**:

One thousand five hundred and seventy-seven (1,577) tons of cast-iron water pipe, ranging from four (4) to sixteen (16) inches diameter.

Sixty-two thousand two hundred and seventy-six (62,276) pounds of special castings.

Eighty-four (84) six (6) inch double nozzle fire hydrants.

Fifty (50) four (4) inch double nozzle fire hydrants.

Ninety-seven (97) stop valves, from four (4) to fourteen (14) inches diameter.

Ninety-seven (97) stop boxes for above valves.

Laying of above Pipe, and setting of above Special Castings, Fire Hydrants, Stop Valves and Stop Boxes.

One brick Pumping Station.

One brick-lined circular Pump Well.

One timber Intake Pier.

One or two systems of Driven Wells.

Two (2) compound duplex direct-acting pumping engines, each of one million five hundred thousand (1,500,000) gallons daily capacity, together with two (2) return tubular boilers, sheet-iron chimney and all appurtenances necessary to complete said machinery.

Proposals must be made on the blank forms furnished by The Water-Works Manufacturing Company, and all legal formalities must be complied with to secure consideration of the proposals.

Plans for above work may be examined and blank forms of proposal and specifications can be obtained at the office of the Water-Works Manufacturing Company, Huntington, Ind., or the office of the Consulting Engineer, rooms 21 and 22 Glenn Building, Cincinnati, O.

The proposals must be sealed and addressed to The Water-Works Manufacturing Company, Huntington, Ind., and be indorsed with the name of the person, firm or corporation which make the tender, and be accompanied by a certified check, payable to the order of the Treasurer of The Water-Works Manufacturing Company, as follows:

Water pipe and special castings	$500
Fire hydrants	300
Stop valves	300
Pipe laying	500
Pumping station	300
Pump well	100
Intake pier	200
Driven wells	250
Pumping machinery	500

The company reserves the right to reject any or all proposals.

THE WATER-WORKS MANUFACTURING COMPANY,
WILLIAM MCGREW, Pres't.
JOHN W. HILL, Consulting Engineer,
Cincinnati, O.
HUNTINGTON, IND., June 30, 1890.

PROPOSALS FOR CEMENT FOR THE DISTRICT of Columbia.—Office of the Commissioners. Washington, D. C., July 15, 1890.—Sealed proposals will be received at this office until 12 o'clock M., on TUESDAY, July 29, 1890, for furnishing **CEMENT** for the Public Works of the District of Columbia. Blank forms of proposals and specifications can be obtained at this office upon application therefor, together with all necessary information, and only bids upon these forms will be considered. The right is reserved to reject any and all bids, or parts of bids.

J. W. DOUGLASS,
L. G. HINE,
H. M. ROBERT,
Commissioners, D. C.
8

PROPOSALS FOR THE CONSTRUCTION OF Sewers.—Office of the Commissioners, Washington, D. C., July 14, 1890.—Sealed proposals will be received at this office until 12 o'clock M., on THURSDAY, July 31, 1890, for constructing in the District of Columbia, **TERRA COTTA PIPE SEWERS**, Brick Sewers and Receiving Basins. Blank forms of proposals and specifications can be obtained at this office upon application therefor, together with all necessary information, and only bids upon these forms will be considered. The right is reserved to reject any and all bids, or parts of bids.

J. W. DOUGLASS,
L. G. HINE,
H. M. ROBERT,
Commissioners, D. C.
8

JULY 15, 1890.

SEALED PROPOSALS WILL BE RECEIVED at the office of the Supervising Architect, Treasury Department, Washington, D. C., until 2 o'clock P. M., on the 8th day of August, 1890, for all the **LABOR AND MATERIALS** required for the extension of the U. S. Post-Office, etc., building at HOUSTON, TEXAS, in accordance with the drawings and specification, copies of which may be had on application at this office or the office of the Superintendent. Each bid must be accompanied by a certified check for $100. The Department will reject all bids received after the time fixed for opening the same; also, bids which do not comply strictly with all the requirements of this invitation. Proposals must be sealed and indorsed, "Proposal for the extension of the U. S. Post-Office, etc., building at Houston, Tex.," and addressed to JAS. H. WINDRIM, Supervising Architect. 8

PROPOSALS.

COMMONWEALTH OF MASSACHUSETTS.

Metropolitan Sewerage Commissioners.—Notice to Contractors.

SEALED BIDS FOR BUILDING SECTIONS 8 and 9 of the Metropolitan Sewerage System (East Boston) and Sections C and D (Brighton), all in the city of Boston, in accordance with the form of contract and specifications to be furnished by the Board of Metropolitan Sewerage Commissioners, will be received by said Board at its office, 93 Lincoln Street, Boston, Mass., until 12 o'clock M. of WEDNESDAY, August 13, 1890.

No bid will be received unless accompanied by a certified check for the sum of one thousand dollars.

All bids must be made upon the blank forms furnished by the Board.

The exteral diameter of the sewer on Sections 8 and 9 is from eleven to fifteen feet, and on Sections C and D is from six and one-half to nine feet.

Some other particulars are approximately as follows:

Section.	Length. Feet.	Average Depth. Feet.	Cub. yds. Brick Masonry.	Cub. yds. Concrete Masonry.	No. Piles.
8	4,100	15	1,800	4,900	40
9	3,700	14	2,000	4,000	40
C	5,800	15	1,500	2,600	1,000
D	5,400	16.5	1,600	2,400	100

Plans can be seen, and specifications and form of contract can be obtained at the above office.

Each bidder is required to make a statement indicating what sewer and similar work he has done, and to give references that will enable the Board to judge of his business standing.

The Board reserves the right to reject any and all bids.

HOSEA KINGMAN,
TILLY HAYNES,
ROBERT T. DAVIS,
Board of Metropolitan Sewerage Commissioners of Massachusetts.
HOWARD A. CARSON, Chief Engineer. 10

JULY 16, 1890.

SEALED PROPOSALS WILL BE RECEIVED at the office of the Supervising Architect, Treasury Department, Washington, D. C., until 2 o'clock P. M. on the 12th day of August, 1890, for furnishing all **LABOR AND MATERIAL** required for the erection and completion of the U. S. Court-House and Post-Office building at MONROE, LA. (except heating apparatus), including approaches, outhouses, etc., in accordance with the drawings and specifications, copies of which may be had at this office or the office of the Superintendent. Each bid must be accompanied by a certified check for $500. The Department will reject all bids received after the time fixed for opening the same; also, bids which do not comply strictly with all the requirements of this invitation. Proposals must be sealed and indorsed "Proposal for the Erection and Completion of the U. S. Court-House and Post-Office building at Monroe, La.," and addressed to JAS. H. WINDRIM, Supervising Architect. 8

JULY 10, 1890.

SEALED PROPOSALS WILL BE RECEIVED at the office of the Supervising Architect, Treasury Department, Washington, D. C., until 2 o'clock P. M. on the 6th day of August, 1890, for all the **LABOR AND MATERIALS** required in the erection and completion of the U. S. Post-Office building at LOWELL, MASS., (approaches and heating apparatus not included) in accordance with the drawings and specification copies of which may be had on application at this office or the office of the Superintendent. Each bid must be accompanied by a certified check for $500. The Department will reject all bids received after the time fixed for opening the same; also, bids which do not comply strictly with all the requirements of this invitation. Proposals must be sealed and indorsed "Proposals for the Erection and Completion (except Heating Apparatus and Approaches) of the U. S. Post-Office building at Lowell, Mass.," and addressed to JAS. H. WINDRIM, Supervising Architect. 7

TO CONTRACTORS AND BUILDERS.—Office of Lighthouse Engineer, 9th District, Detroit, Mich., July 7, 1890.—Sealed proposals will be received at this office until 4 o'clock P. M. of WEDNESDAY, the 30th of July, 1890, for furnishing the **MATERIAL AND LABOR** of all kinds necessary for the construction and erection of keeper's dwelling, wood shed, elevated walk, etc., required for Cedar River Light Station, Michigan. Plans, specifications, forms of proposals and other information may be obtained on application to this office. The right is reserved to reject any or all bids and to waive any defects. WILLIAM LUDLOW, Lighthouse Engineer.

PROPOSALS FOR SERVICE CONNECTIONS.—Office of Post Quartermaster, Fort Keogh, Mont., July 5, 1890. Sealed proposals in triplicate, subject to the usual conditions, will be received at this office until 12 o'clock noon, on the 5th day of August, 1890, and then opened, for furnishing all the labor required in making **SERVICE CONNECTIONS** with water mains at this post. Specifications, instructions to bidders, and blank forms of proposals will be furnished on application to this office. M. C. MARTIN, 1st Lieut. & R. Q. M. 22d Infantry; A. A. Q. M., U. S. A. 9

PROPOSALS.

OFFICE OF CHIEF QUARTERMASTER, Division of the Atlantic, Governor's Island, N. Y. H, July 12, 1890. Sealed proposals, in triplicate, subject to usual conditions, will be received here until 12 o'clock noon, August 12, 1890, and then opened for construction, at Governor's Island, N. Y. H., of one (1) double set of officers' quarters. All information can be obtained at the office of the undersigned. The Government reserves the right to reject any or all bids. Envelopes containing proposals should be marked "Proposals for Construction of Building at Governor's Island, N. Y. H., and addressed to CHAS. H. TOMPKINS, Assistant Quartermaster General, U. S. Army 9

PROPOSALS FOR MILITARY SUPPLIES. Office of the Quartermaster, U. S. Military Academy, West Point, N. Y., July 9, 1890. Sealed proposals, in duplicate, subject to the usual conditions, will be received at this office until 12 o'clock, noon, on the 8th day of August, 1890, for Gas Coal, Anthracite Coal, Hardwood, Charcoal, Building Materials, Paints, Plumbing Materials, Gas and Steam Fittings, Pulleys, Belting, Arch Plates for Steam Boilers, Fire Brick, Fire Clay, Stationery, Printing Materials, Office Furniture, Brooms, Soap, Brushes, Range Parts, and other miscellaneous stores specified on schedules to be had upon application here. Preference will be given to articles of domestic production or manufacture, conditions of quality and price (including in the price of foreign productions or manufactures the duty thereon) being equal. Inclose proposals in envelope marked "Proposals for Military Supplies," and addressed to the undersigned, CHAS. W. WILLIAMS, Captain and A. Q. M., U. S. A. 9

PROPOSALS FOR PLUMBING, ETC.—Depot Quartermaster's Office, David's Island, N. Y. H., July 1, 1890.—Sealed proposals, in triplicate, will be received until 11.30 A. M., WEDNESDAY, July 30, 1890, and opened immediately thereafter, for supplying and fitting up **BATH-TUBS, WATER-CLOSETS** and **URINALS** in basement of 1888 Brick Barrack at this place. Plans, specifications, general instructions to bidders and blank forms of proposals will be furnished to bidders on application to this office. The right to reject any or all bids is reserved to the United States. Captain J. MCE. HYDE, Assistant Quartermaster, U. S. Army, Depot Quartermaster. 8

SEWERS, Cleveland, O.—Proposals are wanted until July 31, for the construction of certain sewers. Address C. G. Force, City Civil Engineer, as above.

BOILERS, Philadelphia, Pa.—Proposals are wanted until July 29, for furnishing four tubular steel boilers. Address P. F. Harrington, Commander, U. S. N., Lighthouse Inspector, Fourth District, as above.

SEWERS, Gravesend, L. I.—Proposals are wanted until July 28, for the construction of certain sewers, also setting hydrants, etc. Address John L. Voorhies, Town Clerk, as above.

PUBLIC LIGHTING, Cambridge, O.—Proposals are wanted, no date specified, for lighting the public streets, etc., of this place for a term of three years. Address James R. Barr, as above.

STREET WORK, Bond Hill, O.—Proposals are wanted until August 4, for doing certain street work here. Address A. C. Maish, Corporation Clerk, as above.

WATER-WORKS, Springfield, Mass.—Proposals are wanted until July 24, for doing certain work on the improvement of the water supply. Address H. Q. Sanderson, Chairman Water Commissioners, as above.

JAIL, Wheeling, W. Va.—Proposals are wanted until August 11, for the erection of a county jail at this place. Address H. H. Pendleton, Clerk to the Commissioners of Ohio County, as above.

STREET WORK, Binghamton, N. Y.—Proposals are wanted until July 22, for the improvement of numerous streets. Address W. J. Flanigan, City Clerk, as above.

STREET WORK, Cincinnati, O.—Proposals are wanted until July 23, for the improvement of numerous of the city streets. Address Fred. Raine, County Auditor, as above.

BUILDING, Huntington, Pa. — Proposals are wanted until July 25, for the erection of a building to be used as a sewer pipe factory. Address Jacob Snyder, Architect, Akron, O.

HEATING PLANT, West Troy, N. Y.—Proposals are wanted until August 7, for furnishing, etc., a heating plant in the Army Gun Factory at Watervliet Arsenal. Address Lieut.-Col. F. H. Parker, U. S. A., as above.

Building Intelligence.

NEW YORK.

S w cor 99th st and 10th av, br flat; cost, $45,000; o, L Rogers; a, F T Camp.

5 and 7 w 81st, 2 br dwells; cost, $50,000 all; o, G C Currier and W B Baldwin; a, not given.

S s 104th st, 100 w Alexander av, 6 br flats; cost, $90,000 all; o, F Rohis; a, W H C Hornum.

E s Avenve A, 25 n 72d st, 2 br tens; cost, $30,000 all; o, J J Reilly; a, as above.

117–19 Mercer st, 2 br stores; cost, $30,000 all; o, R Lecorn; a, G Provost.

131 E 19th st, 2 br flats; cost, $20,000 all; o, C Natale; a, A Hutton.

BUILDING INTELLIGENCE.

NEW YORK.—Continued.

160 Henry st, br flat; cost, $20,000; o, A Harris; a, C Rentz.

S s 118th st, 60 e Madison av, 5 br flats; cost, $90,000 all; o, N Confortis; a, not given.

Ns 119th st, 125 w 8th av, 3 br flats; cost, $45,000 all; o, J Thompson; a, J C Keit.

156–60 Hester st, 108–108½ Mott st, br factory; cost, $95,000; o, P Nathan; a, A Wagner.

S s 128th st, 160 e Park av, 2 br flats; cost, $36,000 all; o, J Frame; a, Thom & Wilson.

N w cor 72d st and Lexington av, br hotel; cost, $50,000; o, Mrs S Levenson; a, F Koehler.

S e cor 107th st and Madison av, br flats; cost, $20,000; o, M Reilly; a, G H Griebel.

107th st, 100 from Madison av, 7 br flats; cost, $126,000 all; o and a, as above.

Blackwell's Island, br hospital; cost, $8,000; o, City of New York; a, Withers & Dickson

Blackwell's Island, br lunatic asylum; cost, $25,000; o and a, as above.

N s 95th st, 385 e Amsterdam av, br dwell; cost, $15,000; o, D Christie; a, F A Minuth.

237 E 103d st, br flat; cost, $15,000; o, C Nurge; a, B W Berger.

762–766 Broadway, brick, iron and stone warehouse; cost, 65,000; o, S Dessau; a, Schneider & Herter.

4–6 W 4th st, brick, iron and stone bldg; cost, $40,000; o, Havens & Winters; a, R S Townsend.

South 5th av, n w cor Bleecker st, br and iron store bldg; cost, $45,000; o, P H McManus; a, Cleverdon & Putzel.

436 E 18th st, br structure; cost, $16,000; lessee, F Vettel; a, B W Berger.

554–562 W 25th st, br factory; cost, $12,000; o, J W Felter; c, Outwater & Felter.

410 W 48th st, br and s flat; cost, $20,000; o, m and c, R Dick; a, M V B Ferdon.

916 2d av, br flat; cost, $19,000; o, T Fitzgerald; a, Ogden & Son.

75th st, s s, 75 e 9th av, 5 s dwells; cost, bet $24,000 and $27,000 each; o, J T Hall; a, G H Budlong; m, Butler & Mahoney.

84th st, n s, 250 w 10th av, rear, br stable; cost, $2,000; o, and m, C T Wills; a, Berg & Clark.

98th st, n s, 100 e Columbus av, s flat; cost, $20,000; o, A Cameron; a, H Davidson.

98th st, n s, 225 e Columbus av, s flat; cost, $22,000; o and a, same as above.

102d st, n s, 300 e 10th av, 3 br and s flats; cost, $20,000 each; o, F Hack; a, Cleverdon & Putzel.

106th st, n s, 265 w 9th av, 3 br flats; cost, each, 23,000; o, J J Barnes, Jersey City; a, A Birch.

115th st, n s, 200 e 8th av, br and s flat; cost, $18,000; o, W T Coggeshall; a, A Spence.

165 W 122d st; br and s dwell; cost, $15,000; o and m, I A Hopper; a, R S Townsend.

Railroad av, w s, 144 n 161st st, 3 fr dwells; cost, $3,500 each; o, C Vallender; a, C C Churchill; c, A Ferguson.

ALTERATIONS—NEW YORK.

299 Madison av, extension; cost, $10,000; o, Fannie L Hellmuth; a and c, Wm Baker.

514 5th av, extension, interior alterations and walls altered; cost, $10,000; o, m and c, D H King, Jr; a, C S Luce.

MISCELLANEOUS.

ADAMS, MASS.—High school, 2 stories, 50x70; cost, $12,000; a, C T Rathburne, of Pittsfield.

AKRON, O. — Forge st, br shop; cost, $8,000; o, Robinson Bros & Co.

ANN ARBOR, MICH.—A $20,000 res will be erected here. Address E W Arnold, 57 Buhl Block, Detroit, Mich.

ATLANTA, GA.—2½-story fr res; cost, $8,000; o, Thos Peters; a, G W Myers, of Detroit; b, not let.

BEARDSTOWN, ILL.—An $8,000 hotel will be erected here. Address A M Smith, as above.

BUILDING INTELLIGENCE.

BALTIMORE, MD.—S w cor Lombard and Green, 3-story br bldg; o, Maryland Infirmary.

Light near Lee, 3-story br bldg; o, Baltimore, Chesapeake and Richmond Boat Co.

Patterson, Park av and Gough, br church; o, Faith Reform Church.

N e cor Madison and Roberts, stone church; o, The Hebrew Synagogue.

S e cor Charles and Huntington av, 6 3-story br bldgs; o, W F Webber.

1014 Valley near Eager st, 3-story br bldg; o, Theo Rosensteel.

Charles near Ostend, br chapel; o, Advent Chapel.

Hollins near Parkins, 2 3-story br bldgs; o, J Knefely.

N e cor 11th and Boundary, fr cottage; o, Frederick Utterbaugh.

BELAIRE, O.—3 stores and dwells; cost, $10,000; o, H Schumlback; a, Jos Leina; b, not given out.

BOSTON, MASS.—54–56 Market st (Bri), 2 fr dwells; cost, $9,000; o, Margaret Denver; a and b, R Ryan.

Humboldt av, cor Homestead st (Rox), fr dwell; cost, $9,000; o, L Foster Morse; a, Arthur Little; b, C H Blodgett.

Whitten st, off Hampshire st (Rox), 6 fr dwells; cost, $18,000; o, Silas Pierce; a, G F Crosbie; b, Cassidy & Davis.

Huntington av, nr W Chester pk, br clubhouse; cost, $65,000; o, Elysium Club; a, L Weisbein & W H H Jones; b, W A & H A Root.

6–8 Brookford st (Rox), double fr dwell; cost, $13,000; o, Edwin Frothingham; a and b, Marquis & Chapman.

4 to 10 Elmore st (Rox), 4 fr dwells; cost, $26,000; o, a and b, J J Johnson.

Tufts, Essex and Lincoln sts, iron mercantile bldg; cost, $7,000; o, U S Hotel Co; a, Fred Pope; b, J G Scott.

2221 Dorchester av (Dor), fr addn and alteration; cost, $5,000; o, Rev J J Williams; b, G K Cavanagh.

133 Dartmouth st, br addn and alteration; cost, $8,000; o, H R Merrill & Co; a, S D Kelley; b, Currier & McCoy.

BRAINTREE, MASS.—Bldgs costing $15,600 all.

BRIDGEPORT, CONN.—Cor North av and Parallel st, br and stone dwell; cost, $60,000; o, St Patrick's R C Church; a, Murphy, of Providence, R I; b, P Garvey.

CAMBRIDGE, MASS. — Valentine st, br dwell; cost, $8,020; o, C L Jones & Co.; a, T Johnston; b, McDonald & Co.

42 Harvard st, fr factory; cost, $6,000; o and b, F H Holton; a, W Williams.

Orchard st, br and fr bldg; cost, $7,250; o, Wm C E Patch; a, F M Eaton; b, R H Callupy.

CANTON, O.—S e cor Market and 4th sts, pressed br bus block; cost, $10,000; o, Sharer Bros; a, Guy Tilden; b, not let.

CHARLOTTE, N. C.—An auditorium bldg will be erected here at a cost of $15,000. Address George B Hanna, as above.

CHICAGO, ILL.—1722–24 York place, br flats; cost, $10,000; o, A Schneider; a, Frowann & Gebson; b, Jno Woodstrom.

Terry av and 73d st, br dwell; cost, $8,000; o and b, Schields & Cooke; a, Robert Rae.

4346 Grand boulevard, br dwell; cost, $12,000; o, A Mendell; a, R G Pentecost; b, O Anderson & Co.

4921 Madison av, br dwell; cost, $10,000; o, A H Trotter; a, F W Perkins.

5623 Drexel av, br dwell; cost, $10,000; o, E L Garlott; a, J A Miller.

423 Cottage Grove av, br store and flats; cost, $11,000; o, Mrs C F Johnson; a, C C Foote.

265 W Indiana st, br store and flats; cost, $12,000; o, Pat Monihan.

322–24 Hermitage av, br flats; cost, $8,000; o, Geo Turnbull; a, Elmslee.

495–535 Washburn av, boiler shop; cost, $80,000; o and a, same as above.

1904 Wabash av, br store and flats; cost, $10,000; o, Wm H Emerson; a, F L Charley; b, Wm M Crilly.

BUILDING INTELLIGENCE.

CHICAGO, ILL.—Union and Mark sts, br flats; cost, $8,000; o, Geo Tegtmoyer; a, F Ahlschlager.

428–30 Cleveland av, br flats; cost, $15,000; o, R Henderson; a, A F Hussander; b, J Olson & Son.

Milwaukee av and Holburn st, br store and flats; cost, $35,000; o, M E Tabor; a, J E O Pridmore; b, J B Sweet.

197 California av, br flats; cost, $8,000; o, Mrs A C De Luce; a, J M Haskins; b, H Hughes.

114–16 Hoyne av, br factory; cost, $22,000; o, Peter Fahrrey; a, C A Weary; b, W D Price.

345–53 Michigan av, addn br story; cost, $8,000; o, Manual Training School; a, S S Bowan; b, Barney & Rodatz.

1077–79 W Harrison, br livery stable; cost, $10,000; o, Frank Warren; a, Edbrooke & Burnham; b, C & A Price.

270 Sedgwick, br store and flats; cost, $14,000; o, Mrs M A Smith; a, H Sierks; b, Rodgers & Koch.

1267–1317 W 12th, br foundry; cost, $150,000; o, Fraser & Chalmers; a, Raeder & Coffin.

3005 Indiana av, addn to church; cost, $20,000; o, Fifth Presbytertan Church; a, J T Long; b, W & S Nelson.

2968 Lake Park av, br dwell; cost, $14,000; o, O S Lyford; a, J J Egan; b, Slattery & Sons.

1552–62 Wilwaukee av, br store and flats; cost, $70,000; o, Mrs Marie Schueltler; a, H Sierks; b, O W Menke.

194–202 Van Buren, br store and flats; cost, $80,000; o, E J Monaghan; a, Lamson & Newman; b, Ed Lehman.

552 Halsted, br st, cost, $10,000; o, L Klein; a, Furst & Rudolph; b, T Nicholson.

119 Dearborn, additional stories; cost, 50,000; o, Mrs Mary Jones; a, Burnham & Root.

308 W Erie, br store and flats; cost, $10,000; o, Martin Olson; a, Lutken & Thieslen, b, A Nelson & Son.

3801–11 Prairie av, br dwells; cost, $35,000; o, E A Springer; a, Pond Bros; b, Hammond & Chapman.

866–70 W Madison, br store and flats; cost, $25,000; o, Judge M F Tuley; a, Wm Strippelman.

222–26 Campbell av, br flats; cost, $12,000; o and b, Chapman Bros; a, F B Townsend.

267 Franklin, br store and flats; cost, $15,000; o and b, H T Lundgren; a, Ostling Bros.

N California av nr Kinzie, br foundry; cost, $30,000; o, Griffen Wheel and Foundry Co; a, E Lee Heidreich.

177 buildings costing less than $7,000 each.

CHARLESTON, S. C.—Nothing over $7,000 in value to report.

CINCINNATI, O—N w cor Horton and Saffron sts, 2-story br church; cost, $11,500; o, St. Martin's Congregation; c, C F Meyers.

Miami Canal and Dodsworth st, 3 and 5-story br warehouse; cost, $10,000; o, Clifton Springs Distillery Co.; a, O H Meyers.

Langland st, Cumminsville, 1 story passenger station; cost, $7,000; c, Walker Branch.

4th and Race st, 7-story br addn to St. Nicholas Hotel; cost, $50,000; o, Carlisle Estate; a, A C Nash and H E Siter.

S e cor Wheeler and Warner st, 2½-story br dwell and ten; cost, $8,500; o, M Rothschild; a, G and A Brink.

Vine and Mulberry sts, 4-story br store and flat bldg; cost, $16,000; o, Louis F Ahlers; a, as above.

CLEVELAND, O. — Madison av, West Cleveland, br and s 8 room bldg; cost, $25,000; o, Board of Education, West Cleveland; a and b, not let.

COLUMBUS, O—Long st, s and br business block; cost, $30,000; o, M G Lilley Co.

Long st, shops, etc., cost, $13,000; o, same as above.

Long st, 7 dwells; cost, $19,200; o, same as above.

BUILDING INTELLIGENCE.

DENVER, COL.—Sherman av, bet 12th and 13th sts, br and stone dwell; cost, $15,000; o, W R Thompson; a, Varian & Sterner.

Union Depot prop., br and stone addition; cost, $30,000; o, Union Depot Co; a, same as above.

Highland st, pressed br dwell; cost, $8,000; o, E W Ray; a, same as above.

Capitol Hill, Roman br dwell; cost, $15,000; o, F Miller; a, same as above.

Arapahoe st, bet 21st and 22d sts, br store; cost, $8,000; o, F Garbarshy; a, same as above.

Lincoln av, bet 2d and 3d sts, br dwell; cost, $7,000; o, Geo K Speer.

DETROIT, MICH.—S w cor Trumbull and Alexandrine avs, 2½-story br and stone res; cost, $12,000; o, Wm Northwood; a, Geo E Depew; b, individual contracts.

N w cor Trumbull and Alexandrine avs, 2½-story br and stone res; cost, $10,000; o, Wm J Howard; a, same as above; b, not let.

S s Montcalm st, bet Antoine and Hastings sts, 5 2½ story br res; cost, $15,000; o, Theodore Gorenflo; a, P Dederichs, Jr; b, not let.

E s Mt Elliot and opposite Hendricks av, 2½-story br res and barn; cost, $7,000; o, G Burlage; a, same as above; b, not let.

Kanter, Hamlin and Baltimore avs, 41 2-story fr dwells; cost, $82,000; o, R M Baham.

151 E High st, 2-story br res; cost, $8,000; o, Dr F D Wheeler.

DULUTH, MINN.—Architects Palmer & Hall have prepared plans for the erection of a $250,000 high school building at this place.

FINDLAY, O.—White addition br school bldg; cost, $8 600; a, Wm Burge, Toledo, O; b, Brake & McMillan.

FORT WORTH, TEX.—Frank W. Kane, architect, is preparing plans for a brewery to cost $95,000; plans will be out in a few days. Also one large business house to cost $37,500.

GALVESTON, TEX.—Wharf front, warehouse, N Y & Texas Steamship Co; cost, $11,000; o, C H Mallory & Co; a, N J Clayton & Co; b, not let yet.

GROSSE POINTE, MICH.—2½ story fr and br res; cost, $7,000; o, John Villoran, Detroit; a, L M Smith & Son, Detroit; b, not let.

HOLYOKE, MASS—Br addition, 4 stories, 60x100; o, Connecticut River Paper Co; a, E A Ellsworth.

KNOXVILLE, TENN.—S B Luttrell has prepared plans for the erection of a $25,000 residence at this place.

MARSHALL, TEX.—A $10,000 church will be erected here. Address J B Carter, as above.

MILWAUKEE, WIS.—S e cor 14th and Vliet sts, stockhouse; cost, $5,000; o, Thos Given; a, Chas Kirchhoff; b, Hausmann Bros.

Eastwater and Huron sts, stockhouse; cost, $13,000; o, H Ludington; a, H C Koch & Co; b, A Wendt.

Cor Eastwater and Huron sts, stockhouse, cost, $65,000; o, D Adler; a, same as above, b, Kiesen Bros.

MINNEAPOLIS, MINN.—S e cor Main and Bank sts, 5-story br piano factory, cost, $50,000; o, Century Piano Co; a, A F Struch.

88–98 Central av, 3-story br stores and flats; cost, $20,000; o and b, A Gagnon; a, J H Record.

S Wash av, bet 10th and 11th avs, 2-story br stores and flats; cost, $13,000; o, J M Robertson; a, Orff Bros; b, Pike & Cook.

BUILDING INTELLIGENCE.

MINNEAPOLIS, MINN.—A police station, to cost $15,000, will be built at 35th st and 20th av.

1815 Kenwood boulevard, br dwell, cost, $8,000; o, C S Brockett; a, Geo Bertrand, b, J H McClay.

1101–3–5 n 20th av, br stores and flats; cost, $15,000; o, E B Hubbard; a, F B Hart; b, Seymour & Hart.

MT. CLEMENS, MICH. — A $150,000 hotel will be erected here. Address N J Gibbs, as above.

PEORIA, ILL.—Plans have been prepared for the erection of a $90,000 hotel at this place. Address Architect N J Gibbs, Mt Clemens, Mich.

PHILADELPHIA, PA. — Holmesburgh Junction, administration building; o, W R Dougherty.

PORTLAND, ORE.—Stone city hall; cost, $500,000; o, city of Portland; a, H J Hefty; b, not let.

READING, PA.—5th and Elm sts, 2-story Queen Anne bldg; cost, $10,000; o, A Hoff; a, Smith Bros.

5th and Exeter sts, 2-story s church; cost, $12,000; o, Rev Stoner.

SHOLES, IND.—M. Q. Wilson, architect, Louisville, Ky., has prepared plans for a hotel near here, to cost $30,000, also for another hotel in an Indiana town.

SOUTHERLAND, FLA.—A hotel will be erected here at a cost of $100,000. Address C T Taylor, Barker Block, Omaha, Neb.

ST. LOUIS, MO.—Vandeventer place and Grand av, addition to br dwell; cost, $7,000; o, Chas Clark; b, J W Givens.

Wabash and Boyle avs, br power house; cost, $15,000; o, Missouri R R Co; b, Milburn & Rich.

Easton and Ewing avs, br store and dwell; cost, $7,900; o, J A Scudder; b, same as above.

Rauschenbach av and Benton st, br dwell; cost, $8,000; o, F H Schlingman; b, H Schulte.

Clemens and Goodfellow avs, fr dwell; cost, $7,000; o, P A Wilcox; b, E Marlatt.

Cabanne and Goodfellow avs, fr dwell; cost, $9,000; o, Mary Hausman; b, sublet.

N w cor 2d st and Clark av, br store; cost, $30,000; o, M Forster; b, A H Haessler.

ST. PAUL, MINN.—Iglehart st, near Milton st; 7 fr dwells; cost, $17,150, o, John Elms.

Mound st, near Earl, 2-story br dwell; cost, $28,000; o, J F Eisemmenger.

Dayton st, near Kent st, 2-story br dwell; cost, $8,000; o, J W Miller.

Rice st, near Front, 2-story br store; cost, $8,000; o, Frank Haines.

WHEELING, W. VA.—Store bldg, granite front; cost, $25,000; o, Geo E Stifel & Co; a, Jos Leina; b, not given out.

Cor 17th and Eoff sts, store and dwell, br, s and pressed br trimmings; cost, $8,000; o, Leop Schafer; a, same as above; b, Wittkuhn & Karcher Bros.

Mt Fulton nr Wheeling, 5 fr residences; cost, $5,000; o, F Schafer; a, same as above; b, not given out.

WILKES BARRE, PA.—Butler alley, br tens and stables, cost, $12,500; o, L C Paine estate; b, P R Raife.

WAVERLY, N. Y.—A $15,000 church will be erected here. Address Rev L E Wheeler, as above.

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When a change of address is desired, both the old and new addresses should be given.

Discontinuances.—We must be notified by letter when a subscriber wishes his paper stopped. All arrearages must be paid.

The Courts have decided that all subscribers to newspapers are held responsible until arrearages are paid and their papers are ordered to be discontinued.

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THE WESTERN UNION BUILDING FIRE.

THE recent fire in the Western Union Telegraph Company's building in New York City has attracted unusual attention, partly because it resulted in widespread inconvenience to the public and partly because so furious a conflagration occurred in a structure intended to be fire-proof. Very large and high buildings, intended chiefly for business offices and constructed with special reference to resisting fire, have multiplied in the principal cities of the country in recent years, and this case is full of interest. A portion of the daily press in various parts of the country has jumped to the conclusion that the building was not properly constructed and condemned almost everybody concerned without discrimination. To get at the real facts of the case, especially as to the structure itself, a member of the editorial staff of this journal has made an investigation as complete as the circumstances would permit, and his report is given in another column.

Some facts with regard to the fire are hard to establish, and precisely what injury was sustained by the building cannot be known until the walls and floors are taken down, but it is at least true that the catastrophe does not show the method of construction adopted a failure as against fire. The upper floors of the building had wires numbered by thousands, mostly insulated, and with paraffine and other highly inflammable substances largely used as insulating material, besides which there were a large number of wooden tables, quantities of paper, etc., in the rooms. All this burned like tinder; so fiercely, in fact, as to imperil the lives of some of the persons in the building, but the structure itself did not collapse. That, in a nutshell, is the whole case. The upper stories of the building are to be reconstructed, but, so far as appears, this course is taken rather to improve the interior arrangement than from any fear that the walls and floors are seriously injured.

ROPE TRANSMISSION OF POWER.

SYSTEMS of rope transmission of power in manufacturing establishments have been in use for many years, but it is only quite recently that they have given promise of becoming more widely recognized as convenient and efficient means of accomplishing the ends for which they were designed. The results which have been obtained with them, it is true, have not in all cases been of uniform excellence, but this has been mainly due to the fact that designers have occasionally failed to properly appreciate the requirements of good workings. Where rope driving has been tried and has failed, examination has almost invariably revealed a disregard of correct principles of construction, and has shown nothing calculated to detract from the favor with which the system is regarded, especially where continuous high speed is required.

As regards the comparative cost of rope and other systems of transmission, and the average life of a rope of the kind ordinarily used in manufacturing establishments, it is difficult to get any precise data. As compared with leather belting, however, we have seen figures making a very favorable showing for rope, the relative cost having been in the ratio of about 8 to 1. As to the life of a rope, it has been roughly estimated that, with proper usage, it should not be less than about seven years. Cases where ropes have suddenly broken are few in number, the risk in this respect being reduced by the fact that any defects in a rope, arising from wear or other causes, will show themselves long before the point of danger is reached. In mill districts, particularly, engineers have not been slow to avail themselves of these advantages, and with the cotton rope, which is there chiefly used, most satisfactory performances have been recorded. It is but natural that, under these circumstances, the field of practical usefulness of rope driving is gradually being extended. The system has already spread from general mill practice to various kinds of manufacturing establishments, and those who have adopted it have had little cause for regret.

With wire rope transmissions for out-door use, and with long spans, running up as high as about 1,000 feet, serious trouble had been found to arise from excessive vibrations of the rope. Careful management, however, has had the effect of almost entirely eliminating these disturbing influences, and instances are now not rare where such long spans are used with perfect satisfaction,—that at Sibley College, Ithaca, N. Y., affording a good example. The span there, we believe, amounts to fully 1,100 feet, and, with some modifications in the plan as originally put into practice, no difficulty has been encountered in obtaining good results.

CARE OF HEATING BOILERS.

THE question of what should be done with a boiler when out of use and laid up for some time—a house-heating boiler during the warmer months of the year, for example—so as to best protect it against corrosion and general deterioration, has been frequently asked. The answers have, in the main, concerned themselves with the matter of internal corrosion, and various more or less effective methods of guarding against this have been suggested. One very important source of trouble and expense—external corrosion—has, however, been generally overlooked. With large boilers, used for power purposes, and under the care of trained attendants, this matter has received some attention, and proper measures are generally taken to protect the boilers on the outside as well as inside. The average house-heating boiler, on the other hand, is comparatively neglected in this respect, and to it, consequently, our remarks apply more particularly.

One of the principal causes of rapid destruction of boiler plates from without, when boilers are out of use, is the presence of sulphur in its different forms, as evolved by the coal burnt on the grates. This sulphur, besides being brought into direct contact with the heating surfaces by sublimation, tending to cause red-shortness in the metal, acts also in the forms of sulphurous and sulphuric acids which are held by soot deposits in flues and other convenient lodging places in the boiler. The sulphurous acid is formed directly by the combustion of coal, and rapidly changes to sulphuric acid in the presence of iron and of the moisture absorbed by the soot. The energy and rapidity with which sulphuric acid attacks iron is well shown by the familiar rapid rusting, as it is popularly termed, of stove pipes attached to stoves which are not used during the summer. This so-called rusting is brought about in exactly the way just described, and is nothing more than sulphuric acid corrosion. Careful cleaning of the flues and other portions of the heating surface of a boiler is the only practicable means of guarding against this form of deterioration, and should be given careful attention, particularly at the end of the cold weather term, when a house-heating boiler is thrown out of use for a comparatively long period. Compared with the internal corrosion, or common rusting of a boiler, due to dampness, when empty, the external ravages of sulphuric acid are accomplished with great rapidity and should be promptly met with suitable preventive measures.

FIRE IN A FIRE-PROOF BUILDING.

THE recent disastrous fire—that barely escaped being fatal as well—in the upper part of the Western Union Telegraph Company's building in New York City has excited especial comment and attention on account of its rapidity, violence, and the destruction caused in broad daylight in a building of modern fire-proof construction prominently situated in the down-town business part of the metropolis, and where the best skill and efforts of experienced firemen, with abundant water and apparatus, were immediately available. The building is on the corner of Broadway and Dey Street, is about 80x150 feet, and eight stories high from the street to the roof, with floors in the roof as hereafter described, and a tower about 50 feet high; it was built of stone, brick and iron, and was occupied chiefly by the telegraph company.

The rolled iron floor beams, 10 to 15 inches deep, were carried by the masonry walls and intermediate cast-iron tubular columns. Brick arches were turned between the floor beams, upon whose lower flanges they rested, and the floors were of cement or tiles on concrete bedding; the partitions and the wall linings were of plaster blocks. Some of the ceilings were formed by the floor arches themselves, and others were flat plastered on iron tees or angles suspended from the floor beams.

Air chambers were left between the brick piers and the brick facing walls.

The roof was very steep and contained one nearly full story and two stories of lofts above that. The rafters were of rolled I beams in several sections, their depth diminishing to the top, where some of those at the valleys were trussed, king-post fashion. Angle-iron purlins, closely spaced, supported the slates, and the cornice, etc., was cast iron. The main stairways were cast iron, but the spiral stairway in the tower had a light wrought iron frame and wooden tread. The elevator shaft was of brick.

The wooden door and window frames were about all the combustible material included in the real construction of that part of the building which was burned, although a gallery in the operating room had a wooden floor and railings supported on light uncased iron beams. The lower flanges of the floor beams and the columns were not sheathed or fireproofed. The seventh story was only seven feet high and was used as a battery and storage room, containing 50 battery stands, which consisted, essentially, of vertical wooden walls and horizontal wooden shelves built of pine, exceedingly dry, and stained and saturated with the oil that was used in the tops of the battery cells. A set of wardrobes was at one end of the room. The ceiling of this room was covered with multitudes of insulated cables and wires connected with the switch-board, and the operators' tables above. Part of these wires were covered with gutta percha, which of course is very inflammable, but many of them were said to have been recently re-covered with an insulation considered fireproof, and which did burn off in this case.

The eighth story was used for the operating room, and contained at one side the switch-board, beneath which, through a large hole in the floor, came the wires from the battery room. The operating room was filled with wooden tables, each accommodating four operators, placed in rows as close together as possible. Under each table was a small iron well, a few inches square, through which the wires came up to the instruments.

On the ninth floor were the offices of the Associated Press, some private offices, and the restaurant. The lofts above were mainly used for storage, and contained great quantities of books and papers, in piles and in racks made of sheet iron and gas pipe. Considerable paper was of course contained in the operating rooms and offices, much of it being a fine, soft tissue paper, in loose sheets and bundles.

The fire is supposed to have been caused by crossed electric light wires, and first broke out about 7 A. M., July 18, in the battery room, which was open on both sides with full opportunity for a draught through. The flames came up through the floor of the operating room and almost immediately set fire to the dry tables all over the room, then quickly reached the lofts and tower, barely allowing the fifty people there time to escape, which they did, some through the elevator which was run from the fifth floor.

The woodwork and contents of the battery and operating rooms were wholly consumed with the most of that in the Associated Press and office rooms above. The restaurant and kitchen and some private rooms in the rear of the lofts were not much injured. The front of the lofts and the tower were thoroughly burned out as to woodwork, trimmings, etc., though not much of the solid paper and books was consumed. The fire did not go below the battery room, where it originated and apparently made its principal ravages on the inflammable contents of the building. A hasty examination by a member of the editorial staff of THE ENGINEERING AND BUILDING RECORD disclosed remarkably small injury to the building. The floors appeared practically intact where visible or where cleared of the plaster, paper and other debris that was two feet deep in places. None of the columns examined were broken nor had apparent cracks. The main walls appeared sound and the most of their hollow brick facing was good. But few cracks were noticed in the cast-iron main stairway, which is in service now.

The roof endured well, little or no damage or distortion being evident in the heavy lower sections of the rafters. Some of the upper sections were bent and warped, and one piece entirely crippled, but many pieces not bent at all. Some of the trussed rafters had their tie rods and struts broken, etc. Much of the light wrought-iron frame of the spiral stairs in the tower retained its shape and position, but the wooden steps were consumed. The sheet-iron shelves were destroyed, and the 6-inch rolled iron gallery beams in the operating room were badly bent and twisted.

The roof and cornice trimmings were of cast iron and were not greatly damaged.

The fire lasted an hour and burned until the fuel was about exhausted. Much of the damage was done by the water and it is estimated that the building, instruments, etc., could be restored to the same condition as before the fire for about $100,000. The condition of the building is considered suitable and safe for such a restoration but the Western Union Company has decided to improve the opportunity to make some desired alterations and will rebuild the upper part of the building at a cost of about $500,000.

The lower stories of the old building are still occupied. The building was finished in 1871 at a cost of about $2,000,000. George B. Post, of New York, was the architect; J. T. Smith and J. B. & J. M. Cornell, also of New York, were the principal contractors; the former for the masonry and the latter for the iron work.

PLANS FOR IMPROVING BROOKLYN BRIDGE WANTED.

A NOTICE is issued by the Brooklyn Bridge Company as follows:

> "Notice is hereby given that the Board of Experts appointed to prepare plans for the improvement of the termini of the New York and Brooklyn Bridge in the two cities will receive plans for the improvement of the termini from any person who may choose to submit them. Plans must be in writing, and must be accompanied by drawings. No compensation will be given to any person for plans or drawings submitted unless such plans or drawings, or some portion thereof, shall be adopted, and in such case the compensation for such plan and drawing will be fixed and determined by the Board of Trustees.
>
> "The decision of the Board of Trustees upon all the questions relating to compensation shall be final and not subject to question or review. The plans must be submitted to the Board of Experts, addressed to C. W. Buckholz, Secretary, at the office of the bridge trustees, on or before September 1. Due notice will be given hereafter of the time and place where oral explanations will be heard.
>
> "Any information concerning the subject matter can be obtained at any time at the office of the trustees of the bridge."

SYDNEY, Australia, is to have an hydraulic power system, modelled, in the main, after that in successful operation at London, England. The undertaking is in the hands of the Sydney and Suburban Hydraulic Power Company.

OBITUARY.

J. ROLAND SMITH, assistant in the City Engineer's office, Albany, N. Y., died July 20, at the age of 22 years.

HENRY J. DAVISON, M. Am. Soc. M. E., died suddenly at Liverpool, July 22, on the steamer "Majestic," on which he was about to sail for America. He was born in New York City in 1835, where he had always lived. He was prominent as a mechanical engineer and manufacturer, and was connected with many business enterprises. He became superintendent of the Novelty Iron Works in New York City when only 20 years old, a year later went to New Orleans and built the two Bogardus baking ovens, which cost $400,000, then directed the taking down of the tower of the Crystal Palace in New York, for which the Common Council gave him a vote of thanks, and afterward built steamboats and machinery to be shipped to South America in sections. In recent years Mr. Davison gave his attention chiefly to gas-works, of which he erected a considerable number, introducing a water-gas system.

PERSONAL.

W. A. SOMERS has been elected Assistant City Engineer of St. Paul, Minn.

F. L. SIZER and J. S. Keerl have opened a general engineering office at Helena, Mont.

D. BONTICOU has been appointed Engineer of the Kansas City, Fort Scott and Memphis Railroad.

J. K. SROUFE has been appointed Engineer of Maintenance of Way of the Kentucky Union Railway.

RICHARD E. GANNON has been appointed Superintendent of the new Water-Works at Murphysborough, Ill.

JOHN BOGART, New York State Engineer, with Mrs. Bogart, sailed, July 19, on the Etruria, for a two months' vacation in Europe.

THOMAS W. GANNON, who has had charge of the Cairo, Ill., Water-Works for the past four years, has been appointed Superintendent.

RUDOLPH MEYER, civil engineer, San Antonia and Aransas Pass Railroad, has moved from San Antonio, Tex., to Monterey, Nuevo Leon, Mexico.

A. E. ALBY, C. E., has resigned his position as Assistant Engineer of the Elmira Bridge Company, to become General Manager of The Fire Proof Flooring Company, with main offices at 18 Broadway, New York City.

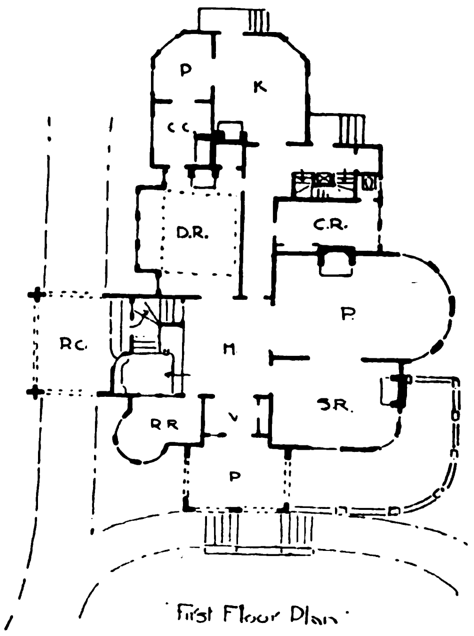
F. W WHITLOCK, Assistant City Engineer of Waterbury, Conn., is acting as City Engineer, by order of the Board of Sewer Commissioners, pending the filling of the vacancy caused by the death of City Engineer F. F. Weld.

HENRY H. KENDALL and Edward F. Stevens, architects, have opened an office at 8 Oliver Street, Boston, Mass. Mr. Kendall was recently at 40 State Street, and Mr. Stevens was clerk of the works at the new public library.

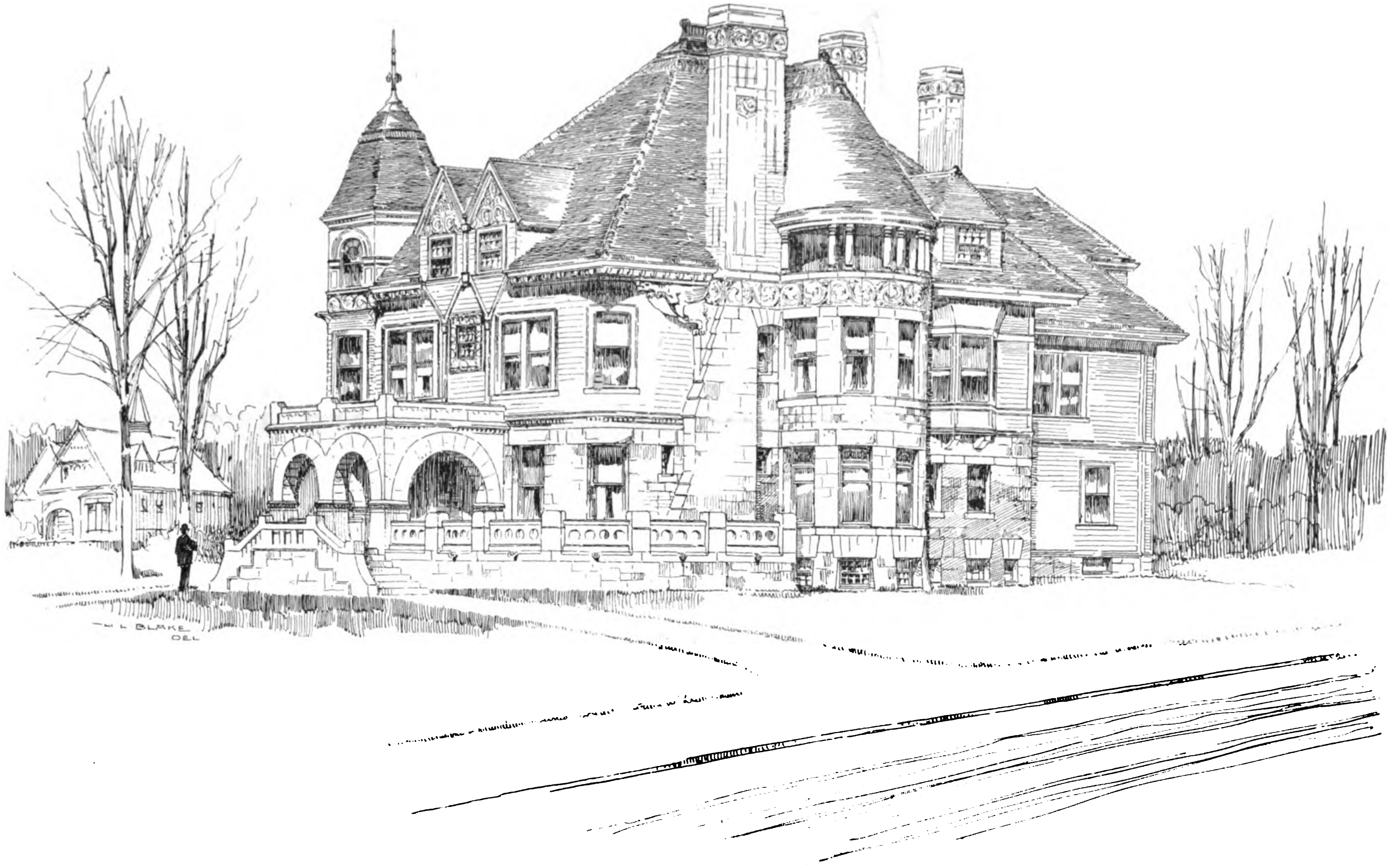
OUR ARCHITECTURAL ILLUSTRATIONS.

C. M. RUSSELL'S HOUSE, MASSILLON, O.
WILLIAM G. PRESTON, ARCHITECT, BOSTON, MASS.

HOUSE AT WABAN, MASS.
H. LANGFORD WARREN, ARCHITECT, BOSTON, MASS.



C. M. RUSSELL'S HOUSE, MASSILLON, O.



THE ENGINEERING AND BUILDING RECORD ILLUSTRATED SERIES.

C. M. RUSSELL'S HOUSE, MASSILLON, OHIO.

WILLIAM G. PRESTON, ARCHITECT, BOSTON, MASS.

NEW YORK, VOLUME XXII.

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ENGINEERING SOCIETIES.

The Engineers' Club of Cincinnati held a meeting July 17, and W. B. Ruggles read a paper on the history and construction of the Ohio and Mississippi Railway.

Dr. P. H. Dudley, the inventor of the dynagraph car, gave a description of his apparatus and the diagrams taken by it, which illustrate the condition of the surface of the rails, gauge, alignment, elevation of outer rail on curves, etc., of railroad tracks.

GRANITE PAVING BLOCK INSPECTION IN NEW YORK.

As there has been complaint that the granite blocks with which a large number of streets in New York City are being paved in many cases exceeded the size permitted by the specifications, a member of the editorial staff of The Engineering and Building Record, on Monday of this week, investigated the matter. He visited seven streets where work is in progress or has just been completed, and in each measured ten blocks taken at random from different points in each street, intending to get an average of the whole. The specifications provide that the blocks shall be not less than 3½ nor more than 4½ inches wide, nor less than 8 nor more than 12 inches long. There were no blocks found among the 70 measured below the limit in either direction, but over 10 per cent. were above the limit as to width, and nearly one-half as to length. In three cases, as appears below, where the laying of the pavement had not begun, blocks piled on the sidewalk were measured, but in all other cases stones laid in the street were taken. The measurements in detail, the dimensions given being inches, were as follows:

Fifteenth Street, Between Tenth Avenue and Hudson River; Blocks Piled on the Sidewalk.

1.—13½ × 4½	2.—11½ × 5
3.—12 × 4	4.—13 × 4
5.—11 × 4¾	6.—13 × 4½
7.—11½ × 4¼	8.—11 × 4
9.—13½ × 4	10.—12¾ × 3¾

Twentieth Street, Between Tenth Avenue and Hudson River; Blocks Piled on the Sidewalk.

1.—13 × 4½	2.—15 × 4½
3.—10½ × 4½	4.—11½ × 4¼
5.—12½ × 4	6.—12 × 4½
7.—12¼ × 3	8.—11 × 3¾
9.—12½ × 4	10.—14½ × 3¼

Fifty-third Street, Between Tenth and Eleventh Avenues; Pavement Laid, and the Street Given Over to Traffic.

1.—12 × 4	2.—11 × 4
3.—12 × 5½	4.—12 × 4
5.—12 × 3½	6.—10½ × 4¼
7.—12½ × 4½	8.—12 × 4
9.—11 × 4	10.—12 × 4

Sixty-fifth Street, Between Tenth Avenue and the Boulevard; Pavement Laid and the Street Given Over to Traffic.

1.—14½ × 4	2.—13½ × 3½
3.—13 × 4½	4.—13½ × 4¾
5.—13 × 5	6.—12 × 5
7.—13½ × 4	8.—11 × 4½
9.—12½ × 4¾	10.—12½ × 4½

Sixty-sixth Street, Between Eighth and Ninth Avenues; Pavement Laid and the Street Given Over to Traffic.

1.—15¾ × 4½	2.—10 × 4½
3.—12½ × 4	4.—10½ × 4¼
5.—13 × 4½	6.—10½ × 4½
7.—12 × 4½	8.—12½ × 4½
9.—13½ × 4½	10.—11½ × 4

Lexington Avenue, Between Sixty-ninth and Eighty-third Streets; Blocks Piled on the Sidewalk.

1.—11½ × 4	2.—12 × 4
3.—13 × 3¾	4.—12 × 4½
5.—12 × 3½	6.—12 × 4
7.—12½ × 4½	8.—14½ × 4
9.—14½ × 4½	10.—13 × 5

Whitehall Street; Pavement Partially Laid at South Ferry.

1.—12 × 4	2.—12 × 4
3.—13 × 4½	4.—12½ × 5
5.—15 × 4	6.—14¾ × 4¼
7.—15¼ × 4¼	8.—13 × 4½
9.—11½ × 4½	10.—13½ × 4

These figures speak for themselves and call for no comment on what ought to be a conscientious and competent inspection service.

ANNUAL REPORTS.

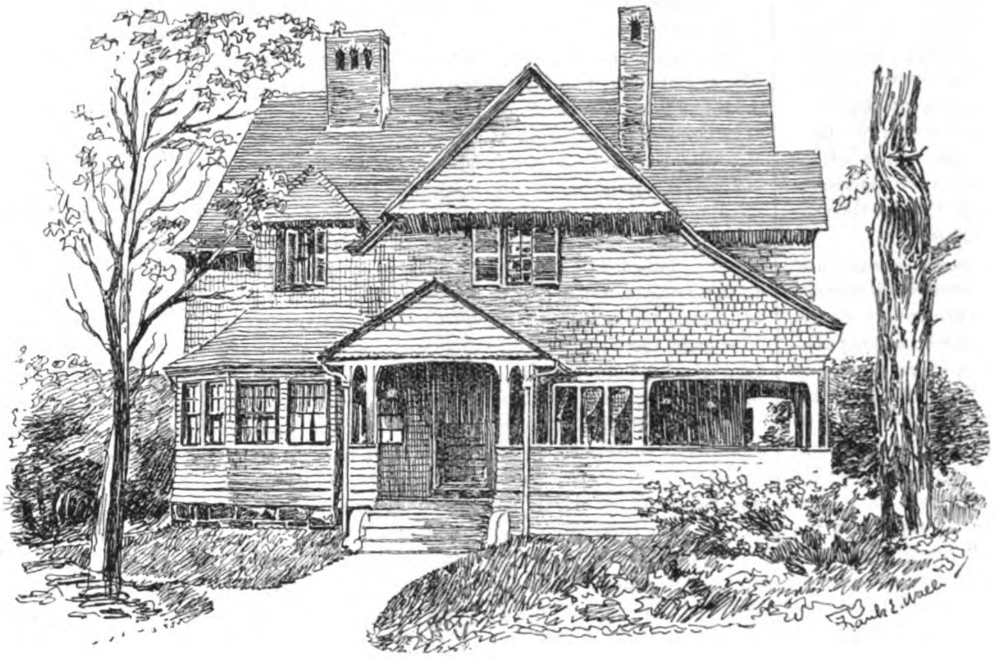
Annual Report of the Trustees of Water-Works of the City of Zanesville, O., for the year ending March 31, 1890, together with the reports of the Secretary and the Superintendent; also By-Laws and Rules, and Schedule of Water Rates.

The trustees' report shows the total receipts for the year to have been $37,345.04, and the total disbursements $35,724.09. In the disbursements is included the sum of $10,422.62 for extensions. In the report of the Superintendent, R. M. Saup, a brief review is given of the power houses and reservoirs, pumping record, fire protection and allied subjects, and a larger and higher standpipe, to be located on the most elevated site procurable, is recommended. The extensions, noted above, included 450 feet of ten, 1,904 feet of eight, 4,266 feet of six, 7,946 feet of four, and 733 feet of two inch mains. Eleven new fire hydrants were added to the works, and five new fire hydrants put in place of old Troy plugs taken out. There are now 46 miles and 4,865 feet of city mains in use.

A detailed statement of the cost of the extensions is given. A further detailed exhibit of expenditures from April 1, 1889, to April 1, 1890, is embraced in the secretary's report.

NEW ENGLAND WATER-WORKS ASSOCIATION EXCURSION.

A joint excursion of the New England Water-Works Association and the Boston Society of Civil Engineers has been arranged, to be about the middle of September. The trip will include four days in the White Mountains, and the whole cost is put at not over $25. Details will be published hereafter.



HOUSE AT WABAN, MASS.—H. LANGFORD WARREN, ARCHITECT, BOSTON, MASS.

THE WORLD'S FAIR SITE FIXED.

The Chicago Common Council adopted an ordinance Wednesday night, which is accepted as fixing the site of the World's Fair on the "lake front," with perhaps certain parts of the exhibition in Jackson Park, about eight miles south of the city, on the Illinois Central Railroad. The "lake front" location is opposite the heart of the city and very near it, where the reported plan is to add to the existing strip of land by filling in to the Government breakwater, making perhaps 250 or 300 acres in all.

Some particulars on the valuation of coal-tar pitch are given in a German paper by F. Muck. He considers the test of placing a sample between the teeth a good one as to consistency. To test the softening point a cylindrical piece of the pitch of 4 mm. diameter and 100 mm. long is bent round the bulb of a thermometer, so that there is a length of 20 mm. on the one side of the bulb and of 80 mm. on the other. The longer limb is fixed parallel with the stem of the thermometer, and the whole placed in a beaker filled with water, and provided with an agitator. The water is then gently heated till the longer limb of the little rod of pitch bends round; this is taken as the "softening temperature" of the sample.

TRANSPORTATION OF CRUDE PETROLEUM IN THE UNITED STATES.

AS BEARING on an inquiry recently received regarding the pipe-line method of oil transportation in the United States, the following extract from a paper entitled "The Different Methods of Transporting Crude Petroleum in the United States," read before the British Association for the Advancement of Science, by John H. Harris, of New York, will prove interesting. The details of pipe-line operation, given in this paper, are as comprehensive as they can be made.

Mr. Harris said that the only method of getting oil to market in the early days was by putting it into oaken barrels at the wells, each barrel of a capacity of 40 to 45 gallons. One or more of these barrels only could be drawn by teams (on account of the nature of the roads) from the wells in the wilderness to Oil Creek, where they were emptied into bulk barges, holding about 2,000 barrels. As Oil Creek was not navigable, these barges were floated down the creek on what were termed "Pond Freshets." At different points in Oil Creek dams were erected, which set back the water, and ponds were formed. When a sufficiency of water had accumulated, a wing in the dam was opened, and these barges were floated on the flood to the next dam, and the operation repeated until they reached the mouth of Oil Creek at its junction with the Allegheny River, from which point there was good flat-boat navigation to Pittsburg, the head waters of steamboat navigation in the Ohio and Mississippi valleys. This method of transportation was accompanied by great expense, incident to the loss of many of the boats, with their contents, in these drives, as well as the great labor and cost attending the building of the dams. The boats sold for what they would bring, on their arrival at Pittsburg. So late as 1862, the cost of sending one barrel of oil to New York was about $7.50, and the cost of transporting one barrel from Oil City, at the mouth of Oil Creek, to Pittsburg, about $2.30; the cost of transportation being so high as to break the market, oil at the time being sold at the wells at 50 cents per barrel.

In the latter part of 1862, a branch of the Atlantic and Great Western Railway was projected into the oil regions. Later, a line of railway was built up Oil Creek to Corry, a station on the Atlantic and Great Western, making continuous and direct railway connection to New York and the West. Still later, the Allegheny Valley Railway was opened up from Oil City, at the mouth of Oil Creek, to Pittsburg, Pa., thus perfecting the railway system from the regions to the large cities. A number of narrow-gauge railways were also built as feeders to the main lines. The lowest cost of moving oil by rail from the regions to the seaboard on the completion of these railways was about $1.04. Cylindrical tanks, 26 feet by 66 inches, made of light boiler plate, and mounted on eight-wheeled platform cars, and holding about 2,000 gallons, were used for its transportation. Bulk was broken several times, and the losses from leakage and evaporation were serious. In March, 1862, a bill was introduced in the Pennsylvania State Legislature at Harrisburg, for a franchise to carry oil in pipes from Oil Creek to Kittanning, Pa., with the privilege of extending the line to Philadelphia. Nothing, however, came of this bill. Later on, in 1864, a scheme was outlined for laying a pipe line down the Allegheny River to Pittsburg, for the transportation of oil. A large proportion of the people in the oil country, teamsters, oil producers, and railway corporations, opposed this as a blow to their prosperity, and, like the former scheme, it came to nothing.

In 1865, the first pipe line was built from Pithole, Pa., toward Oil Creek, and oil was pumped through it, the distance being 3,200 feet. Three pumps were used, and 81 barrels of oil per day forced through from Pithole to Miller Farm, a station on Oil Creek. This pipe was maliciously cut from time to time by teamsters, whose monopoly promised to be destroyed by this new method of transportation, and it was kept from utter destruction by constant patrol of armed guards.

Later on in the same year a pipe line was laid from Pithole Creek to the Island Well, a distance of seven miles. In November, 1865, still another pipe line was laid from Pithole to Titusville, which latter point was then the center of the oil-producing districts, and also a great refining point. The cost of transportation so late as December 1, 1865, from Pithole to New York, was $5.75 per barrel.

Gradually the collection of oil was made by means of pipe lines running from the different wells to central stations, and thence to loading racks at the railway stations. Much opposition was encountered from teamsters, but finally overcome, and in 1876 there were no less than eight or nine different pipe-line companies in the oil regions, whose lines radiated from the loading racks and storage tanks at the railway stations to the different wells in the interior. The business of these companies was collecting, storing and insuring oil at a stated price. They also issued storage certificates which were negotiable and used in commercial transactions as collateral. In 1875 a 4-inch pipe line was laid from the lower oil country to Pittsburg, Pa., a distance of about 60 miles. This, the pioneer trunk line, as in the case of the early local lines, at first had to be guarded by armed men to protect it from disturbance from those whose interests it antagonized.

In the latter part of 1875, the great oil field of McKean County, Pa., known as the Bradford Oil Field, was opened up, and its production has steadily increased, until at the present time probably three-fourths of the oil production of America is in and near the Bradford field.

The total pipe deliveries from 1876 to 1884, were :

In 1876	9,068,376	barrels
1877	13,012,713	"
1878	15,011,425	"
1879	20,085,716	"
1880	24.788,950	"
1881	29,674.458	"
1882	31.789.190	"
1883	24.385,666	"

Up to 1876 the refining of petroleum was carried on very largely in the oil country adjacent to the wells, and along the line of Oil Creek.

Meanwhile large refineries had been built at Cleveland, O., at Pittsburg, Pa., at Buffalo, N. Y., and on the seaboard at Boston, New York, Philadelphia and Baltimore. The increase in the price of the products of petroleum, naphtha, paraffine and the residuum, for which there was no market obtainable in the oil regions, led to the greater development of refining at the lake ports and on the seaboard, where these products could be disposed of at a profit. This led to greater shipments of crude petroleum to these points, and as the business developed, the matter of transportation assumed such formidable proportions as to engage the attention of the refiners, who, under the lead of the Standard Oil Company, of Cleveland, O., associated with the principal local pipe-lines, known as the United Pipe Company, and the American Transfer Company, surveyed and laid down pipe-lines from the regions to Cleveland, Buffalo, New York, Philadelphia and Baltimore. They also purchased the pipe line, already in operation, to Pittsburg, Pennsylvania.

The pipe-lines of America, with but a single exception, are all amalgamated in one company, known as the National Transit Company. The length of the New York line is about 300 miles. There are two lap-welded wrought-iron tubes, 6 inches in diameter the entire distance, while a portion of the way a third 6-inch pipe is laid. The number of pumping stations is 11, they are about 28 miles apart, and are equipped with duplicate compound condensing pressure pumping engines, and the greatest elevation between stations above tide-water is 2,490 feet. The Philadelphia line is 280 miles in length; diameter of pipe, 6 inches; number of stations, six. The Baltimore line covers 70 miles of direct pumping through a 5-inch pipe. The Cleveland line is 100 miles long; diameter of pipe, 5 inches, with four pump stations. The Buffalo line, 70 miles long; diameter of pipe, 4 inches, and has two stations. The length of the Pittsburg line is 60 miles; diameter of pipe, 4 inches, with two pump stations. The entire length of these lines, including the duplicate pipes, is upwards of 1,300 miles, while the length of the collecting lines of 2-inch diameter in the oil region is estimated to be from 8,000 to 10,000 miles.

In projecting these lines the experience of pumping oil through the short collecting lines of the oil country was of course available, but beyond that everything was simply conjecture. There were theoretical tables showing the resistance to be overcome in liquids passing through tubes for short distances, which, with a multiplier, would presumably give the friction for longer distances; yet there were no tables based on practical results, and certainly it was entirely experimental to attempt to force oil through hundreds of miles of pipes, over a very broken country, crossing two ranges of mountains, with rivers and creeks innumerable. The engineering difficulties were novel, yet were uniformly and successfully met and overcome. Forcing oil through the smaller pipes and shorter distances of the oil country had been hitherto accomplished by means of single cylinder pumps, sometimes called donkey pumps. The limit of their usefulness had been found in the extension of the various local lines, by the bursting of the pipes, the stripping of threads at pipe joints, and the frequent breaking down of the pumps, incident to the constant shock and jar upon pumps, pipes and connections, at the change of stroke, under the heavy pressure due to enormous frictional resistance, as well as exceptional head, due to elevation.

Pumps were frequently put in on these local lines (most of which were 2 inches in diameter and 15 miles in length), where the frictional resistance was equivalent to a pressure of 1,500 to 2,000 pounds per square inch.

The steam cylinders on these pumps were in some cases of a diameter of 30 inches, moving a ram of only 4 or 5 inches, and the concussion at each change of stroke under these pressures resembled the report of a rifled gun. Of course these conditions were preposterous, and in fact prohibitory, no pipes or material being found equal to the excessive and intermittent strain.

After mature consideration, a committee was appointed to wait upon the late Mr. Henry R. Worthington, of New York City, who in his lifetime was undoubtedly at the head of hydraulic engineers in America, and asked him to consider the conditions of the service, and give his opinion as to the type of pumping engine best adapted to meet these severe conditions. The result was that an engine was designed and constructed by Mr. Worthington, sent to the oil country, located near Bradford, set up, and connected to a section of pipe line of 4 inches diameter, 16 miles in length, reaching from Bradford to Carrollton, an oil station on the Erie Railway, which line had been laid for some time, but was in a constant state of rupture from the causes hereinbefore mentioned.

The result of the working of this machine was to revolutionize the entire transportation of petroleum. It exceeded even the maker's anticipations. The action of this pumping engine under these severe conditions was as quiet and as free from harshness of motion as could be desired. The movement of the column of oil through the pipe was uniform and constant, and whereas under the old system of single cylinder pump the column of oil came to a stop at the end of each stroke, with a variation of pressure on the gauge of several hundred pounds, with the Worthington type there was no stoppage, but a constant flow from the starting to the stopping of the engine, and an almost uniform pressure on the gauge.

From 1878 to 1881–82 the building of the trunk lines to the seaboard was continuous, and refining of oil in the oil regions proper either remained stationary, or, as the different refineries were destroyed by fire (a fate which overtakes them all sooner or later), refining was discontinued, while on the seaboard and lakes large and extensive refineries were erected.

The Worthington type of pumping engine is used exclusively on the pipe-lines of the National Transit Company. The engines vary in size according to the condition of service under which they are placed. On the New York and Pennsylvania lines, the most refined type of compound condensing engines are in use. On the Buffalo, Cleveland and Pittsburg lines, compound non-condensing engines are employed, while for the local lines a plain high-pressure pump is adopted. The average amount pumped per day through the New York lines is about 28,000 barrels, and the average head due to friction and elevation is about 900 pounds, sometimes rising to 1,200 and 1,500 pounds, depending, of course, on the piston speed of the pump.

At the different pumping stations are located one or more receiving tanks made of light boiler plate, dimensions 90 feet diameter by 30 feet high, and the oil is pumped from tanks at one station to tanks at the next, though there have been cases where loops have been laid around stations, and oil has been forced a distance of 110 miles with one pumping engine. Duplicate pumping engines are located in each station, so that there may be no cessation in pumping, one engine being in constant service.

The engines on the main 6-inch lines are from 600 to 800 horse-power, while those on the 4-inch and 5-inch lines are from 150 to 200 horse-power, and the local lines from 25 to 30 horse-power. The pipe is made especially for the service, is lap-welded wrought iron of selected material, tested critically before leaving the mills, and is known to the trade as oil-line pipe. The lengths of 18 feet are fitted at each end with coarse and sharp-cut taper threads nine to the inch, and with long sleeve couplings also screwed taper. The taper is usually ¼ inch to the foot for 4-inch pipe.

The usual way of threading iron pipe is to cut the threads straight or parallel; as a consequence only three or four threads come in contact with the thread of the socket, or help in any way to assist in making the joint.

With a taper socket, the contact is perfect throughout the whole length of the thread on the pipe, thus making a tight joint.

The lines are usually laid 2 or 3 feet below the surface of the ground, and from time to time bends are made in the pipe to allow for expansion and contraction, thus dispensing with expansion joints.

Numberless creeks and rivers are crossed by the different lines, some on trestle bridges, others by laying the pipe at the bottom of the river, with a bend up-stream. In crossing the Hudson and East Rivers at New York City, quite an engineering feat was performed, as both rivers are very deep at this point, and the tide very rapid.

The lines have become obstructed from time to time by the precipitation of paraffine, which, adhering to the pipe, reduced its area, and consequently the delivery of oil materially. A novel device is used for removing the paraffine or other obstruction. It is known to the employees as a "Go Devil," as it travels through the pipe at the same speed as the oil, being propelled by the pressure transmitted from the pumps, and as its position can only be located by its noise in motion, it has to be followed by relays of men, for should it stop unnoticed, the pipe would have to be cut to locate it.

The reduction in cost of transportation of oil by pipe is not known absolutely, as the system is in the hands of a close corporation, whose financial statements are not public property, but, having the particulars as to engines employed, miles of pipe, and conditions of service, it is easy to see that a vast reduction in the cost of transportation of oil has been effected. Certainly among other benefits that arise from this change of methods of transportation, one great danger to the traveling public has been avoided —*i. e.*, the constant liability of railway trains and barges containing crude petroleum being destroyed by fire in transit, thereby endangering the lives of passengers on passing trains and boats, with consequent loss of property, as well as blocking for a time the most important trunk lines of railway.

PROPOSED BRIDGE OVER THE SHIP CANAL AT DULUTH.

THE third annual report of the Board of Public Works of Duluth, Minn., includes a plan for a combined railroad and highway bridge over the Ship Canal through Minnesota Point, submitted by Alfred P. Boller, civil engineer, of New York City, at the invitation of the Board.

The structure proposed is a single span swinging draw, 475 feet over all, affording a clear water way of 200 feet between fenders, and 20 feet 6 inches clear height above mean water. Only two drawbridges in the world, those over Staten Island Sound, and the Thames River, at New London, exceed this in length and width of waterway, the former being 500 feet and the latter about 210 feet in each case.

The drawings which accompany the report show a central tower 25 feet square and 70 feet high, supporting two arms each 225 feet long, divided into nine panels of 25 feet each, diminishing in depth from the full height of the tower at the center to 25 feet at the ends, with end posts inclined at an angle of 45 degrees. The top chords appear to be designed to resist compression for only 5 panels from the ends, the 4 inner panels being supported, cantilever-wise, from the tower.

The trusses are 24 feet to centers and between them is placed a single track railway with footways on either side. The roadways, 9 feet 6 inches in the clear, are supported by cantilevers outside of the trusses. The turn-table will have a rim bearing and run on 58 cast-steel wheels 20 inches in diameter, with 10 inch faces. The free ends of the draw will be supported on pedestal feet with vertical screw movement operated from the center of the bridge, which will be swung by steam 90 degrees in 90 seconds, 15 seconds more being required to unlock the ends and raise the rails.

The structure is proportioned to carry in addition to its own weight a moving load of two 86-ton consolidation engines, followed by a train load of 3,000 pounds per lineal foot, and a load of 500 pounds per lineal foot of the whole length of each roadway with stresses of 10,000 pounds per square inch for live load and 20,000 pounds per square inch for dead load, modified by the formulæ for columns and shear. The material is to be a soft steel of 62,000 to 68,000 pounds ultimate strength, and 36,000 pounds elastic limit.

To form the foundation of the central pier it is proposed to dredge by pumping about 6 feet below the bed of the canal, which is here about 30 feet deep, and then drive piles by the water jet and cut them off 1 foot above the dredged bottom. Coarse sand will then be filled in to the level of the pile heads, on which will be placed an open caisson of wood, whose bottom will be composed of a grillage of solid timber 6 feet thick, on which the masonry will be built of coursed ashlar with concrete backing and granite coping.

The estimated cost of substructure and masonry is $112,079 and for the superstructure $114,290, which, with 10 per cent. for contingencies, engineering, etc., amounts to a total of $249,005.

There will be 1,200 feet of iron trestle in the highway approaches, costing, at $100 per foot, $120,000, and 1,500 feet of timber trestle on each side in the railway approaches, to be eventually replaced by embankment. This at $10 per foot would cost $30,000, or a total of $400,000 for the whole work exclusive of right of way and damages.

CURIOUS UPHEAVAL OF BRIDGE FOUNDATIONS IN HOLLAND.

IN building a three-span railway skew arch bridge over the Poldewaart, in Kettrel, Holland, J. Wuckelback writes in the London *Architect*, the proceedings were commenced in the usual manner, with the intention of having separate foundations for each pier. This was by shooting in large quantities of sand, to form dams within which, when pumped dry, the foundations would have been excavated. After a length of about 70 feet of sand-dam, 10 feet deep, had been filled in without exhibiting any signs of sinking, a heavy thunderstorm occurred, during which the whole mass was suddenly engulfed to a depth of 29 feet, whilst there arose simultaneously, at a short distance dŏwn the canal, to above the water level, a mass of bog earth of an area of 4,489 square feet. This mass increased at subsequent periods of the proceedings to the area of 9,628 square feet, and there was reason to fear for the safety of the adjacent dykes and other works. Piles 70 feet in length, when driven and tied together by waling pieces, severed bodily from their position and became useless. Fascines equally failed in producing stability. The engineer, therefore, after directing the canal water into a side cut, surrounded the site of the intended foundation with mounds of sand, and the foundation pit was pumped dry. It then became necessary to remove all the bog earth from within the space for the foundation, which was accomplished by digging out spaces of a yard square and filling them in with sand as they proceeded, until, by commencing at the exterior and working inwards to the center, all the bog earth was removed and a bed of sand had been formed in its place. The piles for the ordinary foundation used in Holland were then driven through the made ground, and the structure was completed with perfect success, the sand dam and the masses of upraised bog earth outside being subsequently dredged up in the ordinary manner to restore the canal to its original bed. The sudden rising of the bog earth during a thunderstorm is of frequent occurrence in Holland, and it would appear as if the adhesion of the masses of bog earth to the bottom was so slight that the vibration communicated to the water by the thunder sufficed to destroy the equilibrium, and the bog turf, which from its slight specific gravity will float even when wet, instantly rose to the surface.

ELECTRICAL CHAIN-HAULING IN A COAL MINE.

AN account of an electrical chain-hauling system in a coal mine near Beuthen, Silesia, Germany, is given in a recent issue of the *Zeitschrift fur das Berg-Hüttenund Salinen-Wesen*.

According to the abstract given in the Excerpt Minutes of the Proceedings of the British Institution of Civil Engineers, the gallery in which chain-hauling is employed is about 500 yards long, having a double line of rails, of 25-inch gauge. The number of wagons dealt with per shift of ten hours is 800, weighing 440 tons.

In a continuation of the gallery is situated the driving drum, 6.55 feet in diameter, mounted on a vertical axis, around which the chain is wound one and a half times. The chain having been conducted over a system of tightening pulleys, it is guided into the center of each line of rails, one for the full and one for the empty wagons. At the opposite end of the gallery it passes around a vertical pulley 4.8 feet in diameter, equal to the distance from center to center of the rails. The bearings of this pulley rest in a channel iron so as to admit of tightening. The links of the chain are 0.80 inch in diameter, and it weighs 15 pounds to the yard. It rests on the top of the wagons, and is kept in that position by two vertical projecting pieces. The wagons are placed at intervals of 20 yards on the chain.

The current is supplied from the surface Schuckert dynamo, driven by a 60 horse-power twin-engine. Running at 680 revolutions per minute, this machine gives a current equal to 35.9 horse-power. The current is conducted down the shaft to the motor by a copper cable 320 yards in length, consisting of 19 stands of wire each 0.064 inch in diameter, giving a total metallic section of 0.059 square inch. The cable is insulated with gutta-percha and inclosed in a lead pipe. The motor in the mine is also a Schuckert machine, developing a maximum horse-power of 28.8 when running at 700 revolutions per minute. Between the motor and the chain drum intervenes a system of geared wheels, which reduces the speed down to 10.5 revolutions per minute, giving the chain a velocity of 3.5 feet per second. The dynamo and the motor are both provided with ampere meters having a range of 80 amperes and resistance coils, by means of which starting is effected gradually, and the current afterwards maintained at the working rate.

THE WATER SUPPLY OF VIENNA.[*]

THE authorities of Vienna, who have to face a deficiency in the drinking water supply every winter, have determined to reinforce the existing supply, which falls short of the minimum daily volume needed of 5,100 cubic meters[†] by 1,130 cubic meters; the joint capacity of the Hochquellen and the Pottschach Springs being only 3,970 cubic meters per diem. The author gives an account of the attempts made in the past to obtain pure supplies of spring water in the Vienna Neustadt district, and describes the new project to secure deep spring water from the Neustädter Steinfeld. This district, which is a portion of the Vienna inner-alpine tertiary basin, extends for about 57 kilometers in length by 11 kilometers in average breadth. The soil is a diluvial limestone breccia, which rests upon a very deep lying impervious stratum. Into this breccia soaks the rainfall of an area of 1,413.9 square kilometers, and finds for the most part a subterranean discharge, as only a small portion is accounted for in the waters of the Pitten, Schwarza and Leitha and the Hochquelle Springs. Generals Sonnklar and Streffleur, as far back as 1859, drew attention to this district, and in 1864 a prize of 100 ducats was adjudged to Mr. Karlitschek for a scheme prepared in 1861 dealing with this source of supply. The quality of the water, which has been many times investigated, is very good, varying as it does in hardness from 13 degrees to 15 degrees, and having an average temperature of 9° to 11° Cent. The water company has acquired an area of 230 hectares. The subsoil water, which flows at a mean velocity of 3 millimeters per second, attains a maximum daily volume of 3 millions of cubic meters, the minimum volume being 0.56 million cubic meters. Of this only 1.2 cubic meter per second, or 103,680 cubic meters per diem, is to be diverted. The water is to be collected in a concrete gallery or adit 7,050 meters in length (7,710 yards), ending about 2 kilometers to the southward of Wiener Neustadt. The adit is formed at a depth of from 15 to 28 meters below the surface, and 4 meters beneath the lowest subsoil water level. The internal dimensions of the adit are 4.5 meters high, 3 meters wide, fall 0.157 meter per thousand meters. For the purpose of inspection and maintenance there will be 17 manholes. At the end of the gallery there is to be a collecting reservoir formed of concrete in two compartments. The discharge of the water from the gallery into this reservoir is regulated by sluices, and the water in it will be kept at a nearly uniform level. From the first compartment of the reservoir the water flows into the second at an adjusted rate of 1.2 cubic meter per second. The sill of this reservoir is 262.5 meters above datum. By reference to a plan, the course of the main and the position of the various subsidiary reservoirs is explained. The latter, 18 in number, vary in capacity from 49,500 to 50,000 cubic meters. The pipe system extends to a total length of about 520 kilometers varying in diameter from 1,000 to 80 millimeters. The price for water supplied by gravitation is to be 1 kreutzer per hectoliter (9*d.* per 1,000 gallons), or for high-pressure service water 1 2 kreutzer per hectoliter (11*d.* per 1,000 gallons). The works have been put in hand, and will, it is expected, be in operation in 1892.

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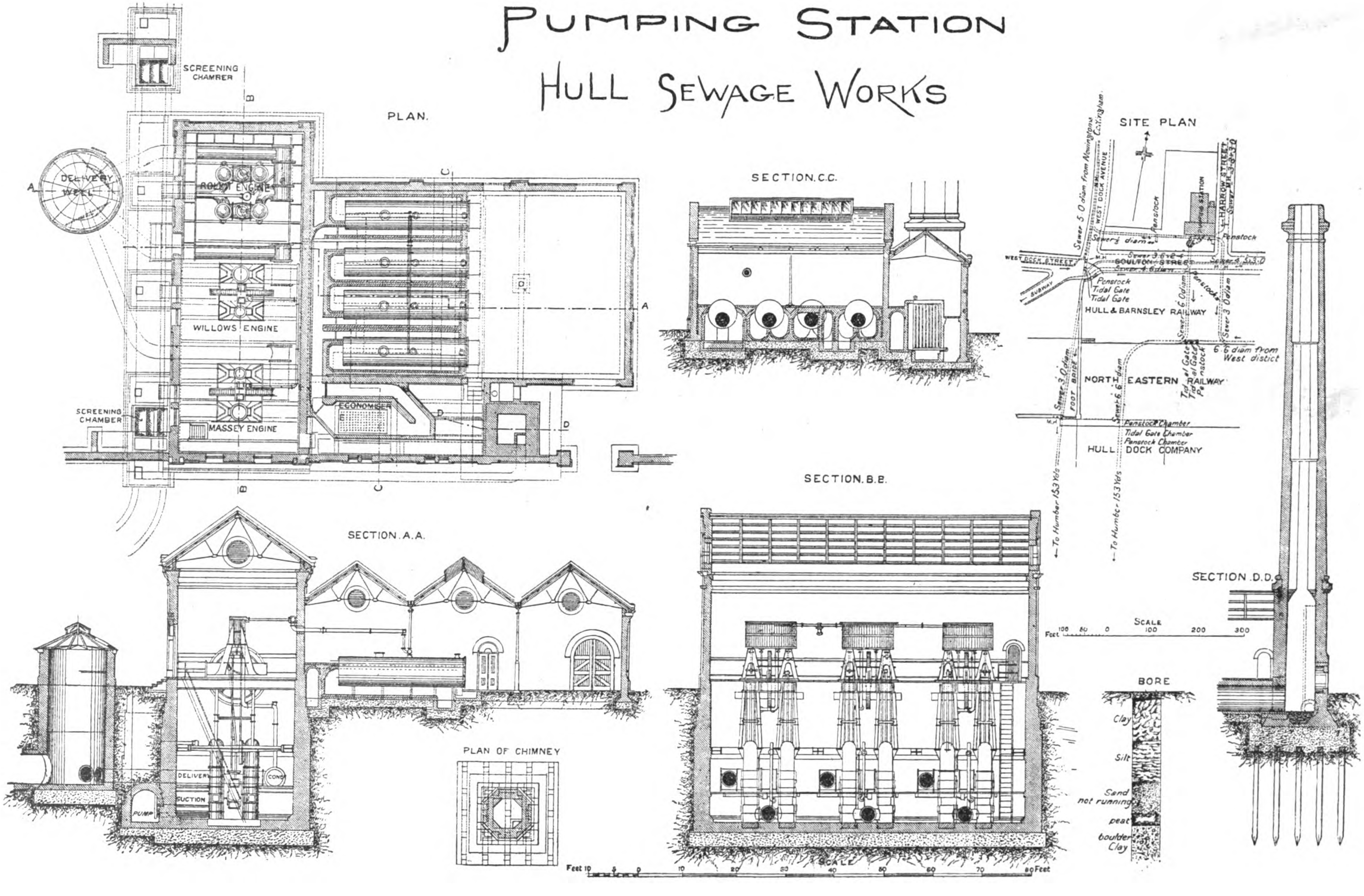
[*] A paper by A. Frank in *Gesundheits Ingenieur* abstracted in Excerpt Minutes of Proceedings of the Institution of Civil Engineers.

[†] One cubic meter equals 220 gallons.


PUMPING STATION
HULL SEWAGE WORKS
PLAN.
SCREENING CHAMBER
DELIVERY WELL
ROBEY ENGINE
WILLOWS ENGINE
MASSEY ENGINE
SCREENING CHAMBER
ECONOMISER
A
B
C
D
SECTION. C.C.
SITE PLAN
Sewer 5.0 diam. from Newingtons Cottingham
WEST DOCK AVENUE
WEST DOCK STREET
SUBWAY
Penstock
PUMPING STATION
HARROW STREET
Sewer M.H. 3·8×3·0
Sewer 3 diam.
Sewer 3.6×2.4
BOULTON STREET
Sewer 4.6 diam.
Sewer 4.5×3.0
M.H.
Penstock
Tidal Gate
Tidal Gate
Penstocks
Sewer 6.0 diam
Sewer 3.0 diam
HULL & BARNSLEY RAILWAY
6.6 diam from West distict
Tidal Gate
Tidal Gate
Penstock
NORTH EASTERN RAILWAY
Sewer 3.0 diam
FOOT BRIDGE
Sewer 6.6 diam
Penstock Chamber
Tidal Gate Chamber
Penstock Chamber
HULL DOCK COMPANY
To Humber 153 Yds
To Humber 153 Yds
SECTION. A.A.
DELIVERY
SUCTION
COND.
PUMP
SECTION. B.B.
SECTION. D.D.
SCALE
Feet 100 50 0 100 200 300
BORE
Clay
Silt
Sand not running
peat
boulder Clay
PLAN OF CHIMNEY
SCALE
Feet 10 5 0 10 20 30 40 50 60 70 80 Feet

THE HULL SEWAGE WORKS AND PUMPING ENGINES.

THE Sewage Works of Hull, England, including the pumping station and pumping engines, are described in the London *Engineer*, from information received from A. E. White, Assoc. M. Inst. C. E., the Borough Engineer of Hull, as follows:

The estimated population is 208,000; rateable value, £700,000; and land area, since the extension of the boundary in 1883, 7,901 acres. Previous to the extension the population was 154,000; rateable value, £587,000; and area, 3,621 acres. The entire borough is very flat and low-lying, and the average level of the streets, which are almost without exception somewhat above the natural surface level, is only about 9 feet above Ordnance Datum, and, as a rule, the ground nearer the Humber is higher than that farther inland. The subsoil consists of a stiff yellow clay to an average depth of about 6 feet, below which are strata of silt varying more or less in character; also in most places a thin stratum of peat, and often a quantity of running sand. Boulder clay is met with at depths varying from 14 feet to 35 feet or more in different parts of the borough. The upper clay forms a good foundation for ordinary buildings, but for structures of a heavier character it is usually necessary to go to the boulder clay. The borough is divided by the river Hull, and a line of docks, into three districts—(1) The Old Town, which was the portion formerly fortified, bounded on the south by the Humber, on the east by the river Hull, and on the north and west by docks, which portion contains a population of about 12,000; (2) the west district, west of the river Hull, and of the line of docks referred to, containing a population of about 152,000; (3) the east district, east of the river Hull, containing a population of about 44,000. The borough is further severed by five large open agricultural drains, flowing to the river Hull or the Humber, from extensive low lying districts, north of the town.

From these facts it will be gathered that considerable difficulties have had to be contended with in the sewerage of Hull. The average level of the streets, as stated, is about 9 feet above Ordnance Datum, while in the Humber, to which the sewage flows, the level of high water of ordinary spring tides is 12.37 feet above Ordnance Datum, and the level of low water of ordinary spring tides 10.10 feet below Ordnance Datum; and under such conditions the inclinations of the main sewers are necessarily very flat, and the outfalls, where pumping is not adopted, are, of course, closed for a considerable period each tide. As a rule the sewers are at least of sufficient size to enable men to enter for the purpose of brushing them out, where the inclination and flow of sewage are insufficient to render them self cleansing; and their large size assists in a rapid discharge during the short periods that the outfalls are not tide-locked; and also enables the sewers, when the outfalls are closed, to act as a reservoir, if pumping is not available, or if the quantity of water during excessively heavy rains is more than the pumps for the time being can deal with.

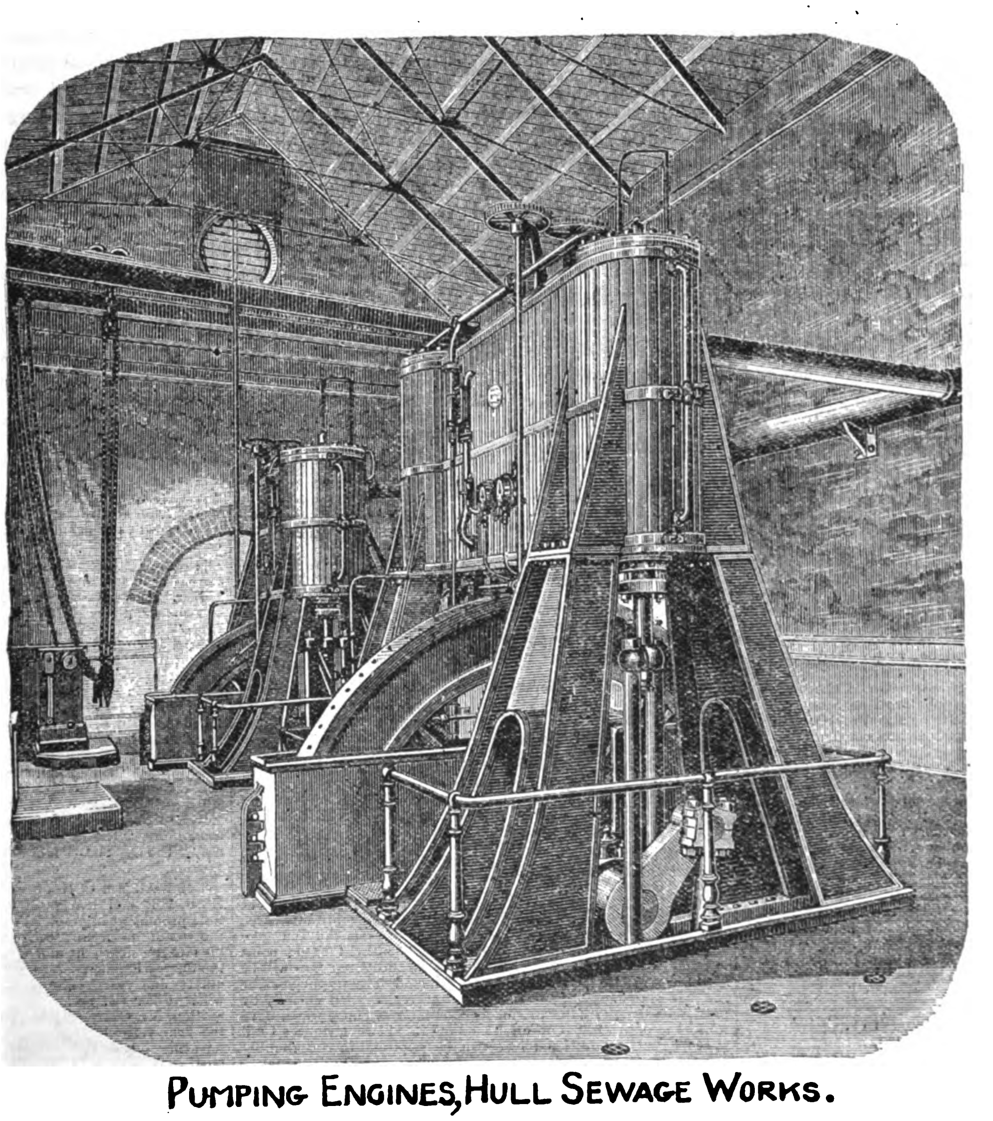
A main sewerage system for the east district was carried out in 1854 and subsequent years, and for the west district in 1863 and subsequent years. Considerable additions have since been made from time to time to such systems. During the past ten years the Corporation have expended the sum of £40,000 upon new sewers which have been constructed under various contracts, exclusive of sewers included in the works specially mentioned herein, and of works of minor importance executed by the Corporation workmen: and the Corporation are now applying to the Local Government Board for sanction to borrow a sum of £7,950 for the construction of further works of sewerage. The whole of the west district within the old borough boundary is drained to one outfall, excepting a small area which, although connected to the main sewerage system, has also a separate outfall. The main outfall sewer, which discharges into the Humber between the William Wright Dock and St. Andrew's Dock, is 6 feet 6 inches diameter for a distance of 1,900 yards, and although laid to an inclination of only 1 in 3,000, it keeps itself clear of any deposit of sewage matter. The area added to the borough on the west side in 1883, which included the Local Board district of Newington and a part of the Local Board district of Cottingham, is drained to an outfall 4 feet in diameter, discharging into the Humber within 33 yards of the main west district outfall; and since the borough extension a pumping station, hereinafter described, has been established to deal with the sewage of the main west district sewer and the Newington and Cottingham sewer, including the sewage of the portion of the Cottingham district not added to the borough.

The present sewerage system of the east district, with the exception of a short length of sewer, all falls to one point and discharges into the Humber by an outfall 4 feet in diameter; a new system of sewers, however, which is usually described as the East District and Stoneferry Drainage, is now in course of construction, and will, when completed and connected to the existing system, not only drain portions of the borough which cannot be drained by gravitation to the present sewers, but will also provide an improved outfall for the entire district. The new outfall will be to the east of the Alexandria Dock of the Hull and Barnsley Railway Company, in the face of a river embankment constructed by the company a few years since; and its level will be 10 feet below Ordnance Datum, or practically the same level as the three existing outfalls already mentioned. The outfall sewer is 6 feet 6 inches diameter, with an inclination of 1 in 3,000 for a distance of 700 yards from the Humber, and almost the whole of such length—being through made ground, or through what was until recently the foreshore of the Humber—is intended to be constructed of cast-iron pipes, supported upon piles. The pipes are flanged and jointed. A strip is cast upon the face of each flange at the outer edge, so that a space of ⅜-inch is left between each pair of flanges, when bolted together, and such space is calked from the inside with iron cement. In laying the iron pipes considerable difficulties have been encountered in consequence of the nature of the ground and of the water finding its way into the trench each tide; about half the intended length of pipe has, however, now been successfully laid. The remainder of the sewers, excepting two syphons under agricultural drains, are all of brickwork, varying in size from 6 feet diameter to 3'3"x2'2", egg-shaped, with inclinations varying from 1 in 3,000 to 1 in 450. The length of sewer from the outfall to the most distant point is four miles, and the total length, including branch sewers, six miles, of which about four miles have now been constructed. The brick sewers, 6 feet 6 inches diameter and 6 feet diameter, are in 14 inch work. Those 5 feet diameter and the egg-shaped sewers, from 5'6"x3'8", down to 3'6"x2'4", were all intended to have been in 9-inch work, but in constructing some lengths of the larger sizes through bad ground it has been found necessary to use an additional half-brick ring on the invert. The sewers of the smallest size, 3'3"x2'2", are in 4½-inch work. Cradling composed of 1-inch deal boards on elm ribs, as shown by sections of 6-foot brick sewer, has been largely used under some of the deeper sewers; and in the case of these works, as well as in previous works in the borough, such cradling has been found a cheap and efficient means of supporting the brickwork, where the nature of the ground has rendered some support necessary. One tidal gate is provided at the outfall, and a pen-stock and two further tidal gates 670 yards from the outfall, where it is intended ultimately to erect a pumping-station. Manholes with ventilating gratings are constructed at intervals of 100 yards, and provision for flushing the main sewer will be made near the highest point.

The sewage pumping station provided for the west district of the borough, for dealing with the sewage of the main west district sewer and the Newington and Cottingham sewer, is about 370 yards from the outfalls into the Humber. At low tide the sewage flows to the Humber by gravitation as before, and when pumping is necessary, the sewage is still discharged by one or both of the old outfalls. Two tidal gates and a pen-stock have been fixed on each of the old sewers, between the points of connection of the sewer leading to the station and the return sewer from the pumps; and while pumping is proceeding, the tidal gates are of course closed, and the length of sewer outside them is under pressure, varying with the rise and fall of the tide in the Humber. When the tide is low enough to allow of a discharge by gravitation, the tidal gates are open, permitting the sewage to flow direct to the Humber without passing the pumping station. There are three compound pumping engines of the vertical, inverted, direct-acting type, each capable of discharging 10,000 gallons per minute, or 14,400,000 gallons per 24 hours, when working at the maximum speed of 20 revolutions per minute. The cylinders are 18 inches and 30 inches diameter respectively, with 4 foot stroke, and the high-pressure cylinders are fitted with variable expansion gear. Each engine works two double-acting pumps, 30 inches diameter and 4 foot stroke, one pump being placed beneath each cylinder. The maximum lift is 20 feet; but as the pumps have only to work against whatever head of water there may be in the Humber, the lift varies with the state of the tide. A surface condenser is fixed on the delivery pipe from each pair of pumps, so that the whole of the sewage pumped is passed through the condenser. The boilers are of the Cornish type, four in number, each 26 feet long and 6 feet diameter, with 3 feet flue. Steam is supplied at a pressure of 80 pounds, and each boiler is capable of working one engine. A Green's economizer, for heating the feed-water, is fixed on the line of the flue, between the boilers and the chimney.

The foundations of the pump chamber are carried into the boulder clay to a depth of 32 feet below the ground level, and formed of cement concrete 6 to 1. The walls of the chamber are of brickwork in cement up to the level of the engine-house floor, and are supported against the lateral pressure of the earth by a heavy frame-work of cast-iron girders and struts, fixed at a level about midway between the base of the wall and the surface of the ground. The buildings are faced with white stock bricks, with Pateley Bridge stone dressings. A tell-tale, designed by Mr. White, and manufactured by Messrs. W. H. Bailey & Co., Salford, is placed in the engine-house. This tell-tale is worked by gearing and spindles from the engines, and by floats and platinum wires from the sump and delivery well, and shows at a glance the level of the sewage in the sump, which is the same as that in the adjoining sewers, the level of the sewage in the delivery well, which practically corresponds with that of the Humber, and also the head against which the pumps are working. The tell-tale further automatically records the above levels on a roll of paper driven by a clock throughout the day, and indicates the time at which each engine is started and stopped, and the number of revolutions worked. To make the instrument more perfect, it is intended to attach to it a rain gauge, which will automatically record not only the daily rainfall, but also the quantity falling within any given time.

The engines, pumps, boilers, etc., were supplied under a contract with Messrs. James Watt & Co., Birmingham,



PUMPING ENGINES, HULL SEWAGE WORKS.

who, together with a number of other firms, submitted their own designs in accordance with a general plan and specification supplied to them. The foundations, buildings and sewers were executed by Mr. A. W. Stanley, Hull. The cost of the pumping station was as follows: Engines, pumps, boilers, etc., £8,229; foundations, buildings and sewers, £8,873; other sundry works, £1,243; cost of site, £3,085; total, £21,430. The pumping station was commenced in February, 1883, and formally opened in June, 1884, and has worked very successfully since that time. The average volume of sewage pumped in dry weather is about 7,000 gallons per minute, or at the rate of 10,080,000 gallons per day, which is well within the power of one engine; on rare occasions, however, during excessive rains, the volume is considerably greater than all three engines can properly deal with. As a rule the pumps are worked for eight hours each tide, but during heavy rain the time is extended. The working staff consists of six men, three of whom are on duty each tide.

In a paper which Mr. White read before the Association of Municipal and Sanitary Engineers in June last, he gave the annual working expenses, exclusive of repairs, approximately as follows: Wages of staff, £515; coal, 650 tons best South Yorkshire, at 10s. *2d.*, £330; oil, stores, water, gas, etc., £130; total, £975.

REQUIREMENTS OF SPECIFICATIONS FOR STEEL AND IRON.*

THIS subject is one which could be discussed at great length, but would occupy too much space and time for the limits of this paper. The writer has endeavored to show a few of the points which should be included in specifications for quality of material only, and to give a few reasons for the use of such requirements.

Engineers have gradually made their specifications, especially for steel, more rigid and more comprehensive in their requirements; they call for higher grades with each new specification, and as the engineers increase their demands, the manufacturers put in the necessary machinery to comply with them. Engineers should bear in mind that the strain a piece of iron or steel will bear depends on the amount of rolling or forging which it receives. A fair quality of iron is that specified in the Bridge Builders' Standard Specifications, which make the ultimate tensile strength depend upon the area of section and the circumference of the piece, as indicated by their formula for ultimate strength in pounds per square inch—viz., $52{,}000 - \frac{7{,}000 \times \text{area}}{\text{circumference}}$ for tension members and all iron except plates over 8 inches wide and shaped iron. Plates between 8 and 24 inches are required to have an ultimate strength of 48,000 pounds, and over 24 inches wide of 46,000 pounds per square inch. All shaped iron is specified to have an ultimate strength represented by $50{,}000 - \frac{7{,}000 \times \text{area}}{\text{circumference.}}$ The results of these formulæ give quantities in conformity with the class of material manufactured by the best rolling mills of the country.

Great care must be taken in determining the elastic limit and elongation of the material—the qualities which should be regarded as determining the allowable strain on tension members: 26,000 pounds per square inch is generally taken as the lowest elastic limit allowed by the best authorities. The allowable elongation varies from 12 to 25 per cent., according to the section from which tests are taken. One of the most important points to look after for surface defects is the inspection, which is the most difficult to thoroughly accomplish.

Rolling mills usually have very little spare yard room for inspection of material, thus making it necessary to hurry the surface inspection in order to clear the yard, but with proper care the surface inspection can be done very satisfactorily.

A very important test of steel and iron is the cold bend test, which should be required for all specimen tests. In the tensile tests wrought iron should show a strictly fibrous fracture, and in general must be tough and easily welded, and should show no weld marks after being cooled.

A sufficient number of tests should be made to fairly represent the sizes of the material ordered and the number of full size tests should be sufficient to represent the eye-bars or tension rods; usually about one bar in 15 or 20 is considered a fair proportion.

Steel should have much more rigid inspection than iron, and should be rejected for much less important appearing defects. A steel eye-bar having any defects within 3 feet of either end before the heads are made, should be rejected, as the upsetting of the same will tend to increase the size of the defects, while in iron bars the piling and forging of the heads will be more likely to remove them. It is customary to require two tests from each heat or blow of steel, one being a ¾-inch round rolled from a small test ingot, which is poured as nearly as possible from the middle of the melt, and the second is cut from finished material, so as to represent as nearly as possible the different sizes of the same. These specimens are tested for elastic limit, ultimate tensile strength, elongation, reduction of area and bending cold.

The elastic limit of steel should be not less than 40,000 pounds per square inch for high grade steel, 36,000 pounds for medium steel and 30,000 pounds for soft steel.

The ultimate tensile strength of high grade steel should range between 70,000 and 80,000 pounds per square inch: of medium, between 60,000 and 70,000, and of soft, between 52,000 and 60,000 pounds per square inch.

The elongation in 8-inch length should be not less than 18 per cent. for high grade, 22 per cent. for medium and 25 per cent. for soft steel. The reduction of area at point of fracture should be not less than 35 per cent. of the original area. High-grade steel should be used for compression, bolsters, bearing plates, pins and rollers.

Medium steel should be used for tension members, floor system, laterals, bracing, portals and, unless high-grade steel is specified, should be used for all steel members except rivets.

Soft steel should be used in rivets only, and should be tested by actually making up into rivets, riveting two plates together, and upon being nicked and cut out, should show a good, tough, silky structure with no crystalline appearance. Rivet steel should not have over 0.$\frac{16}{100}$ per. cent. carbon.

Steel made by the Bessemer process should not have over 0.08 per cent. of phosphorus and open hearth steel not over $\frac{1}{10}$ of 1 per cent. The amount of phosphorus allowed should always be stated in the specifications, as this determines the price of the pig iron required to make the steel.

About 0.04 per cent. of sulphur is allowable and sometimes more. Excessive sulphur in steel or iron causes the same to be "red short;" that is, it cannot be hammered or forged at or above a red heat, but can be worked below that heat, while excess of phosphorus causes the metal to be "cold short" or incapable of being worked at or below the temperature of dull red heat.

Analysis should be required of each melt showing the amount of carbon, manganese, phosphorus and sulphur in the steel, and these analyses would better be made from drillings taken from the finished material.

The writer hopes to see the specifications of bridge engineers made of a uniform character, which can be easily complied with, and which will be based upon a thorough knowledge of the physical metallurgical and chemical qualities of the material.

PROPOSED SEWERAGE FOR QUINCY, MASS.

THE annual municipal reports of Quincy, Mass., for 1889, John P. Prichard, Commissioner of Public Works, includes reports by Percy M. Blake, C. E., of Hyde Park, Mass., on a sewerage system for the city. The plan recommended by Mr. Blake, to include the larger part of Quincy, contemplates a system of sewers to collect the sewage by gravity at a point near the town farm, where it is to be pumped to a discharge pipe, which will run to an outlet in deeper sea water, either 12,000 feet to Gull Point or 16,000 feet to Nut Island. The main trunk sewer would be 30 inches in diameter at the pumping station, and the outfall pipe 16 inches or larger, of cast iron, laid level. The cost of the disposal works, with brick pumping station, two boilers, two pumps each with a capacity of 2,000 gallons per minute, with pipe to Gull Point and protection of outfall, is put at $98,600, or, with reservoir at Gull Point to permit discharging at ebb tide only, $110,600. The cost with the outlet at Nut Island is given at $124,300 in one case and $140,300 in the other.

With regard to a part of the city called Atlantic, which is so situated that its sewage could not be collected by gravity at the town farm, Mr. Blake makes a separate report advocating separate collection by gravity and pumping to the main system. The cost of this, with pumping plant, he estimates at $72,320.

A FOOT BRIDGE IN INDIA.

A VERY light foot bridge for moderate spans has been designed by J. H. Apjohn, C. E., of the Orissa Coast Canal Company, and used to cross the "drainages" along the canalized portions of the Surpai River, India. The details of its construction are shown by the accompanying illustrations prepared from sketches in the *Indian Engineer*.

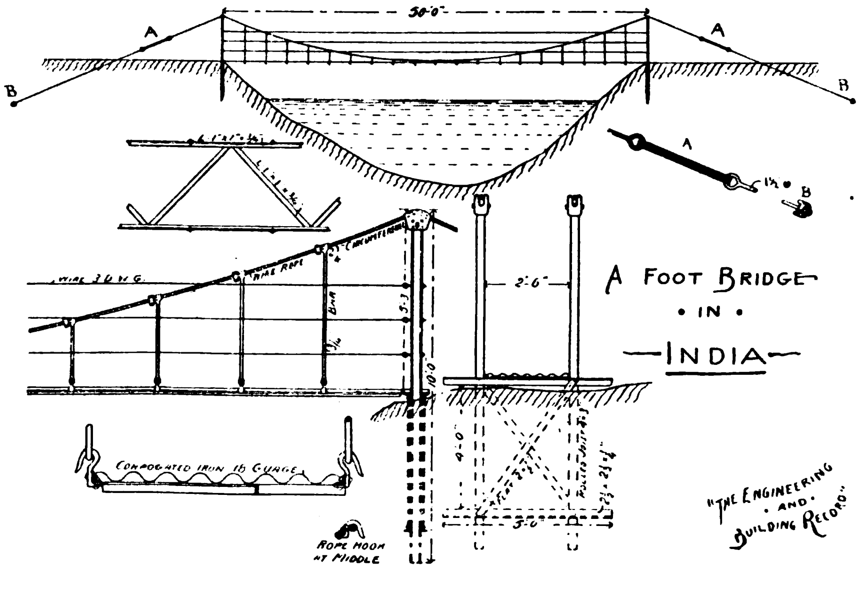
Evidently this footwalk must be very flexible, but that might be admissible for a temporary or little-used structure, and various modifications, such as the use of floor guys, a trussed hand-rail, braced towers, etc., will readily suggest themselves.

The suspension cables are adjustable at A, and are anchored at B to an old rail 20 feet long. From the appearance of the floor beam hooks it seems probable that it was intended to make portability a feature of the structure.

A PECULIAR WROUGHT-IRON CHIMNEY.

THE following particulars have recently been published of the construction of a wrought-iron factory chimney of somewhat novel character, built at Creusôt, France. The total height of the chimney is 279 feet, the diameter 23 feet at the base and 7 feet 6 inches at the top, the total weight being 80 tons, exclusive of masonry foundations. The latter are carried 3 feet 3 inches above the ground, and weigh about 300 tons. The shaft was built in successive rings, each 4 feet 1 inch high, the thickness varying from $\frac{9}{16}$ inch at the base to $\frac{1}{4}$ inch at the top. The nine lower rings were formed of eight plates each, the upper ones of four plates each. The base was encircled by a massive angle iron bolted to the foundation. The eight lower rings were lined with fire brick. The erection of the chimney occupied seventy days, including taking down the flying scaffold. The latter was of a somewhat novel character. It consisted of a central wrought-iron tube 7 inches in diameter, and provided at the bottom with four wooden crossbars or arms, so clamped that their length could be adjusted to suit the varying diameter of the chimney, and carrying the internal platform. These arms rested on angle brackets refitted to the interior of the plates. The upper part of the central tube carried four crossarms or jibs, each consisting of a pair of timbers stiffened by raking struts from the central tube. From their outer ends was slung the exterior circular platform. The latter consisted of a pair of angle iron rings, to the outer part of which was riveted a plate-iron fence, while the inner was provided with T iron stanchions. Radial bearing timbers, resting on these rings, and adjustable endwise to suit the varying diameter of the chimney, carried the platform, an annular space being left just sufficient for hoisting the plates. The latter operation was effected by a rope passing over an adjustable pulley fixed to each jib in turn, and carried down a central tube to a snatch block fixed at the bottom of the chimney. As each successive ring was riveted up, two pairs of bars were laid across, by which the scaffold was slung by four jack screws furnished with ratchet collars, and thus raised high enough to take a bearing on the next set of angle brackets.

The complete scaffold weighed about four tons, and the heaviest plate about eight hundred weight. The total cost of the chimney, without foundations, was about $8,000.



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*A paper read by James Ritchie before the Civil Engineers' Club of Cleveland, and published in the *Journal of the Association of Engineering Societies*.

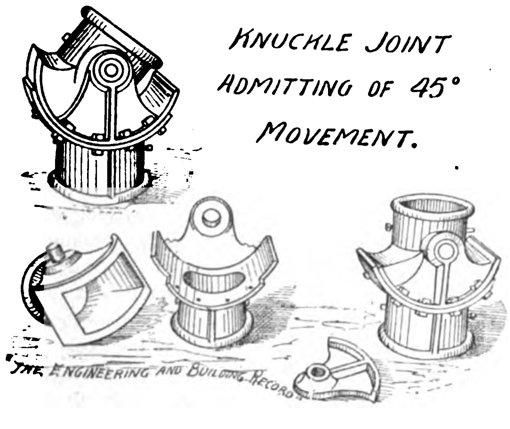
NEW ENGLAND WATER-WORKS ASSOCIATION SKETCHES.

No. XV.

(Continued from page 104.)

FORTY-FIVE DEGREE KNUCKLE JOINT FOR WATER PIPE.

THE accompanying illustration, showing a knuckle joint admitting of 45 degrees movement, formed one of the several sketches submitted at the Portland meeting of the New England Water-works Association. It was presented by F. H. Crandall, Superintendent of the Burlington, Vt., water-works. The joint is in use on the distributing pipe of the lower service reservoirs at that place. The construction is clearly shown in the cut.



THE PLANNING OF EARLY CITIES.

A DISSERTATION on "The New Town of Edinburgh, and on the Planning of Early Cities," formed the subject of Prof. G. Baldwin Brown's recent presidential address before the Edinburgh Architectural Association. Professor Brown, in the course of his remarks, pointed out the fact that the rectangular planning was a prominent feature in ancient Greece, whither it seems to have been imported from the seats of older civilization in the East. Wherever cities have to be laid out afresh on level ground, where no natural features are present to suggest a varied direction, the straight line and the right angle present themselves naturally, and would be delighted in by a people mathematically inclined. This was accordingly the scheme adopted by the old Egyptians and the Babylonians, who built upon flat alluvial plains, and who had, besides, a special reason for favoring a square or rectangular plan. This was Orientation. Among both these peoples, East and West, North and South had religious significance, and buildings or groups of buildings were commonly turned with their sides or their corners facing the points of the compass. The Egyptian tombs and the Babylonian temple mounds followed this law, which was strikingly exemplified also in the city of Khorsabad, built by Sargon II. of Assyria, near Ninevah. This city was foursquare, each side a mile in length, and provided with gates, the corners being turned towards the cardinal points. So much were the people of these regions enamored of this regularity, that in the case of Babylon itself, rebuilt by Nebuchadnezzar on each side of the Euphrates, which has naturally a winding course, the engineers first straightened the river-bed, and gave it a perfectly even line through the city, and then laid out their streets, the main ones parallel to the river quay, and the cross streets joining them at right angles.

The scheme of street planning thus established was transported to the West under the following circumstances. When the epoch of magnificence in public works came to Athens, after the defeat of the Persians, the Peiræus, the sea-front of the city, which was to Athens as Leith to Edinburgh, came to be laid out anew under the administration of Pericles, and his adviser planned it all in straight streets crossing each other at right angles. This adviser was one Hippodamus of Miletus, in Asia Minor. As native of a city on the eastern side of the Greek world, and one famous for its foreign trade and colonizing activity, Hippodamus would be familiar, through travel or report, with the old cities of Mesopotamia, and we may regard the plan be adopted at the Peiræus as derived from this more ancient source. From this time onward the scheme of Hippodamus was regularly adopted in laying out new cities throughout the Grecian world, as in the cases of Thurii in Southern Italy, Rhodes and Megalopolis in Peloponnesus. Still more remarkable was the adoption of this scheme in the magnificent cities laid out by Alexander the Great and his sucessors throughout their extended dominions. In the most splendid of these, Alexandria and Antioch, the whole length of the city was traversed in a straight line by a broad street some four miles in length, bordered by colonnades, and this was intersected at right angles by a second principal thoroughfare, the spot where the two crossed being marked by a circus or a public monument. Lines of trees in the center turned some of these streets into boulevards. Parallel to these great guiding lines ran the subsidiary streets, all measured out with the rule and set square. So far was this passion for regularity carried, that in one of these post-Alexandrine cities—Nicæa in Bithynia—the seat of the famous Council of the early Church that issued the Nicene Creed, we learn from Strabo [xii, 14, 7] that its shape was quadrangular, eleven furlongs in circuit. It had four gates, one on each side; and four main streets, running from these, met at right angles in the center, so that all four gates could be seen from a single stone set up in the exact middle point of the city.

Now it is a remarkable fact about city-planning that this rectangular arrangement could not have presented itself naturally in the case of these Greek cities, for it contradicted in nearly every case the actual lie of the ground. There were here no flat alluvial plains; but, on the contrary, marked natural features. The Peiræus was a seaport occupying a bold rocky headland stretching out into the sea, and almost cut in half midway by deep bays indenting it on each side. The highest point of the headland rose to 300 feet. There were natural features of the most prominent and picturesque character, yet this very spot was chosen for the adoption of an artificial geometrical scheme, completely ignoring the configuration of the site. In the same way with Alexandria. We are especially told that the chief public buildings of the city were grouped together so as to face the great bay which formed the principal port; but it was not the sweeping line of the coast or the boldly projecting Lochias promontory which bounded the bay that gave the guiding line to the streets, but again the geometrical right angle and straight edge. Antioch was built on a hilly site, and it cost the engineers some trouble to secure, by means of substructures, a level line for its principal thoroughfare. The constant adoption of this rectangular scheme for cities situated upon broken ground or by natural harbors naturally provokes comment, and the following may, to some extent, explain it. Hippodamus of Miletus, who set the fashion, was not so much an architect, as a sophist, or amateur philosopher and moralist. Every intelligent citizen of the more advanced Greek States was in his way a political philosopher, and had his own views of the manner in which a city should be organized, and of the proper relations of the various classes of its inhabitants. Just as naturally would he think out the ordering of the material streets and houses in which these were to dwell, and this the more readily because the professed architect in one sense of the term hardly then existed. Hippodamus, therefore, only followed the normal course. Aristotle tells us that he was a thinker who busied himself greatly about the constitution and internal ordering of States, and to lay out streets and squares was merely to him a part of the same work. While he probably obtained the first idea of rectangular planning from the older Oriental cities, he worked it in, doubtless, with his ideas for dividing the classes of citizens and regulating their moral and social life. The persistent use of the scheme in Greece is in this way a testimony to the strength of the principle of order and regularity so binding on the Hellenic intelligence, which they would emphasize in the plans of their cities as one means of inculcating the principle in its moral aspects upon the minds of the inhabitants. A similar moral idea may underlie the conception of the New Jerusalem in the Book of Revelation, which was to lie "foursquare" like Babylon and like Nicæa, and the scheme of which had as much affinity with the New Town of Edinburgh as the old historical Jerusalem had with the "Auld Reekie" of the High Street and the Closes.

There was, however, another way in which this feeling for regularity in city planning might be gratified without adopting the rectangular scheme. This was by working on the principle of radiation, and running the streets in every direction outwards from a central point like the spokes of a wheel. I am not aware that any Greek architect actually carried out such a plan for a city, but that it was contemplated as possible is proved by a passage in the *Birds* of Aristophanes, where the town built by the birds in the air is to be circular, with a market-place in the center, and roads branching in every direction like the rays of the sun.

After the Greek period had passed we find Roman practice greatly strengthening the tradition of rectangular planning. Rome itself, like Athens and all the older cities of Greece and Italy, was of the type of the Old Town of Edinburgh, and remained ill-built, with narrow, crooked streets, bordered by immensely tall houses, till after the great fire, under Nero; but the rectangular scheme was always adopted in the arrangement of the Roman camp of the late Republican and early Imperial times. This was of a square, and sometimes oblong form, with four gates, and was intersected by two or three principal streets, parallel to which ran the subsidiary alleys. As many of the new cities founded by Rome were at first merely military stations, and grew up out of permanent camps of the kind just described, rectangular planning was in this way extended over the regions conquered by the Roman arms.

It would be an interesting task to endeavor to authenticate in Western towns, which had such a beginning, the traces of this original arrangement of the camp; but, speaking generally, we may say of all the cities of the mediæval period following on the breaking up of the Roman Empire, that there was little thought of regular planning, but that they all reverted to the old fortified type, and squeezed themselves in within walls at the foot of their citadels to secure for the inhabitants the utmost possible protection in times of violence and disorder. It is very noteworthy, however, to find the regular rectangular scheme coming forward again into prominence at a more settled period of history. Edward I. of England had a delight in founding new cities both in France and Britain, and adopted the arrangement in every case of a rectangle, with a market-place in the center, and straight streets crossing each other at right angles. Winchelsea, in Sussex, is the best example of his work in the British Islands. The once busy town is now almost deserted, but the broad roads marking out the rectangular plots are still conspicuous, and where the houses which lined them have disappeared their course can be traced by the ranges of finely vaulted cellars which still exist, and give some idea of the former magnificence of the place.

If, now, it be sought to determine in the abstract what is the most effective and convenient scheme to adopt in the laying out of new quarters or new cities, the following points would have to be borne in mind. Unquestionably, where pronounced natural features exist, such as the lines of hills, or of the sea coast, these should be allowed to furnish the main outline of the scheme, and it is curious to find the Greeks, of all people in the world, ignoring the directions thus given by nature.

In the case of more purely artificial schemes, there can be little question of the superiority of the rectangular over the radiating plan. The latter may give scope for a few fine avenues, as in the case of those that converge to the Arc de Triomphe at Paris; but the subsidiary streets have no definite place or plan, while in the parts near to the center, where the ground is most valuable, the plots of land are angular and awkward in shape, and offer perplexing problems to the builder.

In cases where a city or a quarter has to be laid out afresh in a frankly artificial manner, it is probably the soundest taste not to try for picturesqueness and variety, which, after all, will never have the genuine charm of what comes by happy accident, but to aim at stateliness of effect and at an air of calculated unity embracing the whole complexus of buildings dealt with. A rectangular scheme, according to which the space laid out must be definitely bounded on each side, and the whole have compactness and clearness of outline, secures this far better than any radiating scheme, and has the further advantage of giving a natural place for open squares, which come easily and effectively into the composition.

WATER in the city reservoirs at Rochester, N. Y., recently fell so fast as to cause apprehension, and attempts were made to diminish the consumption by stopping the use of garden hose, etc., and by diminishing the pressure. A saving of about 1,000,000 gallons a day seems to have been made by these means.

Novelties.

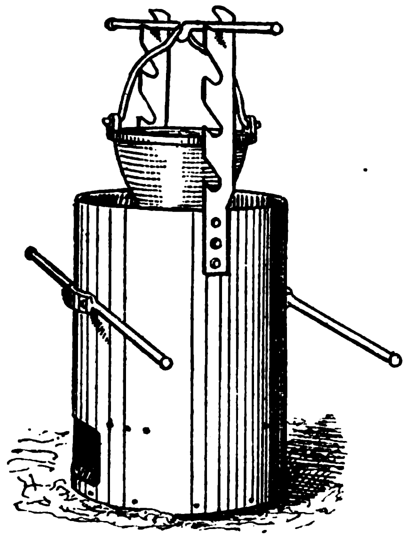
Devices are described under this head purely and strictly as news; because believed to be new and calculated to interest readers.

In no case is pay accepted, directly or indirectly, for publishing a novelty notice.

As the subjects are selected for their supposed novelty and interest merely, it will, of course, be understood that the selection does not imply indorsement.

FURNACE FOR USE IN LAYING WATER MAINS.

SEVERAL months ago this journal had an inquiry from a subscriber asking where he could obtain a furnace for melting lead to use in laying water pipe. There is given herewith a cut showing one form of such a furnace which, with slight variations, may be made to do duty for almost any occasion. The long carrying handles may be replaced by hooks on the side of the furnace into which the workmen may insert bars or pieces of pipe with which to carry it. The grate is made in one piece and rests on angle irons without any fastening, so that it is easily removed. The notched supports which carry the kettle are of great convenience in regulating the temperature of the lead. No door is furnished for firing because there is ample room between the kettle and the sides of the furnace to throw fuel upon the grate. The ash door can be closed, if one wishes to shut off the draught, by a piece of sheet iron. This furnace is manufactured by the Taunton Locomotive Manufacturing Company, of Taunton, Mass., and was designed by the Treasurer, William R. Billings, who is the author of "Some Details of Water-Works Construction," published by this journal. This design grew out of Mr. Billings' practical experience in laying water mains.



Correspondence.

Communications giving information or opinions on matters of general interest to the engineer, the architect, the contractor, or the municipal officer, will be welcomed in this column. Fairness will suggest that when communications are sent simultaneously to this and other journals we should be informed of it at the time. Anonymous letters will not be noticed.

THE PROPOSED WATER-WORKS CRIB IN CHICAGO.

VICTORIA, B. C., July 16, 1890.

To the Editor of THE ENGINEERING AND BUILDING RECORD:

SIR: In reference to the inquiry of a correspondent in your last issue, I can give you a few facts and some opinions.

In January, 1887, the undersigned, together with Mr. B. Williams and Mr. S. G. Artingstall, reported to the Mayor and City Council of Chicago, among other matters, the plan of increasing the water supply of the city. The new pumping station was recommended to be built in the central part of the city and a new tunnel from it to the lake. The report further said:

"We believe that a submerged intake will afford a more reliable and safer structure so far as injury from passing vessels and stoppage by ice are concerned, than a structure projecting above the water.

"With the sewage kept out of the lake there is no need of locating the intake further than two miles from the shore, where water can be obtained sufficiently free from suspended earthy matter, and where a depth of about 30 feet is generally found, which is the least depth desirable for a submerged inlet."

The main recommendations of this report were adopted, except the suggestion of a submerged intake and limiting the length of the tunnel to two miles beyond the shore. I myself have never been able to hear of any good reasons why these exceptions were made, and I am not aware that any other engineer was ever publicly consulted with reference thereto, nor do I know who is responsible for advising this remarkable engineering.

The reasons which led us to recommend the submerged intake were about as follows: In 30 feet of water, about two miles from shore, there would be no danger to a submerged structure, either from vessels during storms or from ice. If the area of the intake is made large enough to reduce the velocity of the inflowing water to but a few inches per second, no drift will tend to obstruct the grating.

In addition to the great economy of a submerged intake, the large structure reaching above the surface of the lake is a decided disadvantage in several respects. The undesirability of banishing human beings for the cold winter months to a desolate spot among fields of ice did not influence our opinion, because if necessary this hardship should and could be endured for the benefit of a large community. But we considered that the structure in the lake would prevent the free movement of ice and therefore be exposed to unknown but enormous strains. If no injury resulted therefrom directly, the ice would probably be forced both up and down the face of the crib and tend to obstruct some of the ports, which trouble has occurred at the present crib. The stone and iron at the ports, and of the structure itself, when cooled by radiation would cause the formation of slush and anchor ice about them, which, as in the case of the previous crib, tend to obstruct the ports. Regarding this question of anchor ice, Sir William Dawson, in a discussion at the Canadian Society of Civil Engineers stated: "The fact that it forms most readily in open water without any covering of ice, and in clear, cold weather, indicates that radiation from the bottom has an important influence in its formation; but where the water is sufficiently cold it may crystallize on any nucleus presented to it, and more especially, it would seem, on metallic bodies and stones which are good conductors of heat." Wooden gratings of a submerged intake will probably be free from the danger of anchor ice.

All these reasons seem to indicate that such a structure as proposed is objectionable, and I am not able to discover for it any advantages (except as a terminus for excursion boats), much less any justification for an outlay of over a quarter of a million dollars.

We have, moreover, some positive evidence to confirm these views, as a number of submerged intakes have been successfully used in different lake cities. The largest one is in front of the city of Toronto. It stands in about 26 feet of water, and is about 2,000 feet from shore. The crib is 40 feet square and covered with an oak grating consisting of 2-inch bars and 3-inch openings. It was put into use in 1882, was examined for the writer in the fall of 1888, and found to be perfectly clean. It had never required cleaning. Nor has there been any obstruction from floating ice, as this can readily float over the crib: nor from anchor ice, because of the oak grating. But even in Chicago the present intake for the old Hyde Park Water-Works is submerged, and, although comparatively near shore, it has been working for several years without interruption.

This subject is certainly of interest to engineers, and I hope you have received, or will receive, further communications, giving actual facts and representing different sides of the question. RUDOLPH HERING.

Questions and Answers.

All questions relating to building construction, paving, sewerage, water supply, or kindred subjects, will be welcomed in this column provided they relate to matters of general interest and are not such as should properly be referred to a consulting engineer. Answers will be carefully prepared and a proof of both question and answer mailed to the inquirer as early as proper consideration will permit. They will be published for the benefit of other readers as soon as convenient. The full name and address should be given, not necessarily for publication, but as a guarantee of good faith, and to facilitate further correspondence in case the question is not sufficiently explicit.

Inquiries of the Editor, in order to secure prompt attention, should *not be written on the same piece of paper as a communication* to the *Publishing Department.* Letters renewing subscriptions are sent to a clerk in the publishing office, and matter for the Editor, if in the same enclosure, is likely to be overlooked unless it is on a separate piece of paper, so that it may be promptly sent to the Editor.

AIR IN WATER.

G. F. COOPER, Superintendent of the Xenia, O., Water Company, writes: "The water here during the summer time is full of small bubbles of air, which makes it look milky when first drawn, but after it has been standing a few minutes the air rises and the water is then clear. Is there any way to remedy it?

We have splendid water, but some people think because it looks milky when first drawn it isn't good?"

[Charles B. Brush, Chief Engineer and Superintendent of the Hackensack Water Company, of Hoboken, N. J., to whom the above inquiry was submitted, writes:

"I do not understand the anxiety of your correspondent in relation to the air bubbles in his water mains. He states that he has splendid water, but that when it is drawn from the mains it looks milky, but after standing for a moment the air rises and the water becomes clear. The condition which gives so much anxiety is one which I have spent a great deal of money to obtain. I have no doubt that the good condition of his water is largely due to the amount of air in it. Nothing pleases our consumers so much as to obtain their water in this condition. If he really wants to get rid of the air he can do so by putting some air cocks in the summits of his mains and blowing the air off. This may be necessary, if there is such an excess of air as to interfere with the operations of his plant. As soon as his customers understand, however, that this æration of the water indicates a high degree of purity and vitality, I believe that further complaint on their part will cease."]

HIGH RANGE PYROMETER.

RUFFORD & Co., of Stourbridge, England, write: "Do you happen to know any makers of pyrometers? We want to have one to register at least from 2,000° to 3,000° Fahr., but cannot find one.

"Our old pyrometer was marked on its face, 'A. Krauss, Paris.' We wrote to Paris to Krauss, but the letter was sent back through the dead letter office. Ours was like a gun barrel with a circular indicator at one end and registered to upwards of 2,000, but it is now worn out."

[We have been unable to find out anything about the firm, "A. Krauss, Paris." Generally speaking pyrometers registering to between 2,000 and 3,000 degrees are not called for owing to their unreliability at such high temperatures, which approach and even pass the melting points of some of the metals used in their construction. Manufacturers frequently state in their catalogues that their pyrometers will indicate correctly only up to 1,000 degrees, though the instruments are graduated up to 1,500 and 1,600 degrees. Such pyrometers can be bought from almost any large dealer in, or maker of, temperature and pressure indicators and appliances. Temperatures beyond their range can, however, easily be determined by a calorimetric method, which consists in exposing a known weight of metal, say iron, to the temperature to be determined, and then cooling it in a known weight of water, noting the initial and final temperatures of the water. The following simple calculation will, with these data, give the desired temperature:

Let T = temperature to be determined = temperature of exposed weight of metal;
" t = initial temperature of water;
" t' = final " " "
" W = weight of amount of water used;
" w = weight of metal;
" s = specific heat of metal.

Then
$$T = \frac{W(t^1 - t)}{w s} + t'$$

For temperatures above 3,000 degrees platinum may be substituted for iron. The specific heat of iron may be taken as .1138, and that for platinum as .0382.]

FILTERING SEWAGE IN BERLIN.

IN a recent paper discussing sewage disposal for London, England, Crawford Barlow, M. Inst. C. E., said of Berlin, that, with a population of 1,400,000, located on 15,266 acres of a flat, sandy plain, there is a total of 30,800,000 gallons of sewage per diem from the 12 drainage districts. This is pumped to several irrigation farms where 6,780 acres of land are in use, of which 3,719 acres are drained.

Mr. Barlow continued, "with sewage five times more charged with fæcal matter than that of Paris, the health of the cultivators and of the inhabitants of the domain is perfect. There is no typhoid fever. The city of Berlin has already established two convalescent homes in the houses of its domains: it is about to found two others in the very middle of its irrigation fields. Typhoid fever has diminished at Berlin till it represents only one-third of what exists in Paris. The towns and villages which are close to the sewage farms make no complaint, and their sanitary state is excellent. Part of the effluent from the sewage farms of Berlin is collected in an ornamental lake in which fish breed freely. This fact alone suffices to show how thoroughly all putrescible matter is removed from the sewage in a well-arranged, well-managed irrigation farm. The chemical analysis of the effluent water from the farms tell the same tale

* * * "We drank of it, for we knew beforehand that chemical analysis showed it to be destitute of organic matter, and to contain fewer microbes than spring water does.

* * * * * * *

"There are no bad odors, and no complaints are made by the convalescents. In the fields of Malchow the meadows of rye grass especially struck our attention. The fourth cutting was being made of grass as green, as thick, and as straight and high, as can be imagined. Seven cuttings are annually made of the same value."

DOMESTIC PLUMBING HEATING LIGHTING & VENTILATION ENGINEERING

PLUMBING IN A SEVENTY-FOURTH STREET HOUSE.

In a new block of five 4-story houses on West Seventy-Fourth Street, New York City, the plumbing in each comprises a servants' bath-room and slop-sink on the fourth floor, two wash-bowls and a toilet-room on both the second and third floors, a butler's pantry on the first floor, and kitchen sink, boiler and laundry tubs in the basement.

The second and third floor toilet-rooms are finished in ceramic tiles and oiled wood-work. Each contains a water-closet, wash-bowl, and a full-length porcelain bath-tub, and that on the second floor contains also a sitz bath.

The water-pipes in these rooms are brass, silver-plated; elsewhere throughout the house they are A A A lead; everywhere exposed. The basement fixtures are polished brass; above they are silver-plated.

City water is delivered by a gas-engine pump in the basement to a tank T Fig. 1, built in an alcove of a fourth story room. This tank is about 7 feet by 2 feet 6 inches by 4 feet deep, copper lined, and neatly cased in wood. The space under it is occupied by a large cupboard, A, affording access to the pipes, and an alcove B that contains a planished copper bath-tub. The tank is filled through a 1¼-inch pump pipe C, and overflows through the pipe D. E is a tell-tale to the basement. F is the emptying pipe, and G is the house service pipe, with a check valve H that opens upwards only to prevent water from rising and overflowing the tank when the city pressure is high. I is a trap vent-pipe. J and K are hot and cold water pipes, respectively, to the servants' bath-tub L, and M M are lead safes.

Figure 2 shows the hot and cold water distribution system in the kitchen. A is an 80-gallon double boiler, the inside portion of which, under tank pressure, is supplied by the pipe G, and delivers hot water to the upper floors through the pipe C with branches D and E to the second floor basins and bath-rooms, and F to the third and fourth floors. Cold water is supplied to the second story bath-rooms and basins through the branches H and I, and to the third and fourth floors through the branch J. The outside boiler is supplied with water under street pressure through the pipe B, and delivers hot water through a pipe N, with branches O and P, to the second story basins and bath-room, and a branch Q to the basement fixtures. Cold water from the street is delivered through branches K and L to the second story bath-room and basins, and through a branch M to the basement fixtures. R and S are hot-water pipes to the laundry tubs, where they are both connected to the same branch. Their check valves T T close against an upward current, and prevent the water from one boiler escaping into the other. The pipes B and C are connected by a special branch with a valve V (not shown) which is generally closed, but may be opened to admit tank water to the street boiler, or *vice versa*. U U are check valves opening upwards. This arrangement gives separate supplies under street and tank pressure, respectively, to the second floor and to the laundry. All the hot water cocks are above and all the cold below; all those at the left hand control the tank pressure system and those at the right the street pressure system, so that their operation becomes very simple, and is facilitated by a brass label on each cock. W W, etc., are marble slabs to which the lead tacks are attached before they are put on the wall. Z is the tack, and X X are common screws that enter the countersunk holes Y Y, which are then poured full of lead.

Figure 3 shows the arrangement of hot and cold water pipes in the laundry, where the cocks are in the same horizontal line, and set at the lowest parts of the pipes so as to completely drain them.

This plumbing was done by Faulkner & Blackburn, of New York.

THE WATER SUPPLY OF BUILDINGS IN A COLD CLIMATE.

J. C. Adamson, of St. Paul, Minn., read at the recent convention of the National Association of Master Plumbers, at Denver, a paper on the water supply of buildings in a cold climate, in which he said: "As a first proposition, I would say that in a properly constructed steam heated building the controlling of the water supply is little or no more difficult in a cold climate than in a warm one. The only mistake that is liable to occur in such a building is the putting of the pipes in exposed parts of the building; in a recess of an outside wall, or crossing an attic with nothing but the roof to protect from the weather. I have in my mind a very prominent building in St. Paul where the pipes froze last winter in a recess of a stone wall three feet thick, and were only kept from bursting by the diligence of the engineer in charge, by putting steam up through the rain conductors, which are in the same box. This difficulty, along with many others, will be avoided when the architect will recognize the importance of having a place provided in a building for the plumbing pipes.

"As a second proposition, I would say that in a poorly constructed, poorly heated building, it is next to impossible to keep your water supply in order in such a climate as ours. In an ordinary self-contained dwelling in a climate where the thermometer takes an occasional dip to 40 degrees below zero, with your water pipes of extra strong lead, seven feet below the surface on the outside, and two feet below the basement floor on the inside of the house, with stop and waste at same depth at foot of each riser, with a rod for convenience reaching to kitchen sink with proper drainage for said wastes, your pipes that are above ground throughout the house graded to empty when shut off, and all placed on inside walls, not under floors, if possible, exposed to view or easily accessible, and you have done all you reasonably can do for the successful working of the job.

"There is a third class of buildings which is commonly met with and uncommonly difficult to handle in the matter of water supply, that is, the unheated tenement, or block of stores with flats over, often well built, but each tenant to furnish his own heat, and probably one-third of the store, or apartments unoccupied. This is where your troubles are at an end, as the Quaker preacher told the young man when he married the shrew, but forgot to mention which end, as the young man soon discovered to his sorrow.

"Now let us see what is commonly done, what is occasionally done, and what ought to be done to get this job to run with some degree of comfort and credit to all concerned, more especially to the man who gets blamed for all the mischief arising from having executed the cheapest kind of a contract, taken under the keenest competition.

"It is not a common occurrence to see a job of the kind with a single line of pipe run up along the stack to supply every fixture from cellar to garret, and under the conditions above mentioned, that is partly occupied, and, of course, partly heated with the mercury meandering among the twenties, how is it possible under such circumstances to control the water supply? Well, very often the water is allowed to run a good stream night and day. That is, doubtless, occasionally effective, but entirely inadmissible for reasons so apparent I need not mention them here.

"Then let us consider the best method of fitting up such a building, and the first important consideration in this connection is, to run a separate riser from a point two feet underground of basement to each and every flat or store or apartment that is to be occupied as a separate tenement; next, to have each line controlled by the occupant at a convenient point in their apartment, by means of the usual rod for stop and waste, or slide with chain and cranks for three-way valves or cock placed, as before stated, below the freezing point, and, lastly, all pipes to be exposed to view, and away from outside walls. You will readily ob-

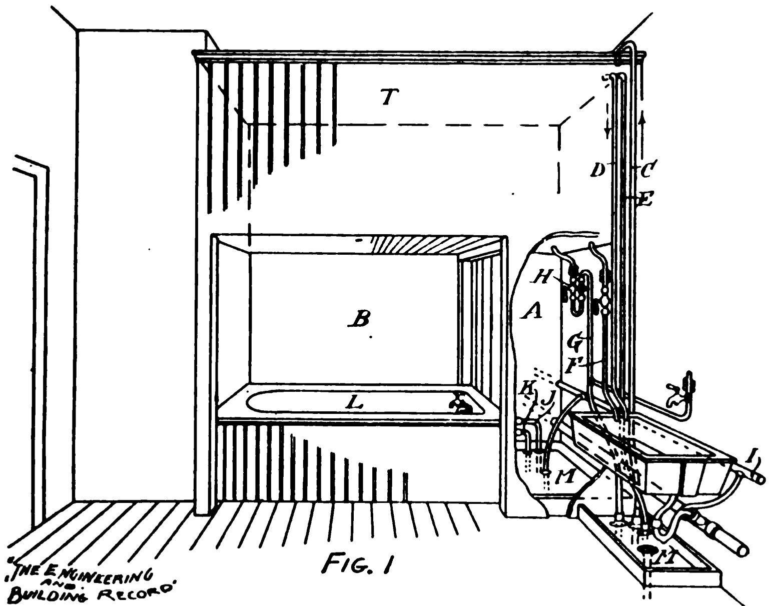


FIG. 1

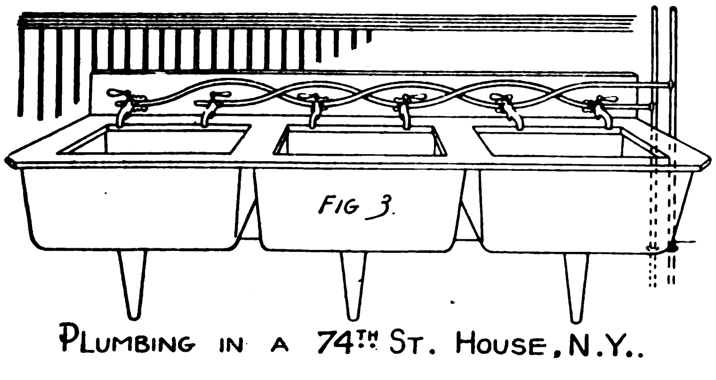


FIG. 3.

PLUMBING IN A 74TH ST. HOUSE, N.Y..

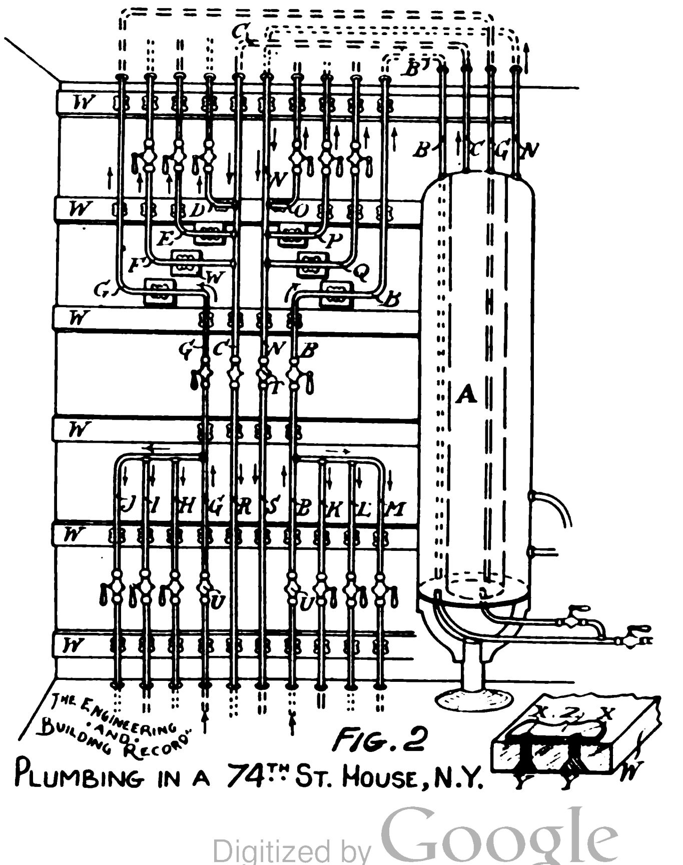


FIG. 2

PLUMBING IN A 74TH ST. HOUSE, N.Y.

serve the advantages of the separate supply, as in the case of a vacant apartment, the water is drained off completely, all fixtures emptied and the traps filled with salt, when all danger from freezing is avoided in that quarter, with the exception of the supply pipe, which may be passing up through for the floor above. This will have to be taken care of. Many details suggest themselves as to the best method of arranging the shut-offs, etc., but I draw this paper to a close by emphasizing my last proposition; that the pipes be exposed to view, and would recommend that the riser be of galvanized iron, standing out from the wall in the same manner as you would run a steam pipe. You will find on reflection much in favor of this system. For example, they can be made to look well, no breaking of walls or ceiling in case of a freeze up, and they are in position for being thawed out, or for large rough temporary boxing, or packing, if thought desirable, in an unoccupied flat."

Experiments on cable propulsion for street cars made on the Chicago City Railway some time ago showed that at an average speed of about 7 miles per hour one horsepower was required for each ton of cable and machinery, and 0.2 horse-power for each ton of car and passengers.

Novelties.

Devices are described under this head purely and strictly as news; because believed to be new and calculated to interest readers.

In no case is pay accepted, directly or indirectly, for publishing a novelty notice.

As the subjects are selected for their supposed novelty and interest merely, it will, of course, be understood that the selection does not imply indorsement.

PORTER & CO.'S HOT-WATER BOILER.

In the accompanying illustrations is shown a modified design of the Page boiler, adapted for hot water heating by W. F. Porter & Co., hot water and steam heating engineers, of Minneapolis, Minn.

It will be noticed that the general character of the boiler has not been changed. The front, however, is cast in one piece, giving a more substantial appearance. Clean-out doors are used at the sides (S), to get at the sections instead of having handholes as formerly. The check draught D lifts instead of revolving and trouble from sticking, due to corrosion, is thus avoided. Openings are left in the top section and on the body of the fire-pot in case it is required to run a separate pipe to a radiator. The grate is made in two sections; one is a round center piece, C, which rotates and can be dumped for cleaning out clinkers, while the other, R, forms an outer ring which rests upon rollers and can be revolved.

The grates are made in two styles, one permitting operation by a lever outside with connecting rods to the grates, and the other being worked by a handle over the ash-pit door. The latter is higher than in the older design, enabling easier inspection of the grate.

In the illustrations Fig. 1 represents a vertical cross section of the boiler and setting; Fig. 2, a vertical longitudinal section, and Fig. 3, a perspective. Figure 4 shows, in greater detail, the screw joint between the boiler sections.

Notes and Queries

on Domestic Engineering.

Communications relating to the practical details of plumbing, heating, lighting and ventilation will be welcomed in this column. The writer's true name and address must always be given, but an assumed name may be used for publication if preferred.

LEAD OR GALVANIZED IRON PIPE.

G. S. Appleton, of Helena, Mont., writes: "I am exceedingly anxious to get an opinion from good authority upon the relative value of lead and galvanized iron to be used as hot and cold water service pipes in ordinary house plumbing, where pipes are completely covered in building.

"If anything has been written upon this subject please refer me to it; otherwise I would suggest that it might be a profitable subject to discuss briefly in the columns of your paper.

"In the case now in question pressure is from tank in the attic; boiler, 60-gallon, heated with an ordinary fire-back in a range; water, soft; the exposed portions of pipe are to be of polished brass."

[We do not know that any comprehensive and authoritative comparison of these pipes has ever been published, and their relative value in any particular case must depend largely upon special conditions not indicated by our correspondent. The fact that elaborate and expensive systems of plumbing are now sometimes put in under similar circumstances with lead and sometimes with galvanized iron throughout, however, indicates either that those doing the work are divided in opinion or regard the choice as immaterial. Illustrated descriptions of plumbing in New York houses recently published by this journal embrace examples of the use of both kinds of pipe.

The relative advantages of lead, tin, brass, iron and galvanized iron pipes, are discussed in the "Catechism of the New York Trade School," as printed in Vol. XV. of this journal, as follows:

1. What size should the pipe from the street-main to the house be?

Should be as large as possible, according to amount of pressure and size of building.

2. What material is used for this pipe in New York?

Generally lead pipe.

3. What other materials besides lead are used for supply-pipe?

Galvanized iron, black iron, tin-lined lead pipe, brass, and occasionally cast-iron pipe.

4. How is iron used?

Galvanized and black—sometimes lined with block-tin or glass.

5. What are the advantages and disadvantages of lead pipe?

Advantages—Pliability, strength, and durability.

Disadvantages—Danger of poisoning and of corrosion.

6. What are the advantages and disadvantages of plain iron pipe?

Advantages—Cheapness, ease of putting together, and safety from poisoning.

Disadvantages—Want of durability, owing to rust eating holes in it, and of filling it up.

7. What are the advantages and disadvantages of tin-lined pipe?

But little used. Difficulty of preventing water from getting between lining and pipe.

8. What are the advantages and disadvantages of glass-lined pipe?

An excellent pipe in many respects, but liable to have lining broken from bending and from frost.

9. What are the advantages and disadvantages of galvanized iron pipe?

Advantages—Cheapness and freedom from rust, durability, etc.

Disadvantages—Some waters decompose zinc, and the salts are poisonous.

10. What are the advantages and disadvantages of brass pipe?

When well tinned it is light, strong, and durable; objection is that it is supposed to be poisonous when not tinned.

11. What are the advantages and disadvantages of block-tin pipes?

Perfectly safe; but expensive and difficult to work. Hot water affects its durability seriously.

12. What are the advantages and disadvantages of tin-lined lead pipe?

It is a safe and durable pipe for cold water. Hot water produces an unequal expansion in the two metals and soon destroys it. Lime also affects the tin.

13. In using tin-lined pipe what must be guarded against?

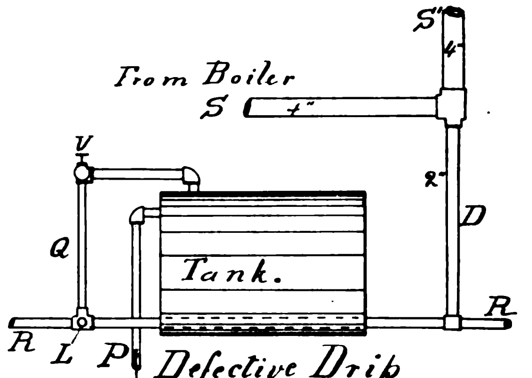
The lining should be carefully preserved in making the joints, either by using the proper kind of solder, or using tinned-brass ferrules.

As regards danger to health from using galvanized iron pipe, as we have before said (page 342, Vol. XVII), with ordinarily pure water, there need be no fear. All drinking water will dissolve zinc on galvanized pipes, but under no circumstances can there be enough dissolved to harm the human body without making the water so milky and giving it such a strong metallic taste that no one would use it. We should be glad to have further correspondence in regard to this matter.]

DEFECTIVE DRIP CONNECTIONS IN A STEAM HEATING SYSTEM.

A correspondent writes as follows: "In overhauling a steam-heating plant which could not be made to perform satisfactorily the peculiar arrangement of drip connections, shown in the annexed cut, was found.

"From the 4-inch main steam-pipe S, a riser S' extended upward to supply the radiators, and a drip-pipe D, extended downward, connecting with the return main R. From this, again, a pipe Q led upward and into a tank. Ordinarily, exhaust steam was used for heating, the pressure in the steam mains being about five pounds. Provision was made, however, for using live steam for heating when the engine was not running, the valve V in that case being closed, and the water of condensation returning to the boiler through the pipe L, with suitable trap connection.



Defective Drip Connections.

"It will be seen that, when using exhaust steam, there was thus an open circuit from the pipes S and S' through the drip-pipe D and returns R into the tank and out through the pipe P, which was designed for an overflow-pipe, into the sewer. While the vertical pipe Q helps to form a water seal, in this case about five feet deep, the water was blown out with a slight increase above about $2\frac{1}{2}$ pounds pressure. As a consequence, a large portion of the steam which ought to have been available for heating, took the more direct course into the tank and thence into the sewer. When turning steam into the system, the tank invariably heated up long before any heat could be secured in the radiators. Will not a steam trap, interposed between the steam and return mains, remedy the difficulty?"

[The interposition of a trap between a steam and return main will prevent a serious loss of steam in that particular direction or pipe, but in cases where there are many connections between the main and return, each would require a trap, and the number might make the remedy impracticable. A trap of the proper kind in the pipe Q will stop the loss of steam through the tank. Of course the pipe Q will be closed when live steam at boiler pressure is used, and the water is being returned directly to the water.

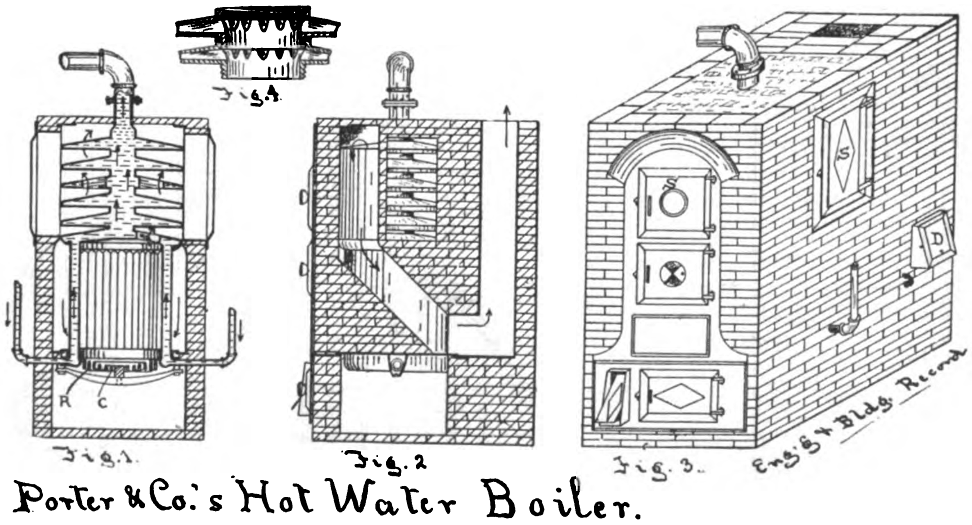
We do not see the necessity for a tank unless it is for a receiving or blow-off tank, to comply with city ordinance.]

TEXAS PLUMBERS' ASSOCIATION ORGANIZED.

Texas plumbers held a meeting at Waco, July 15, and organized a State association, with officers as follows:

F. J. Maddin, of Sherman, President.
J. A. McWhirk, of Dallas, Vice-President.
J. S. Brazleton, of Waco, Secretary.
G. W. Preuit, of Waco, Sergeant-at-Arms.
Frank Pettit, of Denison, Treasurer.
D. J. Sullivan, of Dallas; D. J. May, of Galveston, and F. A. Campbell, of Dallas, Executive Committee.

The next meeting will be held in October, at Dallas.



Porter & Co.'s Hot Water Boiler.

CONTRACTING NEWS DEPARTMENT.

A WEEKLY RECORD

OF SPECIAL INTEREST TO CONTRACTORS, BUILDERS AND MANUFACTURERS OF ENGINEERING AND BUILDING SUPPLIES.

ARCHITECTURAL COMPETITIONS.

Cincinnati, O.—The Board of Education are asking for plans for school buildings, one to cost $70,000, and one to cost $40,000. They will pay $500 for plans accepted for first building, and $300 for second.

Louisville, Ky.—Mayor Lyons invites plans for remodeling the present City Hospital Building, and also for a new building. The sum of $70,000 must cover the cost of remodeling, and $70,000 for the first section of the new building. Plans must be sent to the Mayor by August 2.

CONTRACTING INTELLIGENCE.

For works for which proposals are requested see also the "Proposal Columns," pages i-ii-126-127.

WATER.

For Additional Water Items see Proposal Columns

Asheville, N. C.—There is some talk of establishing a storage system in connection with the local water-works supply of this place.

Roxbury Village, N. Y.—Steps will very soon be taken towards constructing the projected water-works system at this place.

Chambersburg, Pa.—The sum of $35,000 has been voted to make improvements to the local water-works plant.

Waverley, Iowa.—The people of this place will hold a public election, August 1, to settle the water-works question.

Hill City, Tenn.—There is a project being discussed to supply this place with water from the plant at Chattanooga. Water-Works Superintendent Wingfield, of the latter place, can furnish details.

Dayton, Wash.—At the recent city election the water-works proposition to bond the city for $55,000 was carried by a majority of 6 to 1, and only 45 votes were cast against it.

Keyport, N. J.—A special election will be held here on July 29, when there will be voted upon a resolution empowering the Board of Commissioners to raise by special tax the sum of $600, to be expended for experimental purposes, in order to ascertain whether or not a suitable water supply can be secured for the use of the people of the town.

Toledo, Iowa.—The question of issuing bonds for the purpose of establishing a system of water-works is to be submitted to the people of this place at an early day.

Houston, Tex.—It is probable that improvements will soon be made to the plant of the Houston Water-Works Company.

Lamar, Ill.—A water-works plant is to be established at this place by the Lamar Water Company. For particulars address J. Guinney, as above.

Salem, Mass.—Complaint is made of a shortage in the water supply of this city, and steps will probably be taken to remedy the difficulty.

Morgantown, N. C.—It is probable that the sum of $20,000 will be expended on establishing a system of water-works for this place. For particulars, address S. R. Collett, as above.

Babyylon, L. I.—The question of obtaining a water supply is now agitating the people of this place, and it would appear that determined steps in this direction are to be taken. At a public meeting of citizens, held a few days ago, the Board of Town Officers were present and the question was thoroughly discussed, the outcome being that a committee of three was appointed to investigate the matter. At the meeting a petition was offered from the Bay Shore Water Company offering to put water through the village for $750. The fact of a franchise having been awarded to the Long Island Water Supply Company, John Lockwood, President, a few years ago, prevented any decisive action, but as the opinion prevails that the franchise previously granted has become invalid on account of the said company's negligence to fulfill its contract, the committee was appointed to settle the matter. Dr. Arnold is one of the committee, and L. H. Fishel can also give information.

Crewe, Va.—The Crewe Land and Improvement Company has been incorporated here, with a capital of $100,000. Objects: to construct water-works, electric light plants, and gas works.

Quebec, Can.—It is reported that the water supply of this place is to be filtered and that an extensive plant for that purpose is to be established.

Marengo, Ind.—The *Post*, of this place, advocates establishing a system of water-works here.

Carthage, O.—Now that the preliminary steps have been taken it is probable that the construction of the proposed water-works system will commence.

Seattle, Wash.—The City Trustees have decided to purchase a Worthington Pump, with capacity of 1,250,000 gallons per day.

Petaluma, Cal.—The Petaluma Water Company is to build a reservoir on Sonoma Mountain, to hold 50,000,000 gallons of water.

Lumber City, Ga.—There is a project being discussed to establish a system of water-works at this place.

East Aurora, N. Y.—Town Clerk C. H. Luddington writes: "The vote on water-works has been had and stood 153 for and 6 against. Expect to commence surveying and making maps this week."

Chicopee, Mass.—Regarding the report that the water supply at this place was to be increased, Town Clerk John D. White writes; "Our water-works are owned by a private company, but as far as I can learn no steps have been taken to increase the facilities."

Gatesville, Tex.—Richard Potts writes from here as follows: "Our Water Company has just been permanently organized. We are waiting for our charter before going to work."

Monmouth, Ill.—It is probable that an election will be held at this place at an early date to decide the question of expending the sum of $25,000 on a water-works system.

Kimball, Tenn.—This place is to have water-works.

Knoxville, Tenn.—It is probable that immediate steps will be taken towards improving the water-works system at this place.

Fayetteville, N. C.—Reports say that the water-works committee is ready to receive proposals for the construction of water-works. For details address J. D. Neill, Chairman, as above.

Unionville, Conn.—The subject of building a reservoir and water-works at this place is being agitated.

Greensborough, Ala.—Reports say that a system of water-works is to be established at this place at once.

Florence, Ala.—It is reported that the sum of $200,000 is to be issued in bonds for the purpose of establishing a system of water-works.

St. Petersburg, Fla.—Reports say that a system of water-works is to be established at this place.

Quincy, Ill.—A 5,000,000 pumping engine is to be added to the local water-works plant.

Fulton, Ky.—The people of this place will hold a public election at an early day to decide for or against expending the sum of $25,000 on establishing a water-works plant. Edward Starks can furnish particulars.

Duquoin, Ill.—The people of this place held a public meeting recently to discuss the water-works question and the result was that a committee was appointed to look into the matter and report at another meeting to be held later. The clerk of the City Council can furnish particulars.

Amsterdam, N. Y.—Reports say that the local water supply is getting short, and that measures towards a proper remedy will be taken at once by the Water Commissioners.

Monroe, Wis.—Reports say that the water supply of this place is unfit to drink, and that a system of filtration is being considered.

Hicksville, O.—The following proposals for the construction of a system of water-works were received July 16, by J. D. Cook, Engineer, of Toledo, O.:

Bidders.	VALVES, BOXES AND HYDRANTS.											
	Valves.					Boxes.					Hydrants.	
	4"	6"	10"	12"	Amount	4"	6"	8"	10"	Amount		Amount
Holly Manufacturing Co., Lockport, N. Y.	$9 50	$15 00	$23 00	$31 00	$385 50	......	......	......	......	......	$23 40	$819 00
Galvin Brass and Iron Works, Detroit, Mich.	7.80	11 75	18 00	26 95	306 80	......	......	......	......	......	24 00	840 00
											25 90	906 50
Frontier Iron and Brass Works	5 70	9 25	14 50	20 50	233 65	......	......	......	......	......	24 00	840 00
Eddy Valve Co., Waterford, N. Y.	8 10	14 00	21 00	27 00	339 70	$3 50	$3 50	$3 50	$3 50	$105 00	24 25	848 75
A. F. Nims, Nebraska City	10 10	16 20	22 30	31 50	403 70	......	......	......	......	......	28 85 f. c.	1,009 75
R. D. Wood, Philadelphia, Pa.	8 12	12 50	19 00	26 00	320 54	4 15	4 15	4 15	4 15	124 50	38 60 f. c.	1,351 00
National Tube Works, Chicago	8 50	14 00	21 00	29 00	348 50	......	......	......	......	......	25 78	902 30
											30 10 f. c.	1,053 50
Ludlow Valve Manufacturing Co., Troy, N. Y.	8 25	13 70	20 50	28 50	339 95	......	......	......	......	......	25 25	873 75
											29 25 f. c	1,013 75
Bourbon B. & C. Works, Cincinnati, O.	7 00	11 00	17 00	23 00	280 00	3 25	3 75	4 00	4 50	116 22	25 00 f. c	875 00
											23 90 f. c.	836 50
Rensselaer Manufacturing Co., Troy, N. Y.	8 20	13 50	19 85	27 25	335 00	......	......	......	......	......	......	......
D. Kennedy, New York	7 00	10 50	17 50	22 75	274 75	......	......	......	......	......	......	......
Lehigh Valley Brass Works, Bethlehem, Pa.	8 32	13 30	19 95	27 55	235 24	......	......	......	......	......	......	......
Bingham & Taylor, Buffalo	......	......	......	......	......	3 75	4 05	4 05	4 40	116 75	......	......
App. number	17	11	1	1		17	11	1	1		35	

Contracts awarded to Bourbon Copper and Brass Works for hydrants at $25 each. Rensselaer Valve Mfg. Co. for valves at bid. Bingham & Taylor, Buffalo, N. Y., boxes, at bid.

Machinery and Boilers.—Holly Manufacturing Company, Lockport, N. Y.: No. 1, one C. N. C. H. D., 10x16x10x12, $2,850; two C. N. C. H. D., 10x16x10x12, $5,455. No. 2, one C. N. C. H. D., 8x12x8½x12, $1,825; two C. N. C. H. D., 8x12x8½x12, $3,360. No. 3, one H. P., 16x10x12, $2,190; two H. P., 16x10x12, $4,130. No. 4, two boilers set up complete, 54"x12", $2,670.

Hicksville Cart and Machine Company: No. 1, first engine C. N. C. H. D., 10x16x10x12, $2,775; second engine C. N. C. H. D., 10x16x10x12, $2,365. No. 2, first engine C. N. C. H. D., 8x12x8½x10, $2,375; second engine C. N. C. H. D., 8x12x8½x10, $1,875. No. 3, first engine H. P., 16x10x12, $1,975; second engine H. P., 16x10x12, $1,370. No. 4, first engine H. P., 14x8½x10, $1,825; second engine H. P., 14x8½x10, $1,190. No. 5, two boilers set complete, 54"x12", $2,240.

Gordon Steam Pump Company: No. 1, one engine C. N. C. H. D., 10x16x10x12, $2,815; two engines C. N. C. H. D., 10x16x10x12, $5,180. No. 2, one engine C. N. C. H. D., 8x12x8½x10, $2,410; two engines C. N. C. H. D., 8x12x8½x10, $4,280. No. 3, one engine H. P., 16x10x12, $2,015; two engines H. P., 16x10x12, $3,385. No. 4, one engine H. P., 14x8½10, $1,821; two engines H. P., 14x8½x10, $3,015. No. 5, one engine C. N. C. H. D., 12x18½x10¼x12, $2,970; two engines C. N. C. H. D., 12x18½x10¼x12, $5,490. No. 6, two boilers set complete, 54'x12', $2,415.

Hughes Steam Pump Company: No. 1, one engine, each 10x16x10x12, $2,410; No. 2, one engine, each 8½x14x8½x12, $2,050; No. 3, one engine, each 16x10x12, $1,710; No. 4, one engine, each 14x8½x12, $1 390; No. 5, two boilers set complete, 54"x12", $1,790.

Michigan Pipe Company, Bay City, Mich.: No. 1, two boilers complete and two pumps, 12x8½x12 (Holly pumps), $4,540; No. 2, two boilers complete and two pumps, 14x8½x12, (Hughes pumps), $4,670; No. 3, two boilers complete and two pumps, 14x8½x10 (Gordon pumps), $5,000.

William B. Pollock, Youngstown, O., two boilers and fittings, ex. setting, $1,100.

Mansfield Machine Works, Mansfield, O., two boilers and fittings, $1,284.

N. B.—Contract awarded to Hughes Steam Pump Company for two 14x8½x12 pumps, at $1,390 each complete, and two boilers set up complete, $1,790 for two, complete.

Pipe and Special Castings.—Lake Shore Foundry, Cleveland, O., 4, 6, 8 and 10-inch pipe, $25.55 per ton; specials, 2¼ cents per pound; total, $9,085.70. Dennis Long & Co., Louisville, Ky., pipe as above, $29.75 per ton; specials, 3¼ cents; total, $10,642.30. Addyston Pipe and Steel Works, Cincinnati, O., 4-inch pipe, $26.65 per ton; 6, 8, and 10-inch, $25.65 per ton; specials, 2⅜ cents; total, $9,285.92. Michigan Pipe Co., Bay City, Mich., total for all pipe laid, valves, hydrants and boxes, $13,426.65.

Pipe Laying.—Hicksville Cart and Machine Works, Hicksville, O., 4-inch, 17 cents; 6-inch, 19 cents; 8-inch, 23 cents; 10-inch, 26 cents; total, $4,305.87. J. J. Rumsey, Findlay, O., as above, 16 cents, 18½ cents, 23 cents, 26 cents; total, $4,143.45.

Building.—Daniel Weller, Hicksville, O., $1,386; Hicksville Cart and Machine Works, Hicksville, O., 18-inch foundation, $1,889; 36-inch foundation, $1,989.

Contract for pipe, etc., awarded to Lake Shore Foundry Co.; laying pipe to J. J. Rumsey; building to Daniel Weller.

Opelika, Ala.—It now seems probable that the water-works system projected will soon be established.

Piedmont Springs, Ala.—A small system of water-works is to be established at this place.

Galt, Ont.—It is proposed to add 86 hydrants to the local water-works system.

Statesville, N. C.—The people of this place have voted for water-works.

Malden, Mass.—A new brick pumping station is to be erected at the water-works, and additional machinery is to be established.

Norwalk, Conn.—Town Clerk L. Warner writes: "We are about to lay a new iron pipe for a distance of 2¼ miles."

Fulton, Ky.—This town is agitating the subject of water-works.

Ellsworth, Kan.—A system of water-works is to be established at this place by H. M. Hadley, of Topeka, Kan.

Lansdale, Pa.—It is probable that improvements will be made to the pumping machinery at the local water-works station.

Harvard, Ill.—Town Clerk P. E. Saunders writes: "An ordinance has been passed to grant a franchise to James H. Thompson, of Chicago, to erect and maintain a system of works in Harvard, and preparations are now making to complete contract and proceed with the work at once."

Garnett, Kan.—The people of this place have voted the sum of $30,000 for the purpose of establishing a system of water-works.

Quincy, Ill.—The Quincy High-Water Pressure Company has been incorporated at this place to establish a system of water-works.

Americus, Ga.—The people of this place have voted $25,000 for a system of water-works.

Mauch Chunk, Pa.—A new water company is to be formed at this place.

Water-Works.—See our Proposal Columns for information regarding water-works and water-works furnishings at the following places: Huntington, Ind.; Poughkeepsie, N. Y.; Washington, D. C.; Hinton, W. Va.; Goshen, Ind.

SEWERAGE.

For Additional Sewerage Items see Proposal Columns

LA SALLE, ILL.—The City Council has appropriated the sum of $30,500 to be expended on sewers during the year 1890. A letting will take place about August 5th.

GRAND RAPIDS, MICH.—The Board of Health has ordered the establishing of numerous additional sewers.

SALISBURY, N. C.—This city will soon hold an election to decide upon the issuance of $100,000 of bonds for a sewerage system.

KIMBALL, TENN.—Plans are being prepared for a system of sewers for this place.

NORWOOD, O.—Considerable sewer work is to be done at this place. For details address the Sewerage Commission, as above.

BRIDGETOWN, N. S.—A sewerage system is soon to be established at this place.

LOWELL, MASS.—The sum of $50,000 has been appropriated by the aldermen for the purpose of furthering the sewerage work.

SOUTHBOROUGH, MASS.—A new system of sewerage by downward intermittent filtration is being constructed for St. Mark's School, from plans furnished by the engineer, F. L. Fuller, of Boston.

TROY, N. Y.—Numerous sewer extensions are to be established in this city.

MARION, O.—The following proposals for furnishing 17,318 feet of 18-inch outfall sewers were opened July 18 by the Sewer Committee. The figures given are for the following quantities, respectively: Pipe, per foot; excavation and trenching, per foot; masonry, per cubic yard; manholes; covers for manholes; total. Bidders—Baird & Cain, Dayton, O., 45 cents, 65 cents, $6, $12.50 per M, $7.50 each; total, $19,179.80. Kelly Bros., Marion, O., 50 cents, 30 cents, $5, $25 per M, $9.37½ each; total, $14,021.90. Corcoran & Cornell, Toronto, O., 45 cents, 70 cents, no bid, $25 per M, $7.50 each; total, $20,055.70. Irvin & Maher, Greenville, O., 40 cents, 38$\frac{3}{10}$ cents, $5, $16 per M, $10 each; total, $13,683.88. Alexander C. Martin, Seneca Falls, N. Y.; 51 cents, 50 cents, $6, $15 per M, $12 each; total, $17,647.18. W. L. Porter, Lima, O., 40 cents, 39 cents, $3, $10 per M, $9.37½ each; total, $13,780.72. The contract was awarded to Irvin & Maher, Greenville, O., at their bid.

SEWERS.—See our Proposal Columns for information regarding sewers and sewer construction at the following places: Rogers Park, Ill.; La Salle, Ill.; Boston, Mass.; Washington, D. C.; Key West, Fla.; Galion, O.; Gravesend, L. I.; Cleveland, O.; Para, Brazil.

BRIDGES AND IRON STRUCTURES.

For Additional Bridge Items see Proposal Columns

STOCKTON, CAL.—The sum of $25,000 has been appropriated at this place for the construction of bridges.

QUEBEC, CAN.—The Quebec Government has granted $510,000 towards the construction of an iron bridge at Valleyfield, Beauharnois County.

NEW IBERIA, LA.—An iron bridge is to be erected across the Teche River, at this place.

BURLINGTON, IA.—The Chicago, Burlington & Quincy has completed plans for the erection of a railroad bridge over the Mississippi River at this place.

DULUTH, MINN.—The letting of the contracts for the foundations and masonry for the drawbridge over Minnesota Point Canal, at Duluth, has been postponed on account of legal matters.

ST. LOUIS, MO.—Forest Park, this city, is to have two new bridges.

LLANO, TEX.—Reports say that a bridge is to be erected over the Llano River, at this place.

DAYTON, ORE.—The contract for a steel bridge over the Yamhill River, at this place, has been let to Hoffman & Bates, of Portland, for $14,000.

CALERA, ALA.—The Louisville and Nashville Railroad Company has awarded the contract for building the union bridge across the Coosa River, for $40,000.

COLUMBUS, O.—City Engineer Kinnear has completed the plans and profile of the High Street Viaduct, and is now at work preparing his estimate.

BOSTON, MASS.—The following proposals for the construction of the Federal Street bridge were opened, July 21, by the Engineering Department: Shaw & Miller, Somerville and Boston, $67,467; Alexander McInnis, Boston, $75,200; John Cavanagh & Co., Braintree, $79,500; W. H. Keyes & Co,, Boston, $79,668; J. N. Hayes & Co., Boston, $90,000; Benjamin Young, Chelsea, $94,000. Awarded to Shaw & Miller.

COLUMBUS, GA.—A $50,000 iron bridge is soon to be erected over the Chattahoochee River, by the Central of Georgia.

DARDANELLE, ARK.—The Dardanelle & Russellville Railroad will erect a pontoon bridge over the Arkansas River, at this place.

BRIDGES.—See our Proposal Columns for information regarding bridge construction at the following places: Mariette, Ga.; Wheeling, W. Va.; Roanoke, Va.; Toledo, Wash.; Waxahachie, Tex.

RAILROADS, CANALS, ETC.

NEW YORK.—A daily newspaper reports that the elevated railroad in New York City is to be extended "at one jump" from the present terminus of the Ninth Avenue line to Yonkers. Nothing authoritative, however, has been made public.

GAS AND ELECTRIC-LIGHTING.

TOWANDA, PA.—The Towanda Electric Illuminating Company will make extensive improvements to its plant.

COLLINSVILLE, ILL.—An electric light plant is to be established at this place by Louis Lumaghi and others. Proposed outlay, $25,000.

MERRIMAC, MASS.—The people of this place are still discussing the electric light question.

SPRINGFIELD, MASS.—Improvements are to be made to the plant of the local electric light company.

TICONDEROGA, N. Y.—An electric light plant is to be established at this place by the Ticonderoga Automatic Light Company. Estimated outlay, $14,000. Address John De Verennes, as above.

BINGHAMTON, N. Y.—The movement to establish an electric lighting plant at this place will probably end successfully. A committee of the Common Council now has the matter in charge.

NEW BRITAIN, CONN.—The Anglo-American Electric Light Company at Kensington, whose plant was burned out, will rebuild at once.

TOLEDO, IOWA.—There is talk of establishing an electric light plant at this place.

ATLANTIC, IOWA.—An electric light plant is to be established at this place.

WAYNESBORO, GA.—The question of electric lights for this place has been decided in favor of establishing a plant at once.

WINDSOR LOCKS, CONN.—The Directors of the Windsor Locks Electric Light Company held a meeting recently and voted to double the capital stock, making it $20,000. Improvements are to be made in the plant.

BEVERLY, MASS.—The people of this place are discussing the electric lighting question.

RUTLAND, VT.—A plant is to be established at this place by the Marble City Electric Light and Power Company.

BALLSTON SPA, N. Y.—Improvements are to be made to the local electric lighting plant.

SLATER, MO.—The people of this place have voted the sum of $7,750 for the purpose of establishing an electric lighting plant.

WARE, MASS.—The electric light station at this place, which was recently destroyed by fire at a loss of $12,000, is to be replaced immediately.

CREWE, VA.—It is now settled that the Crewe Land and Improvement Company will establish an electric lighting plant at this place.

BURRELL, PA.—The Burrell Gas, Water and Improvement Company has been incorporated here. Incorporators, Joseph P. Cappen, W. C Stewart, and others.

LAFAYETTE, IND.—The Lafayette Electrical Manufacturing Company has been incorporated here with a capital stock of $50,000. Incorporators, Dr. E. A. Hutchins, H. A. Hutson, and others.

OTTAWA, CAN.—Improvements will shortly be made to the plant of the Chaudiere Electric Light and Power Company at this place.

ELECTRIC RAILWAYS.—New electric railways will be established and improvements will be made to those already in operation at the following places: Whitinsville, Mass.; Littleton, N. H.; Cedar Rapids, Mich.; Asheville, N. C.; Albuquerque, N. M.; Duquoin, Ill.; St. John's, Ill.; Middletown, N. Y.; Tamah, Iowa; Toledo, Iowa; Cairo, Ill.; Naugatuck, Conn.; Waterbury, Conn.; Rockville, D. C.; Amsterdam, N. Y.; Brockton, Mass.

STREET-WORK AND PAVING.

SACRAMENTO, CAL.—The people of this city have voted to issue $100,000 worth of 5 per cent. bonds for street improvements.

HOUSTON, TEX.—Considerable street paving is to be done in this city at an early date. For particulars address Mayor Scherffins, as above.

CHATTANOOGA, TENN.—Numerous streets and avenues of this city are to be paved this season. Address the City Clerk for details.

NEWARK, N. J.—Bonds in the sum of $100,000 will be issued here for paving purposes.

HANNIBAL, MO.—The street-paving question is still being agitated at this place.

ALBANY, N. Y.—The following proposals for paving were opened by the Board of Contract and Apportionment, July 21: For paving Madison Avenue with Trinidad sheet asphalt from Lark Street to the intersection of Western Avenue. It will require 53,660 yards of asphalt, 16,000 feet of new curb, 290 feet of circular curb, 540 yards of repairing asphalt at street intersections, 120 elm trees, 15,400 for the 21 feet of new flag, gravel and sod sidewalk; 280 feet of old flag trimmed to shape and relaid; the credit price of 52,260 yards of cobble stone, and the credit price for $16,500 feet of old curb stone. The bids received were as follows: Barber Asphalt Company—Per yard for the first item, $3.25; second, 50 cents; third, 50 cents; fourth, 90 cents; fifth, $10 each; sixth, per foot, $2.45; seventh, $1.50 per square foot; eighth, 1 cent per yard; ninth, 1 cent.

Trinidad Asphalt Paving Company—First item, $3.15; second, 80 cents; third, 80 cents; fourth, $1; fifth, $5; sixth, $2.19; seventh, $1.18; eighth, 3 cents; ninth, 10 cents.

The bid of the Barber Company aggregated about $221,000, that of the Trinidad Company about $212,000. The contract was awarded to the Trinidad Company.

For paving Swan Street, from Elm Street to Irving Street, was awarded to Jacob Holler, whose bid aggregated 3,227.40.

LEXINGTON, KY.—The contract for paving Third Street has been awarded to the Southern Construction Company, of Tennessee, which agrees to macadamize the street, furnish the brick and lay them for $2.35 a square yard.

INDUSTRIAL.

THE Berlin Iron Bridge Company, East Berlin, Conn., has the contract for building the new foundry building for The Pratt & Cady Co. at Hartford, Conn. The side walls will be of brick, but the roof will be of iron and fire-proof boards designed by The Berlin Iron Bridge Company. The Pratt & Cady Co. will require three large cupolas, two large traveling cranes, and about 20 small jib cranes.

GOVERNMENT WORK.

WASHINGTON, D. C.—The following proposals for the work named were opened on the given dates by the Supervising architect of the Treasury Department:

New Orleans.—Alterations and foundations necessary to place a steel money vault in the west wing of the United States Mint Building at this place. Opened July 10. Advertisement of June 9. Bidders: John McNally, $4,782; Thomas O'Neill, $5,475; Louis C. LeCorgne, $7,125.

Denver, Col.—Wood sheathing, copper roof covering, gutter linings, skylights, etc., for the United States Court House, etc., at this place. Opened July 12. Advertisement of June 24. Bidders: J. J. Walters, $15,073; W. H. Mullins, $16,225.93; Jas. A. Miller & Bro., $16,692; F. Stapp, $16,745; J. C. Hademan, $17,000.

Washington, D. C.—Drafting materials for Supervising Architect's office. Opened July 18. Advertisement of July 3. Bidders: Fred. A. Schmidt, $1,099.40; Wm. Ballentynes & Son, $1,102.37; George Ryneal & Co., $1,163.20.

ALBANY, N. Y.—The following bids for dredging Black Rock Harbor and the Erie Basin were received by Edward Hannan, Superintendent of Public Works, July 22: Black Rock Harbor—Louis P. & James A. Smith, Cleveland, O., 18 cents per cubic yard; Hingston & Wood, Buffalo, 9¾ cents per cubic yard; R. J. Cram, Detroit, Mich., 17 cents per cubic yard.

Erie Basin—Louis P. & James A. Smith, Cleveland, O., earth, 15 cents per cubic yard; rock, $6 per cubic yard. Hingston & Wood, Buffalo, 15 cents; $2.74. R. J. Cram, Detroit, Mich., 14 cents; $7.

PHILADELPHIA, PA.—The following bids for building a pile and stone dyke at Bulkhead Bar, in Delaware River were received by C. A. Raymond, Major of Engineers, U. S. A., July 17:

BIDDERS.	Delaware pine piles, 80,000 linear feet.	Georgia pine timber, 160,000 feet, B. M.	White oak timber, 68,000 feet, B. M.	Wrought-iron tie rods and screw bolts and washers, 46,000 lbs.	Drift bolts and spikes, 10,000 lbs.	Stone filling, 17,000 cubic yards.	TOTAL.
Ira Lunt, New Castle, Del.	18c.	$36.00	$39.00	4c.	3½c.	$1.38	$48,462.00
I. H. Hathaway & Co., Philadelphia, Pa.	18c.	35.00	38.00	4c.	4c.	1.33	47,434.00
Colin McLean, New York, N. Y.	11½c.	35.00	35.00	4½c.	3¼c.	1.31	41,845.00
Alvin R. Morrison Co., Wilmington, Del.	13¾c	34.00	38.50	3c.	3⅛c.	1.30	42,850.50
Davis & Irvin, Philadelphia, Pa.	14c.	37.50	44.00	3c.	3c.	1 35	44,822.00
Wm. T. Gaynor, Fayetteville, N. Y.	15c.	37.00	39 00	3c.	3c.	1.35	45,202.00
Geo. C. Platt, Philadelphia, Pa.	13c.	34.00	40.00	3⅜c.	3⅜c.	1.37½	43,825.00
Joseph S. Allen, Philadelphia, Pa.	13c.	35.00	37.00	3½c.	3c.	1.35	43,376.00

NEW CORPORATIONS.

COLUMBUS, IND.—The Louisville, Richmond and Dayton Railroad has been incorporated, with a capital stock of $4,000,000. The line will be 140 miles long.

PROPOSALS.

(Continued from page ii.)

PROPOSALS FOR SERVICE CONNECTIONS.—Office of Post Quartermaster, Fort Keogh, Mont., July 5, 1890. Sealed proposals in triplicate, subject to the usual conditions, will be received at this office until 12 o'clock noon, on the 5th day of August, 1890, and then opened, for furnishing all the labor required in making **SERVICE CONNECTIONS** with water mains at this post. Specifications, instructions to bidders, and blank forms of proposals will be furnished on application to this office. M. C. MARTIN, 1st Lieut. & R. Q. M. 22d Infantry; A. A. Q. M., U. S. A. 9

PROPOSALS FOR PLUMBING, ETC.—Depot Quartermaster's Office, David's Island, N. Y. H., July 1, 1890.—Sealed proposals, in triplicate, will be received until 11.30 A. M., WEDNESDAY, July 30, 1890, and opened immediately thereafter, for supplying and fitting up **BATH-TUBS, WATER-CLOSETS** and **URINALS** in basement of 1888 Brick Barrack at this place. Plans, specifications, general instructions to bidders and blank forms of proposals will be furnished to bidders on application to this office. The right to reject any or all bids is reserved to the United States. Captain J. MCE. HYDE, Assistant Quartermaster, U. S. Army, Depot Quartermaster. 8

TREASURY DEPARTMENT, U. S. LIFE-Saving Service, Washington, D. C., July 23, 1890.—Sealed proposals will be received at this office until 2 o'clock P. M. of THURSDAY, August 7, 1890, for the construction of a **LIFE-SAVING STATION** at Cold Spring, near Cape May City, New Jersey. Plans and specifications containing full information, and forms of proposal, can be obtained of the Collector of Customs, Philadelphia, Pa.; Superintendent of the Fourth Life-Saving District, Point Pleasant, New Jersey; Keeper Cold Spring Life-Saving Station, Cape May City, New Jersey; Superintendents of Construction, Life-Saving Stations, Atlantic and Lake Coasts; No. 24 State Street, New York City, and upon application to this office. S. I. KIMBALL, General Superintendent.

PROPOSALS.

SEWERS.—GALION, OHIO.

PROPOSALS ARE WANTED UNTIL NOON of August 20, 1890, for the construction of about 9,000 feet of **PIPE SEWERS.**

J. B. WEDDELL,
11 City Civil Engineer.

HUNTINGTON, IND., WATER-WORKS.

SEALED PROPOSALS WILL BE RECEIVED until noon of TUESDAY, July 29, 1890, by The Water-Works Manufacturing Company, of Huntington, Ind., for the following items for the Huntington **WATER-WORKS:**

One thousand five hundred and seventy-seven (1,577) tons of cast-iron water pipe, ranging from four (4) to sixteen (16) inches diameter.

Sixty-two thousand two hundred and seventy-six (62,276) pounds of special castings.

Eighty-four (84) six (6) inch double nozzle fire hydrants.

Fifty (50) four (4) inch double nozzle fire hydrants.

Ninety-seven (97) stop valves, from four (4) to fourteen (14) inches diameter.

Ninety-seven (97) stop boxes for above valves.

Laying of above Pipe, and setting of above Special Castings, Fire Hydrants, Stop Valves and Stop Boxes.

One brick Pumping Station.

One brick-lined circular Pump Well.

One timber Intake Pier.

One or two systems of Driven Wells.

Two (2) compound duplex direct-acting pumping engines, each of one million five hundred thousand (1,500,000) gallons daily capacity, together with two (2) return tubular boilers, sheet-iron chimney and all appurtenances necessary to complete said machinery.

Proposals must be made on the blank forms furnished by The Water-Works Manufacturing Company, and all legal formalities must be complied with to secure consideration of the proposals.

Plans for above work may be examined and blank forms of proposal and specifications can be obtained at the office of the Water-Works Manufacturing Company, Huntington, Ind., or the office of the Consulting Engineer, rooms 21 and 22 Glenn Building, Cincinnati, O.

The proposals must be sealed and addressed to The Water-Works Manufacturing Company, Huntington, Ind., and be indorsed with the name of the person, firm or corporation which make the tender, and be accompanied by a certified check, payable to the order of the Treasurer of The Water-Works Manufacturing Company, as follows:

Water pipe and special castings	$500
Fire hydrants	300
Stop valves	300
Pipe laying	500
Pumping station	300
Pump well	100
Intake pier	200
Driven wells	250
Pumping machinery	500

The company reserves the right to reject any or all proposals.

THE WATER-WORKS MANUFACTURING COMPANY,
WILLIAM MCGREW, Pres't.
JOHN W. HILL, Consulting Engineer,
Cincinnati, O.
HUNTINGTON, IND., June 30, 1890.

PROPOSALS
FOR
Key West Improvements.

OFFICE OF CITY CLERK,
KEY WEST, FLA., June 2, 1890.

SEALED PROPOSALS WILL BE RECEIVED by the City Clerk of KEY WEST, FLA., until 1st of September, 1890, for furnishing the necessary material and putting in an underground system of **SEWERAGE**; also for **GRADING** and **PAVING** the streets of said city and furnishing the material for same; also for furnishing and laying of water mains.

1st. All bids must be made upon the printed forms to be obtained from the City Clerk and inclosed in a sealed envelope, directed to the Board of City Commissioners, and marked on the outside of envelope, "Proposals for Key West Improvements."

2d. Each bid must be accompanied by a cash deposit or certified check of five hundred dollars, to be left in the hands of the City Clerk, subject to the conditions specified, as a guarantee of the good faith of the bidder.

3d. The city reserves the right to reject any and all bids.

4th. Bidders are requested to be present at the opening of the bids.

5th. Bidders are expected to bid separately on sewer system and material, on grading and paving of streets, and on furnishing and laying water mains.

6th. Plans and specifications can be seen at the office of the City Clerk, and at the office of Johnson & Flad, Consulting Engineers, Laclede Building, St. Louis, Mo.

WM. L. DELANEY,
8-10-12 City Clerk.

Proposals for Sewer Construction.

CITY OF POUGHKEEPSIE, N. Y.,
DEPT. OF WATER-WORKS AND SEWERS,
COMMISSIONERS' OFFICE, JULY 24, 1890.

SEALED PROPOSALS WILL BE RECEIVED at this office until noon of TUESDAY, August 5, 1890, for constructing about 1,500 feet of **VITRIFIED PIPE SEWERS** in this city.

Plans and profiles may be seen, and specifications, contract and forms of proposal, together with all necessary information, obtained on application at this office. All proposals must be made upon forms obtained at this office. The right is reserved to reject any or all proposals.

By order of Commissioners
CHAS. E. FOWLER,
9 Superintendent of Water-Works and Sewers.

PROPOSALS.

WATER-WORKS BONDS.

SEALED PROPOSALS ADDRESSED TO the City Clerk, will be received by the city of GALESBURG, ILL., until 6 o'clock P. M., August 4, 1890, for the purchase of **CITY BONDS** issued for water-works purposes in the sum of $100,000, said bonds to be dated October 1, 1890; $50,000 payable ten years after date, and $50,000 payable twenty years after date, all bearing interest at the rate of 4½ per cent. per annum, payable semi-annually. Both interest and principal payable at the Chemical National Bank in the city of New York.

Said bonds to be issued in denominations of $1,000 each.

The right is reserved to reject any or all proposals.

By order of the City Council.
9 J. C. STEVENS, City Clerk.

STREET PAVING.

SEALED PROPOSALS WILL BE RECEIVED for furnishing the materials and laying about 3,300 square yards of **GRANITE BLOCK PAVING** and 170 square feet of crossing stone, at the office of the Board of Road Commissioners of the city of Waterbury, City Hall, until 2 P. M. July 30, at which time and place they will be publicly opened and read. All bids must be upon proper blanks and must be accompanied by a bond for $200, with satisfactory sureties conditioned for the execution of the contract within five days after notice of its award.

A certified check for $200, payable to the city of Waterbury, to be deposited with the Board of Road Commissioners, will be received in place of the above bond. Specifications can be seen at the City Engineer's office, at which place blank forms of proposal can be obtained as well as further information.

By order of the Board of Road Commissioners.
F W. WHITLOCK,
Acting City Engineer.

PROPOSALS FOR CEMENT FOR THE District of Columbia.—Office of the Commissioners, Washington, D. C., July 15, 1890.—Sealed proposals will be received at this office until 12 o'clock M., on TUESDAY, July 29, 1890, for furnishing **CEMENT** for the Public Works of the District of Columbia. Blank forms of proposals and specifications can be obtained at this office upon application therefor, together with all necessary information, and only bids upon these forms will be considered. The right is reserved to reject any and all bids, or parts of bids.

J. W. DOUGLASS,
L. G. HINE,
H. M. ROBERT,
8 Commissioners, D. C.

PROPOSALS FOR THE CONSTRUCTION OF Sewers.—Office of the Commissioners, Washington, D. C., July 14, 1890.—Sealed proposals will be received at this office until 12 o'clock M., on THURSDAY, July 31, 1890, for constructing in the District of Columbia, **TERRA COTTA PIPE SEWERS**, Brick Sewers and Receiving Basins. Blank forms of proposals and specifications can be obtained at this office upon application therefor, together with all necessary information, and only bids upon these forms will be considered. The right is reserved to reject any and all bids, or parts of bids.

J. W. DOUGLASS,
L. G. HINE,
H. M. ROBERT,
8 Commissioners, D. C.

OFFICE OF CHIEF QUARTERMASTER, Division of the Atlantic, Governor's Island, N. Y. H., July 12, 1890. Sealed proposals, in triplicate, subject to usual conditions, will be received here until 12 o'clock noon, August 12, 1890, and then opened for construction, at Governor's Island, N. Y. H., of one (1) double set of officers' quarters. All information can be obtained at the office of the undersigned. The Government reserves the right to reject any or all bids. Envelopes containing proposals should be marked "Proposals for Construction of Building at Governor's Island, N. Y. H., and addressed to CHAS. H. TOMPKINS, Assistant Quartermaster General, U. S. Army. 9

JULY 22, 1890.

SEALED PROPOSALS WILL BE RECEIVED at the office of the Supervising Architect, Treasury Department, Washington, D. C., until 2 o'clock P. M. on the 16th day of August, 1890, for all the **LABOR AND MATERIALS** required for the approaches to the U. S. Post-Office, Custom-House, etc., building at WILMINGTON, N. C., in accordance with the drawings and specification, copies of which may be had on application at this office or the office of the Superintendent. Each bid must be accompanied by a certified check for $200. The Department will reject all bids received after the time fixed for opening the same; also, bids which do not comply strictly with all the requirements of this invitation. Proposals must be sealed and indorsed "Proposals for the Approaches to the U. S. Post-Office, Custom-House, etc., building at Wilmington, N. C.," and addressed to JAS. H. WINDRIM, Supervising Architect. 9

JULY 24, 1890.

SEALED PROPOSALS WILL BE RECEIVED at the office of the Supervising Architect, Treasury Department, Washington, D. C., until 2 o'clock P. M., on the 7th day of August, 1890, for all the **LABOR AND MATERIALS** required to complete the plumbing for the U. S. Court-House and Post-Office at CHARLOTTE, N. C., in accordance with the drawings and specification. Each bid must be accompanied by a certified check for $100. The Department will reject all bids received after the time fixed for opening the same; also, bids which do not comply strictly with all the requirements of this invitation. Proposals must be sealed and indorsed, "Proposal for Plumbing for the U. S. Court-House and Post-Office at Charlotte, N. C.," and addressed to JAS. H. WINDRIM, Supervising Architect. 9

PROPOSALS.

EAST RIVER BRIDGE.

Proposals for Plans for Improved Termini.

NOTICE IS HEREBY GIVEN THAT THE Board of Experts appointed to prepare plans for the improvement of the termini of the New York and Brooklyn Bridge in the two cities, will receive plans for the improvement of the termini from any person who may choose to submit them. Plans must be in writing and must be accompanied by drawings. No compensation will be made to any person for plans or drawings submitted, unless such plans or drawings, or some portion thereof, shall be adopted, and in such case the compensation for such plan or drawing will be fixed and determined by the Board of Trustees. The decision of the Board of Trustees upon all questions relating to compensation shall be final, and not subject to question or review.

Plans must be submitted to the Board of Experts addressed to C. W. Buckholz, Secretary, at the office of the Bridge Trustees, on or before September 1. Due notice will be given hereafter of the time and place where oral explanations will be heard.

Any information concerning the subject matter can be obtained at any time at the office of the Trustees of the Bridge.

JAMES HOWELL,
President.

JULY 19, 1890.

SEALED PROPOSALS WILL BE RECEIVED at the office of the Supervising Architect, Treasury Department, Washington, D. C., until 2 o'clock P. M., on the 15th day of August, 1890, for all the labor and material required for the **EXCAVATION CONCRETE FOUNDATIONS, STONE AND BRICK WORK** of the basement and area walls of the United States Custom House and Post Office building at EASTPORT, MAINE, in accordance with the drawings and specification, copies of which may be had on application at this office or the office of the Superintendent, at Eastport, Maine. Each bid must be accompanied by a certified check for $200. The Department will reject all bids received after the time fixed for opening the same; also, bids which do not comply strictly with all the requirements of this invitation. Proposals must be sealed and indorsed "Proposal for Stone and Brick Work, etc., for Basement and Area Walls of U. S. Custom House and Post-Office at Eastport, Maine," and addressed to JAS. H. WINDRIM, Supervising Architect. 9

JULY 15, 1890.

SEALED PROPOSALS WILL BE RECEIVED at the office of the Supervising Architect, Treasury Department, Washington, D. C., until 2 o'clock P. M., on the 8th day of August, 1890, for all the **LABOR AND MATERIALS** required for the extension of the U. S. Post-Office, etc., building at HOUSTON, TEXAS, in accordance with the drawings and specification, copies of which may be had on application at this office or the office of the Superintendent. Each bid must be accompanied by a certified check for $100. The Department will reject all bids received after the time fixed for opening the same; also, bids which do not comply strictly with all the requirements of this invitation. Proposals must be sealed and indorsed, "Proposal for the extension of the U. S. Post-Office, etc., building at Houston, Tex.," and addressed to JAS. H. WINDRIM, Supervising Architect. 8

SEWERS, Cleveland, O.—Proposals are wanted until July 31, for the construction of certain sewers. Address C. G. Force, City Civil Engineer, as above.

SEWERS, Gravesend, L. I.—Proposals are wanted until July 28, for the construction of certain sewers, also setting hydrants, etc. Address John L. Voorhies, Town Clerk, as above.

BRIDGE, Warahachie, Tex.—Proposals are wanted until August 1, for the construction of a bridge over Roger's Spring Branch. Address J. C. Woodlief, as above.

BRIDGE, Des Moines, Iowa.—Proposals are wanted until July 31, for the erection of an iron bridge over the Des Moines River, at this place. Address R. S. Finkbine, of the Board of Public Works, as above.

BRIDGE WORK, Roanoke, Va.—Proposals are wanted until August 4, for doing certain bridge work. Address James A. McConnell, as above.

PAVING, ETC., Washington, Pa.—Proposals are wanted until July 31, for doing certain street work at this place. Address A. M. Linn, Secretary to the Council, as above.

PUMPING ENGINE, Goshen, Ind.—Proposals are wanted until August 4, for furnishing, etc., a pumping engine. Address W. R. Ellis, as above.

LIGHTING, Columbia, Pa.—Proposals are wanted until August 12, for lighting the public streets, etc., of this place by gas or electricity for a term of one or three years. Address Frank H. Gileen, as above.

BRIDGE, Montgomery, Ala.—Proposals are wanted until August 18, for the erection of a bridge over Catoma Creek, at this place. Address the Board of Revenue of Montgomery County, as above.

SEWERS, New York City.—Proposals are wanted until August 5, for the construction of certain sewers. Address the Department of Public Works, as above.

BOILERS, Philadelphia, Pa.—Proposals are wanted until July 29, for furnishing four tubular steel boilers. Address P. F. Harrington, Commander, U. S. N., Lighthouse Inspector, Fourth District, as above.

HEATING PLANT, West Troy, N. Y.—Proposals are wanted until August 7, for furnishing, etc., a heating plant in the Army Gun Factory at Watervliet Arsenal. Address Lieut.-Col. F. H. Parker, U. S. A., as above.

POSITIONS WANTED.

TOO LATE FOR CLASSIFICATION.

DRAUGHTSMAN, THOROUGHLY UNDERSTANDING perspective drawing, well up in architectural work and some knowledge of surveying, desires position where he can be sure of advancement for hard work. Address C. S., Box 8, this office. 9

POSITIONS VACANT.

WANTED.—A GOOD SOBER PLUMBER WHO understands his business. Address THOMAS W. GANNON, Superintendent of Water-Works, Cairo, Ill.

PARTNERSHIP NOTICE.

AN ESTABLISHED ARCHITECT, WITH 22 years' experience in construction and about 11 years in continued office practice, desires to effect a partnership with a reliable builder. Has been principal of the largest draughting night school in the United States for nine years, and entirely free from all vices. No capital to invest but possessed of thorough and energetic habits. Address ARCHITECT, Box 7, this office. 9

Building Intelligence.

NEW YORK.

S s 116th st, 500 e 8th av, 2 br flats; cost, $56,000 all; o, W Eisenberg; a, J C Burne.

213-215 E 44th st, br shop; cost, $22,000; o, J Murphy; a, B E Lowe.

N w cor Allen and Stanton sts, br flats; cost, $60,000; o, P Herter; a, Herter Bros.

408 W 39th st, br flats; cost, $19,000; o, J Weil & B Meyer; a, G F Pelham.

N w cor Broome and Tompkins sts, 5 br flats; cost, $97,000 all; o, A F Schwaizler; a, E Wenz.

S s 124th st, 87 e 9th av, 4 br flats; cost, $100,000 all; o, J Smith; a, E E Grandolph.

236 Greenwich av, br store; cost, $17,000; o, Eliza L Edgar; a, H Edgar.

S w cor Hudson and Franklin sts, br office bldg; cost, $220,000; o, H L Pearce; a, Carrere & Hastings.

51 Broome st, br flats; cost, $18,000; o, F Stacom; a, C Rentz.

3022 Third av; br store; cost, $22,500; o, J D Thees & Sons; a, J C Babcock.

W s Forest av, 299 n 161st st, 4 fr dwells; cost, $12,000 all; o, J Corbett; a, C C Churchill.

17-19 Greenwich av, 2 br flats; cost, $44,000 all; o, J Goerlitz; a, F Baylies.

S s 121st st, 260 w Lenox av, 7 br dwells; cost, $140,000 all; o, S O Wright; a, Cleverdon & Putzel.

5 Cornelia st, br and s flat; cost, $15,000; o, W Duffy; a, Geo Keister; m, W Rankin.

215 Madison st, br, s and terra cotta flat; cost, $23,000; o, J L Buttenweiser; a, R S Pollock; m and c, J V Campbell.

Monroe st, e s, 316 s Jackson st, br flat; cost, $50,000; o, W Broadbelt; a, J C Burne.

540-44 E 17th st, 3 br flats; cost, $18,000 each; o, T E Tripler; a, C Rentz.

78th st, s s, 150 w 3d av, 4 br flats; cost, $21,000 each; o, W C Burne; a, J C Burne.

402 E 80th st, br and s dwell; cost, $20,000; o, St Monica Roman Catholic Church; a, M J Fitz-Mahoney; m, M J Daly; c, J A O'Connor.

438-42 E 89th st, 2 s flats; cost, $17,000 each; o, Bertha Von Barber; a, F Wennemer.

70th st, n s, 180 e 9th av, 2 br and s dwells; cost, $26,000 each; o and a, Buek & Co.

95th st, n s, 100 w Central Park West; s dwell; cost, $28,000; o, C Hanfeld; a, J Stroud; b, J Harney.

252-254 W 125th st br and iron store; cost, $10,000; o, J Kahn; a and b, Doud & Masten.

8th av, e s, 24.7 s 112th st, 3 br flats; cost, $20,000 each, o, Mrs D Tragman; a J C Burne

131st st, n s, 235 w 5th av, 4 br and s flats; cost, $20,000 each; o, H Hawkes; a, same as above.

Boston road, s e cor 164th st, 4 br flats; cost, $15,000 each; o, Mrs M Johnson; a, J E Kerby.

Jackson av, s w cor 166th st, 3 fr dwells; cost, $3,500 each; o, J A Knox.

Riverdale av, n w cor Church st, 3 fr dwells and stores; cost, $4,500 each; o, I M Dyckman; a, m and c, S L Berrian.

BUILDING INTELLIGENCE.

BROOKLYN.

Saratoga av, w s, 40 n Atlantic av, 5 fr (br filled) dwells; cost, $10,000; o, a and b, W D Bogart.

Ellery st, n s, 250 e Marcy av, 4 fr (br filled) tens; cost, $28,000 all; o, L Beer and Mr Schaffner; a, B Holmburg.

Decatur st, s s, 22 e Patchen av, and Patchen av, e s. 82 s Decatur st, 5 br dwells; cost, $3,000 each; o, J B Booth; a, F W Ames; b, J N Booth.

Sumpter st, n s, 125 e Saratoga av, 6 fr (br filled) dwells; cost, $2,500; o and b, Wm H Booth; a J E Dwyer.

Covert st, n s, 275 e Evergreen av, 6 fr (br filled) dwells; cost, $2,500 each; o and b, Wm H Barton; a, same as above.

Van Voorhis st, n s, 270 w Evergreen av, 5 fr (br filled) dwells; cost, $3,000 each; o, Mary N McLean; a, G Nichols; b, E L J Bedell.

Bedford av, n e cor N 11th st, br bakery and storage; cost, $15,000; o, Christian Friedmann; a, C Rentz.

Broadway, n e cor Covert st, 4 br stores and tens; cost, total, $50,000; o, P Johnson; a, F Holmberg.

Adams st, w s, 75 s Myrtle av, br theater; cost, $40,000; o, Hyde & Behman; a, J De La Hayse.

Hamburg av, s w cor Harman st, 5 brick-filled tens; cost, total, $180,000; o, George Covert; a, Schrempf & Loeffler; b, H Loeffler.

Atlantic basin, South pier, near William st, fr storehouse; cost, $20,000; o, and b, Atlantic Dock Co; a, E W Perry.

Vernon av, n s, 165 e Lewis av, 4 brown and Euclid stone dwells; cost, each, $6,000; o, J B Booth; a, F W Ames; b, J N Booth.

McDonough st, n s, 300 e Stuyvesant av, 4 b s dwells; total cost, $15,000; o and b, Jas Cummisky; a, E Dennis.

N s Van Cott av. 25 e Eckford st, 2 br dwells; cost, $9,500 all; o, L Michael; a, H Vollweiler.

N w cor Bushwick and DeKalb avs, br Sunday School; cost, $32,000; o, Epworth M E Church; a, B L Gilbert.

149–51 Navy st, 2 br dwells; cost, $24,-000 all; o, Henrietta Fisk; a C Lincoln.

S s Nelson st, 144 e Hicks st, br dwells; cost, $9,000; o, Catherine Leaves; a, J W Bailey.

S e cor Broadway and Siegel st, fr dwell; cost, $7,000; o, M Heisberg; a, D Acker & Son.

W s Washington av, 28 n Gates av, br dwells; cost, $18,000; o, D H Fowler & Co; a, H Olmsted & Sons.

S s Van Voorhees st, 100 w Bushwick av, 3 fr dwells; cost, $12,000 all; o, F Ammonna; a, A D Vreeland.

N s 10th st, 197 w 8th av, 5 br dwells; cost, $32,500 all; o, J F Ranson; a, I D Reynolds.

N e cor Park and Nostrand avs: 2 fr dwells, cost, $14,000 all; o, Mr Sinson; a, H Vollweiller.

W s Saratoga av, 40 n Atlantic av, 5 fr dwells; cost, $10,000 all; o and a, W S Bogart.

S s Dean st, 165 w Brooklyn av, 4 br dwells cost, $24,000 all; o, J A Bliss; a, A E White.

N e cor Underhill av and Park pl, br dwell; cost, 9,900; o, City of Brooklyn; a, F Freeman.

507 Myrtle av, br dwell; cost, $7,000; o, S L Keeney; a, E Van Voorhees.

N s Joraleman, 111 e Henry st, br dwell; cost, $45,000; o, D Chauncey; a, C P C Gilbert.

N w cor Green and Flushing avs, 3 fr dwells; cost, $11,000 all; o, G Covert; a, Schrempf & Loeffler.

N s Sterling pl, 100 e Flatbush av, 4 br dwells; cost, $22,000 all; o, J Kowalinka; a, R Dixon.

E s Shepard av, 175 n Liberty av, 7 fr dwells; cost, $17,500 all; o, E D Yarber; a, C A Covie.

N s Woodbine st, 125 e Central av, 2 fr dwells; cost, $10,000 all; o, G Schwab; a, Wishert & Copeland.

N e cor Saratoga av and Hancock st, br dwell; cost, $10,000; o, J Crawley; a, D T Atwood.

N s 15th st, 97 e 7th av, br dwell; cost, $7,000; o, J J Ferry; a, J L Young.

BUILDING INTELLIGENCE.

BROOKLYN.—Continued.

N w cor Willoughby and Grand avs, br flats; cost, $12,000; o, E Judson; a, W M Coots.

W s Wythe av, 25 s N 11th st, 3 fr dwells; cost, $18,000 all; o, A Huesdadt; a, H Vollweiler.

E s Bedford av, 125 n Willoughby av, fr dwell; cost, $8,000; o, H F Burrough; a, W H Gaylor.

S s N 2d st, 125 e Graham av, 2 fr dwells; cost, $10,500 all; o, Estate of J Joerger; a, T Engelhardt.

N e cor Knickerbocker av and Hannan st, 4 fr dwells; cost, $18,000 all; o, J Bossert; a, J Platte.

S s Bergen st, 200 w Hopkinson av, 2 br dwells; cost, $8,000 all; o, F Kuchunk; a, F Holmberg.

N s Hancock st, 25 e Marcy av, br dwell; cost, $20,000; o, W G Randolph; a, P J Lauritzen.

MISCELLANEOUS.

ALBANY, ORE.—A hotel, to cost $50,000, is to be erected at this place by Charles Pfeiffer and others.

BALTIMORE, MD.—Charles nr North, 4 3-story br bldgs; o, D E Potter.

Maryland av nr 3d, 3 3-story br bldgs; o, same as above.

5th st nr Oak st, 7 3-story br bldgs; o, Chas A Flaggs.

BEATTYVILLE, KY.—M. Q. Wilson. architect, of Louisville, Ky., will make plans for a $15,000 hotel here.

BINGHAMTON, N. Y.—Cor High and S Water sts, br church; cost, $10,000; o, Methodist Society; a, J C Perry, supt; b, Chas Van Orden.

CANTON, O.—N e cor Court and Seventh sts, br bus block; cost, $8,000; o and a, J R Poyser; b, P Hahn & Wm Shoop.

CAMBRIDGE, MASS.—Brattle cor Mason, stone chapel; cost, $10,000; o. St John Memorial; a, Henry Vaughn; b, F L Whitcomb.

282 Broadway, fr addn; cost, $4,000; o, S J Davis; a, W E Clarke; b, E J Packard.

CHICAGO, ILL.—1–5 Emma st, br store and warehouse; cost, $10,000; o, Robert J Walsh; a, C Nelson; b, Jas Oliver.

318 Breill st, br flats; cost, $8,000; o, Mrs S J Grubbs; b, Jos Hodgson.

2–6 Colorado av, br store, offices, etc; cost, $65,000; o, Lowthers Hall; a, S M Randolph.

268 Racine av, br flats; cost, $8,000; o, E T Dodson; a and b, F W Thomson.

85 Fowler st, br flats; cost, $10,000; o, A B Wait; a, W Ohlhaber.

Adams and Dearborn sts, remodeling and addition to office bldg; cost, $350,000; o, Marquette Building Company: a, Holaboid & Roche; b, Geo A Fuller & Co.

131–37 w Erie st, br flats; cost, $25,-000; o, J Cook; a, J F and J P Doerr; b, E Bushner.

422–24 s Paulina st, br flats; cost, $8,000; o, Andrew Wenigar.

1250 Washington boul, br dwell; cost, $8,000; o, Agner Bros; a, C A Weary.

Sherman and 66th sts, br flats; cost, $50,000; o, McCauley & Swartout; a, J Eighton; b, C A Lake.

4624 Emerald av, br dwell; cost, $8,000; o, D E Hartwell; a, Beman & Parmentier.

Peoria and 56th sts, br dwell; cost, $14,-000; o, J L Swan.

367 Cleveland st, br flats; cost, $12,000; o, M Vogalgerang; a, Fromann & Gibsen; b, H Mueller & Bro.

69 Grant place, br flats; cast, $8,000; o, Albert Anbach; a, B F Werges; b, C Hageman.

733 w Jackson st, br flats; cost, $9,000; o, Jas S Kidd; a, J M Van Osdel & Co; b, Jas S Price.

2977–79 Dearborn st, stone and br church; cost, $35,000; o, Bethel African Methodist Episcopal Church; a, E H Turner; b, E Slatery & Sons.

682 w 18th st, br addition: cost, $8,000; o, F Sonnberg; b, M Schultz.

178 n May st, br flats; cost, $8,000; o, Chas Jesen; a, G Isaacson; b, G Gilbert.

BUILDING INTELLIGENCE.

CHICAGO, ILL.—609–11 w 12th st, br addition; cost, $8,000; o, Jno Schwyer; a, Hy Hildinger; b, Pratt & Nieterink.

1314 Michigan av, br dwell; cost; $23,-000; o, Geo Brandt; a, Burnham & Root; b, N McMillan.

Jackson, Clark and La Salle sts, addition to Grand Pacific Hotel; cost, $32,000; o, Drake, Parker & Co; a, W W Boyinglon; b, Mortimer Bros.

Bliss, Hickory and Cherry sts, malt house; cost, $48,000; o, Bemis & Curtis Malting Company; a, S Lindreth; b, A Lanquist.

756 Washington boul, br flats; cost, $12,000; o, Jacob Kramer; a, Geo Gruessing; b, Geo Lehman & Sons Co.

118–24 State st, br addition; cost, $13,-000; o, Chas W Partridge; a, J J Egan; b, Thos Nicholson.

4528 Drexel st, br dwell; cost, $17,000; o, N W Harris; a, C S Frost, b, Angus & Gibdele.

4536–40 Lake av, br dwell; cost, $14,000; o, Geo H Bliss; a, W H Drake; b, J Stacey.

St. Lawrence and 71st st, br dwell; cost, $11.000; o, W E Palmer.

79–81 44th st, br dwell; cost, $12,000; o, A J Toolen.

166 buildings costing less than $7,000 each.

CINCINNATI, O.—Liberty st and Dalton av, 2-story br factory; cost, $8,000; o, Illinois Leather Co; a, Kukertz & Pfeiffer.

Storrs and Burns sts, 3½-story br store and dwell; cost, $7,500; o, Henry Schultz; a, L P Hague.

4th st nr Broadway, remodeling Christ's Church; cost, $25,000; c, W H Stewart's Sons; a, W Martin Aiken.

DAYTON, O.—Nothing over $7,000 in value to report.

DETROIT, MICH.—N side Joy st, bet 3d and 4th sts, 2½-story br res; cost, $7,000; o, John H Johnson; a, A C Varney & Co; b, not let.

S w cor Terry av and St. Antoine st, 2-story br and s res; cost, $7,000; o, Robt J Wilson; a, E A Walshe & Son; b, not let.

DENVER, COL:—Wynkoop st, bet 15th and 16th sts, br warehouse; cost, $15,000; o, L L Higgins; a, F D Robinson.

1st av, bet Clark and Water sts, br dwell; cost, $8,500; o, H Walker; a, Barressler Bros.

17th st, cor Stout st, stone bldg; cost, $1,000,000; o, Denver Equitable Building Company; a, Andrews, Jaques & Rantol.

13th av, bet High and Williams sts, br terrace; cost, $12,000; o, W H Merideth.

DRACUT, MASS.—4-room school house; address Michael Collins; b, not let.

4-room school house; address Percy Parker; b, same as above

EASTON, PA.—Northampton st, an 8-room br school bldg; cost, $18,000; o, Board of Control; a, John M Stewart.

JACKSON CITY, TENN.—M. Q. Wilson, architect, of Louisville, Ky., will make plans for a $13,000 hotel here.

LIVERMORE, CAL.—A church, to cost $15,000, is to be erected at this place.

LONDON, ONT.—Addns to and remodeling of stone cathedral; cost, $50,000; o, St Paul's Church (Church of England); a, Spier & Rohns, Detroit, Mich; b, not let.

LOWELL, MASS.—Western av, 5-story br mill; 75x120; o, A S Russell; b, not let.

MILWAUKEE, WIS.—Oneida and River st, power house; cost, $60,000; o, Edison Electric Light Co; a, E T Mix & Co; b, F Niezerowski.

Commerce st, power house; cost, $20,000; o, Milwaukee Light and Power Co; a, Charles Kirchhoff; b, Charles F Ehlers.

Clinton st, machine shop; cost, $8,000; o, E P Allis Co.

MILFORD, N. H.—Br library bldg; address Mr H H Barber; b, not let.

MONTCLAIR, N. J.—Nothing over $7,000 in value to report.

BUILDING INTELLIGENCE.

MINNEAPOLIS, MINN.—Cor Grant st and 1st av, stone church; cost, $100,000; o, Centenary M E Church; a, W J Hayes; b, H Downs & Son.

2836–38 8th av S, br stores and flats; cost, $16,000; o, a and b, W H Lang.

110–16–18 2d st N, br stores, cost. $24,-000; o, Whetmore & McMillan; a, F A Clark; b, J Condon.

Cor of 8th av N E and 2d st, br hall and school; cost, $10,000; o, St Anthony of Padua; a, F G Corser; b, Kilroe Bros.

4th av N bet 3d and 5th st, 2 br freight houses; cost, $29,000; o, Minneapolis & St Louis Ry Co; a, W B Hixson.

Cor of 8th av S E and 4th st, stone church; cost. $31,000; o, Andrew Presbyterian Church; a, James Carlisle & Son.

Cor Jackson st and 25th av N E, 2-story br ten; cost, $21,000; o and b, S S Farnham; a, Jas S Record.

3d st N bet 18th and 20th, 2-story brick police station; cost, $15,000; o, city of Minneapolis; a, Jas H Record; b, Foster & Smith.

2220–22 Aldrich av, fr apartment house; cost, $8,000; o and b, A D Alrich; a, J Jepson.

OWATONNA, MINN.—The Commissioners of Steele County have voted to build a $40,000 Court House in this city. Work will be begun next spring.

PORTLAND, ORE.—Mr C H Lewis is about to erect a large brick warehouse on Fourth and D sts for the Overland Warehouse Company.

POTSDAM, N. Y.—Messrs. Ives Brothers will soon begin the erection of two stores, stone fronts, three stories; furnace or hot water heating; cost about $10,000; a, J P Johnston, Ogdensburg, N. Y.

PROVIDENCE, R. I.—Humbolt av, fr dwell; o, John M Rounds; b, Whitaker & Smith.

Parade st, fr dwell; o, Mrs Edward R Crowell.

Pitman st, br and fr bus block; o, Manville Manufacturing Co.

Station st, 3 fr cottages; o, Josephine H White; b, A A White.

Ship and Richmond sts, br bus block; o, Delphine J Lanard.

SALT LAKE CITY, UTAH.—Cor State st and Second South st, 3-story fr business bldg; cost, $60,000; o, G H Holmes; a, Huddart & Jacobson.

Main st, bet South Temple and First South sts, 5-story stone office bldg; cost, $80,000; o, Cutler, Hardy & Young; a, R Bowman.

SPRINGFIELD, O.—Nothing in value over $7,000 to report this week.

SPRINGFIELD, MASS.—Elm st, br block of tens, 3 stories; o, Mrs E C Hawes; b, C L Shaw.

SHORT CREEK, O.—4 fr residences; cost, $2,500; o, F B Wilson; a, Jos Leina; b, not given out.

ST. LOUIS, MO.—8th st and Chauteau av, br store and flats; cost, $10,000; o, E A Maime; b, J Schenck.

Page and Prairie avs, br dwell; cost, $10,600; o, C D Jordan; b, Meehan & Cregan.

4th and Elm sts, front to store; cost, $16,800; o, A Busch; b, C Killerman.

VANCOUVER, B. C.—Plans have just been adopted for the erection of a temperance hall and coffee tavern in this town, to cost $30,000. Address Charles E Hope, architect and engineer, Vancouver.

WILKES BARRE, PA.—Nothing to report this week costing over $7,000.

WORCESTER, MASS.—A public school building, to cost $125,000, is to be erected at this city.

WHEELING, W. VA.—North Market st, br office bldg, with stone trimmings; cost, $50,000; o, Peabody Insurance Co; a, E Franzhein; b, not let.

2 12th street, hotel addn; cost, $7,000; o, Hotel Windsor; a, Jos Leiner; b, D Brooks.

THE ENGINEERING & BUILDING RECORD

AND

THE SANITARY ENGINEER.

A JOURNAL FOR THE ARCHITECT, ENGINEER, MECHANIC, AND MUNICIPAL OFFICER.

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STEEL FOR WATER AND OTHER PIPES.

AT the Chicago meeting, last May, of the American Water-Works Association, the question was asked which would be the best material for water-pipes—steel, cast iron, or wrought iron, irrespective of cost, the design evidently being more particularly to bring out whatever data there might be bearing on the use of steel pipes. Unfortunately, however, facts and figures relating to the subject seemed to be entirely lacking, or, what appears more probable, were too meagre to admit of anything like definite conclusions. At any rate, no expression of opinion was volunteered.

It is of interest, therefore, to note some of the developments in this line more recently recorded in England, and referred to in London *Engineering* a short time ago. According to the account there given, substantial progress towards the adoption of steel for the manufacture of pipes has been made during the past year. Mr. James Riley, a prominent engineer, more distinctly associated with steel construction, has been making efforts of a more or less tentative character to secure the adoption of this metal for the purpose, and has overcome what is repsented as the only technical difficulty—the welding of the tubes.

Some time ago Messrs. A. & J. Stewart, Glasgow, and the Steel Company of Scotland, in conjunction, supplied tubes of steel for carrying the water over the Tay Bridge, this being the first illustration of their use in Great Britain. These pipes were welded by Messrs. Stewart, and were fitted with Riley's patent socket, and completed by the Steel Company. They have proved very satisfactory. Tenders have been put in recently for 1,600 tons of steel water mains of large size for the Sydney Water-Works. Estimates and tenders have been made within the last year or two for several very large quantities, requiring from 100,000 to 150,000 tons of steel, but, as was the case on the introduction of steel for ship construction, the progress is very slow. When the strength of steel is contrasted with that of cast iron, of which those large water mains are usually constructed, it will be at once apparent that a great reduction can be made in the thickness and consequent weight of the metal required for the purpose. For transportation, too, the question of freight is a consideration. As an indication of this it may be mentioned that in a contract now in course of execution, the material for which is supplied by one of the steel companies in Scotland, for 20 miles of water main for Mexico, the sheets are not more than one-tenth of an inch in thickness. The fear of corrosion is not shared in by the engineers of this scheme, for having had experience for a number of years with the behavior of wrought iron for this purpose, they have had no hesitation in adopting the stronger and better metal, steel. This main for Mexico is riveted, and the connections are the same as those used in the Tay Bridge pipe. It is under contemplation to make provision in the west of Scotland for executing contracts for steel piping at a more rapid rate than is now possible.

We would remark here that so far as the welding of steel tubes is concerned, this has been successfully accomplished also in the United States. Another difficulty, however, is the fighting down of the prejudices against steel for such tubes, and the determination whether or not these prejudices have a good, practical foundation. At present there is nothing approaching a consensus of opinion on this point.

RECENT COMPRESSED AIR POWER SYSTEMS ABROAD.

DURING the past few years developments in the line of power distribution from central stations have been remarkably rapid, and experience has proved, very conclusively in some cases, that notwithstanding the heavy cost of construction and expense of maintenance of such plants, there is still a fair margin for profit in their working. Steam and hydraulic power systems afford more familiar examples of what can be done in this field, and their success has, in a great measure, encouraged the undertaking of other work involving the same general principles.

Among this must be classed the various installations for compressing and distributing air through underground pipes, probably the first of which was the plant of the Birmingham Compressed Air Power Company in England. Several others followed in rapid succession, notable among them the system of the widely noticed Popp Company at Paris, the main features of which were outlined in our issue of April 12, 1890.

The degree of favor which this system has obtained is best shown by the various Popp projects which are now on foot, not less than four German cities—Würzburg, Bamberg, Fürth, and Offenbach, having the system under consideration. The German engine and machinery firm, August Riedinger & Co., of Augsburg, is at the head of the enterprises. It has been ascertained that at Würzburg the company is assured of a demand for at least 400 horse-power, and at Bamberg of one for 600 horse-power. At Fürth a contract has already been entered into according to which Messrs. Riedinger & Co. will have a monopoly of the business for a term of 40 years. The city will receive annually a certain sum per mile of pipe in operation, and, in addition, will participate in the profits as soon as these will exceed 6 per cent. of the invested capital. After 11 years the city, further, will have the option of buying the plant, the price to be not less than 15 per cent. above the original cost of installation. Twenty-three hundred horse-power have already been subscribed for. The plant is to be ready for operation within two years. At Offenbach practically the same contract is about to be made, and a demand for at least 1,000 horse-power is assured. Two years is here also specified as the time limit for the completion of the plant, but efforts will be made to have everything ready for work next summer. Messrs. Riedinger & Co. are making efforts also to supply the city of Sachsenhausen from their Offenbach station.

It is self-evident that the construction of these several plants calls for a considerable money outlay, and that this would not be readily entered into were not success reasonably well assured, both from practical and financial points of view. In this country nothing, so far as we know, has yet been done in this field, at least so far as power supply in cities is concerned. The peculiar advantages of the system, however, entitle it to recognition.

CEMENT TESTS IN FRANCE.

In obtaining cement for the harbor works at Boulogne and Calais, France, the plan has been followed, since 1885, of not only subjecting the cement to certain tests before acceptance, but of exercising a careful supervision over its manufacture and instituting a series of analyses of the raw material used.

A ministerial decision, dated November 3, 1886, has placed all this work in the hands of the maritime office at Calais, and authorized the establishment of a chemical-testing laboratory at Boulogne for analyzing the raw materials of cements, under the supervision of the Chief Engineer of this office. The laboratory began its work in the early part of 1887, and, though mainly chemical in character, is fitted up with suitable apparatus for carrying out mechanical tests of cements. An extract from a report to the French Cement Commissioner, prepared by W. R. Feret, Chief Engineer of the laboratory, and published in the *Annales de Ponts et Chaussee* for March, 1890, gives an account of some of the work done during the last three years.

The subject is treated of in considerable detail under the following three heads:

(1) Chemical composition of cement; (2) cement grinding; and (3) preservation of cement before use.

Under the first of these heads Mr. Feret considers successively the character of the raw material, calcining, setting properties, specific gravity and resistance tests, etc., and gives elaborate tables of results obtained in the laboratory practice. Under the head of grinding, the much-discussed question as to the degree of fineness to which cement should be ground is taken up. Several methods of determining the degree of fineness are described, and the influence of the degree of fineness on the properties of cement is considered. The most economical degree of grinding, from the consumers' standpoint is also discussed.

Under the third head, the preservation of cement before using, different methods of preservation are briefly described. Artificial ventilation of cement, and the changes which it undergoes on being exposed, in thin layers, to moist air are dwelt upon at some length, and results of tests of cements so exposed for varying periods of time are given.

The various points discussed and experiments described all have a direct bearing on the intrinsic quality of cement. This, however, as Mr. Feret remarks, is not the only point to be considered in a study of the material. A question not less important is that involving the degree in which the properties of cement mortars are influenced by methods of manufacture and of use. This also has been studied to some extent at the laboratory, but the results will not yet admit of definite conclusions as the experiments made are of comparatively recent date and the element of time is of importance.

Mr. Feret's notes, even though forming but an extract from his complete report, are much too comprehensive to admit of reproduction here. Their study in the original, however, will prove both interesting and valuable.

POOR PAVING WORK IN NEW YORK.

Not alone are the granite paving block specifications for the streets of New York being grossly ignored in the matter of size of block, as shown by some of the figures published in The Engineering and Building Record last week, but inferior material is also being extensively used.

Thus the result of recent inspections on the part of the Finance Department has been that fines have been imposed as follows:

Matthew Baird, contract to pave Hudson Street from Beach to Spring Street, used limestone instead of gneiss in laying 2,000 square yards; Comptroller deducted $200 from contract money

William J. Clark, contract to pave Wall Street from Broadway to Nassau Street, used limestone instead of gneiss to lay 236$\frac{9}{10}$ square yards of foundation; Comptroller deducted $23.69.

Charles Guidet, contract to pave Leonard Street from Broadway to Hudson Street, used limestone instead of gneiss to lay 598 square yards of foundation; Comptroller deducted $59.80. Contract to pave Laight Street from Canal to Greenwich Street, used limestone instead of gneiss to lay 769$\frac{8}{10}$ square yards of pavement; Comptroller deducted $76.98. Contract to pave Broad Street, Exchange Place to Pearl Street, used limestone instead of gneiss to lay 782$\frac{1}{10}$ square yards of pavement; Comptroller deducted $78.21. Contract to pave Reade Street, used limestone instead of gneiss to lay 750 square yards of foundation; Comptroller deducted $75.

Thomas Gearity, contract to pave Lexington Avenue from Thirty-fourth to Thirty-fifth Street, used limestone instead of gneiss to lay 1,500 square yards of foundation; Comptroller deducted $150.

Bernard Mahon, contract to pave Spring Street from Bowery to Broadway, used limestone instead of gneiss to lay 275 square yards of foundation; Comptroller deducted $27.50.

James Pollock, contract to pave Cedar Street from Broadway to Greenwich Street, used limestone instead of gneiss to lay 676$\frac{7}{10}$ square yards of pavement; Comptroller deducted $67.67. Contract to pave Platt Street from Pearl to William Street, used limestone instead of gneiss to lay 750$\frac{6}{10}$ square yards of foundation; Comptroller deducted $75.06.

THE EFFECT OF VEGETABLE AND ANIMAL ORGANISMS ON THE TASTES AND ODORS OF WATER SUPPLIES.

J. M. Diven, of Elmira, N. Y., Secretary of the American Water-works Association, has just sent out the following circular:

> At the Chicago meeting the following resolutions were passed, to which we would earnestly solicit your attention.
>
> *Whereas*, The relations which exist between the growth of vegetable and animal organisms and the offensive tastes and odors frequently affecting water supplies are very imperfectly understood, but at the same time of great practical importance to water engineers and the public generally; therefore,
>
> *Resolved*, That it is the sense of the Convention that the investigation of this topic is one which lies within the particular scope and objects of the American Water-Works Association, and that a committee charged with the conduct of this investigation should be appointed, and requested to report at our next annual meeting.
>
> The committee consists of L. J. LeConte, Oakland, Cal.: L. H. Gardner, Superintendent of Water-Works, New Orleans, La.; and Albert R. Leeds, Stevens Institute of Technology, Hoboken, N. J., acting as chairman. While the meeting to which this committee reports is not held until April of next year (in Philadelphia), yet, inasmuch as the waters are most affected by the troubles referred to during the summer season, the committee is desirous of beginning its labors forthwith. To this end the committee invites correspondence with the superintendents and engineers of all water supplies which have at any time been contaminated by the growth and decay of organisms. All specific and precise information which they can give relating to the date, season, duration, nature, extent and results of these troubles in relation to their particular water supplies will be of value.
>
> Moreover, in case a proper sample, which should be of not less quantity than two gallons, is sent by express prepaid, to the chairman of the committee, a biological and chemical analysis will be made and the results communicated to the sender at the earliest practicable date.
>
> The information obtained in these various ways will be condensed and incorporated in the report to the association next May.
>
> Write speedily, and help in starting this very important piece of work.

THE STEVENS INDICATOR.

The July number of *The Stevens Indicator*, which has just been issued, contains, besides other interesting articles, one on "Fabrication of 12-Inch Mortars," by A. A. Fuller and F. N. Connet. It deals with the 12-inch breech-loading mortars now being built for the Government by the Builders Iron Foundry, of Providence, R. I. The process of manufacture is described in detail, and a number of illustrations are given.

Professor J. E. Denton contributes an article entitled, "Notes on the Action of Lubricants," in which the matter of internal engine friction is specially considered.

C. W. Thomas continues his paper on "Cable Traction as Applied to Elevated Railroads," commenced in an earlier issue, and describes and illustrates various cable gripping devices.

F. E. Idell contributes a note on "The Identification of Dry Steam," with special reference to a recent boiler test, and Professor H. A. Wood explains "A New Method of Extracting Cube Root." A lecture on "The Examination of Lubricating Oils," delivered by Professor Thomas B. Stillman before the Senior Class at Stevens Institute, is also given.

PUBLICATIONS RECEIVED.

Heat; the Warming and Ventilation of Buildings. By John H. Mills. Two volumes; pp. 604.

NOTES.

Rrcent tests made in connection with the underground steam pipes in New York by Dr. Cyrus Edson, of the New York Health Board, show that the temperature in some manholes ranged from 140 degrees to 162 degrees, while the temperature in manholes remote from the pipes was between 71 degrees and 76 degrees. Water in the Croton pipes near the steam pipes was found to be heated to 120 degrees at points where it ran into buildings. In vaults under Broadway buildings the air had been heated to 140 degrees. The question just now is whether the sections shall be cut off altogether.

The first annual convention of the United Association of Journeymen Plumbers, Gas Fitters and Steam Fitters opened in Pittsburg on July 28 in their hall, Market and Water Streets, about 50 delegates being present. P. J. Quinlan, of Boston, presided. The apprenticeship question will be brought up during the convention. This question caused the strike of the Pittsburg plumbers some weeks ago, and it remains with the convention to settle the matter. The plumbers are working at present, pending such a settlement. It is likely that the eight-hour question will also come before the convention. Charles Signor, delegate from St. Louis, said that eight hours would certainly be established among the plumbers before long. Many of them have the eight-hour day now.

The State Railroad Commission has approved the application of the Coney Island and Brooklyn Railroad Company for permission to change its motive power from horses to electricity upon that portion of its road in Sea Breeze Avenue, from East Fifth Street to West Fifth Street, on condition that the rate of speed of cars shall not exceed that to be determined by the Highway Commissioners of Gravesend, and that no car shall be operated with less than two men in charge.

The three Brooklyn surface railroad companies which control most of the street car lines in Brooklyn have decided to adopt as a motive power the overhead system of electric wires. They are the Brooklyn City Railroad Company, Atlantic Avenue Company, and Jay and Smith Street Company. The applications of all the lines for permission to use electricity are now before the Common Council, and the consent of the property owners along the various lines is being solicited.

In a recent issue of *La Semaine des Constructeurs* attention is again directed to the rapid deterioration of lead when in contact with oak timber. Gutters and parts of roofs are frequently much damaged by the chemical action set up by such contact. The Société du Nord cites a case where a lead gutter resting on oak supports was destroyed in a few years, the lead being completely oxidized by the combined action of the wood acid and moisture.

OBITUARY.

Samuel Whitney, head of the firm of Whitney Brothers, founder of the town of Glassboro, N. J., and of the great glass manufacturing business there, died at Cape May on July 29. He was 73 years old and one of the best known glass manufacturers in the country.

PERSONAL.

Charles L. Weber, City Engineer of East St. Louis, will sail for Europe in a few weeks, to be absent until next Spring.

John P. Force, civil engineer, has been appointed Engineer in Charge of Street Improvements and Sewers at North Baltimore, O.

Willard Beahan, M. Am. Soc. C. E., was recently appointed Engineer of Maintenance, St. Louis, Mo., with headquarters at the City Building.

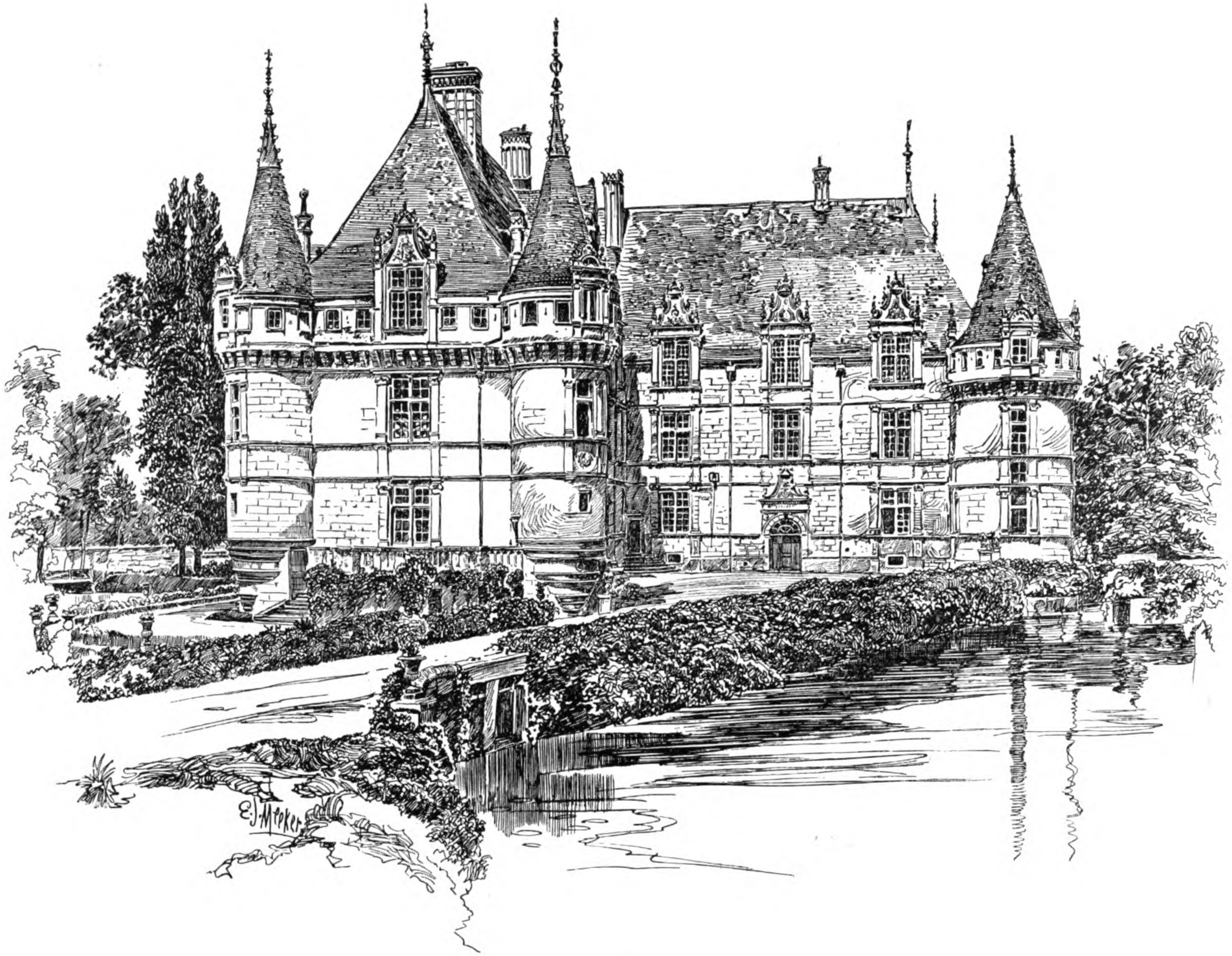
Onward Bates, Engineer and Superintendent Bridges and Buildings Chicago, Milwaukee and St. Paul Railway Company, has removed his office from Milwaukee to Rand, McNally & Co.'s building, Chicago.

J. W. Holmes, Consulting Engineer, who has been in charge of the Paducah, Ky., Water-Works for three or four years past, has recently made a contract for five years to serve as Chief Engineer of the above-named works.

OUR ARCHITECTURAL ILLUSTRATIONS.

CHATEAU D'AZAY-LE-RIDEAU, FRANCE.—FACADES ORIENTAL.

HOUSE AT BROOKLINE, MASS.
ARTHUR LITTLE, ARCHITECT, BOSTON.



THE ENGINEERING AND BUILDING RECORD ILLUSTRATED SERIES.

CHATEAU D'AZAY-LE-RIDEAU, FRANCE.—FACADES ORIENTAL.

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ENGINEERING SOCIETIES.

THE BOSTON SOCIETY OF CIVIL ENGINEERS had an excursion to Fort Warren, in Boston Harbor, on Saturday, July 26, by invitation of Col. S. M. Mansfield, of the U. S. Engineering Corps of this district. There were about 50 members of the Society in the party. The fort was inspected and an explanation given of the new method of coast defence by submarine mines.

A PRELIMINARY notice has been issued by Secretary Hutton, of the American Society of Mechanical Engineers, announcing that the twenty-second meeting of the Society will be held in the city of Richmond, Va. It will probably begin November 11. Intending authors of papers are requested to send in the titles of papers now. Manuscripts of papers, especially if illustrated, are desired before, or in any case not later than, October 1.

The second addition of the Society's catalogue for 1890, corrected to July 1, has been issued.

ARCHITECTURAL LEAGUE COMPETITION.

MEMBERS of the Architectural League are at present much interested in a competition over designs for the proposed new building of the American Fine Arts Society. The designs are to be sent in under cipher to the Committee on Site and Plans, of which Edward H. Kendall is Chairman, and whose Secretary, H. J. Hardenbergh, has just sent out the invitations to architects in the League to enter the competition.

The conditions for the competition were arranged at a meeting of the committee held June 17. A jury of award was appointed, consisting of President Chase, of the Society of American Artists, President Sturgis, of the Architectural League, President French, of the Art Students' League, President Butler, of the American Fine Arts Society, Chairman Marquand, of the Board of Trustees of the Gift Fund of the American Fine Arts Association, and Chairman Kendall, of the Committee on Site and Plans. Should there happen to be a disagreement or a tie vote, Richard M. Hunt is to become a member of the jury.

The designs are all to be submitted by September 1. The jury will proceed to select three, and then a second competition will be arranged, in which the authors of the three selected designs will take part. The one of the three whose design is finally chosen, will be awarded the contract for erecting the building at the regular commission fixed for such work by the schedule of charges of the American Institute of Architects. The authors of the other two designs will be paid $200 each. The jury to make the award in the second competition will consist of Messrs. Chase, Sturgis and Butler.

The proposed new building will furnish quarters for the Society of American Artists, the Architectural League, and the Art Students' League. It is to cost $160,000 and to be fire-proof. Sketch plans of the building are sent to competitors. The building is to be so planned that the Society of American Artists shall have at least 1,750 square feet of floor space, the Architectural League at least 2,500, and the Art Students' League at least 10,000.

THE NEW CROTON AQUEDUCT.

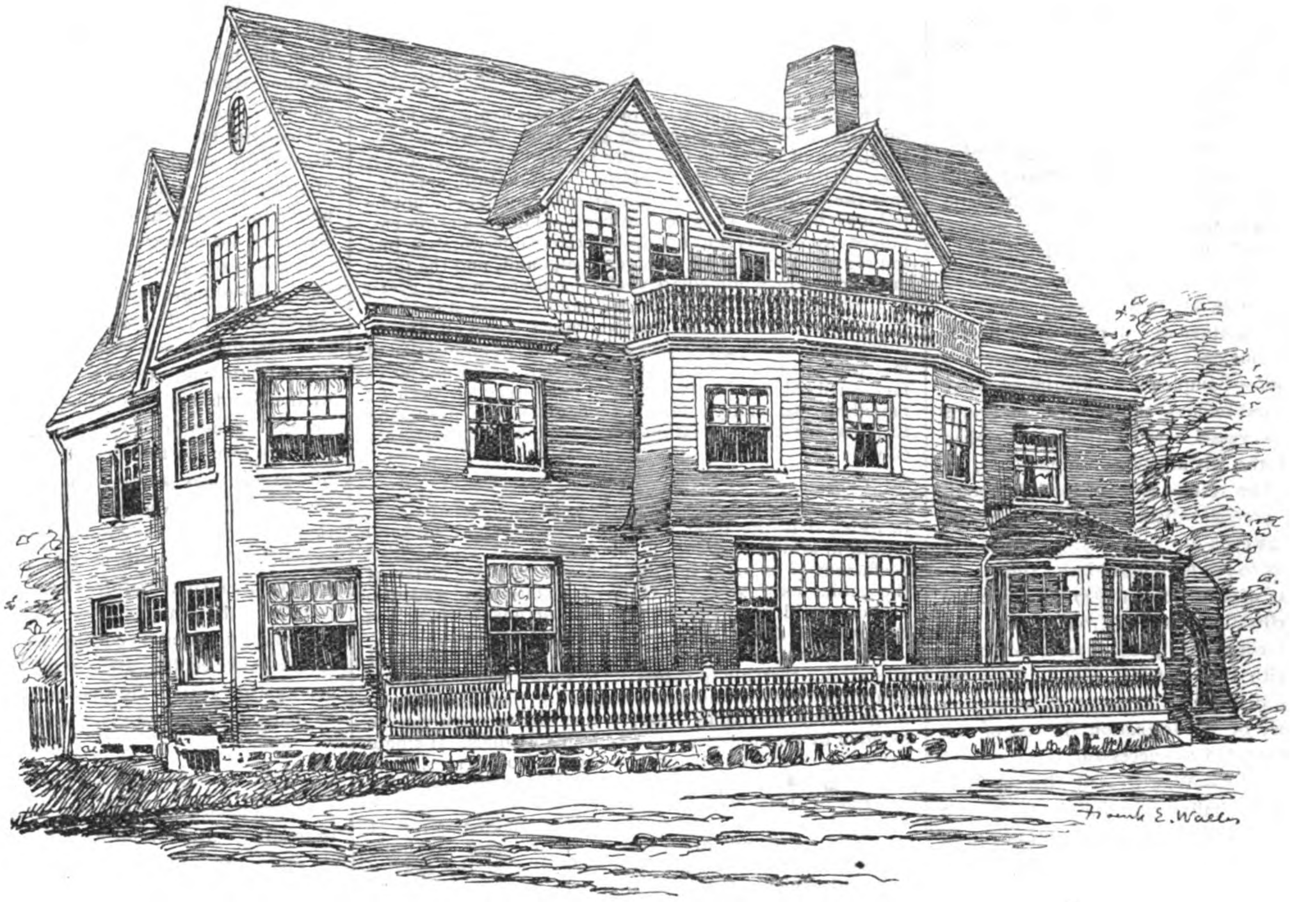
THE first official report since the new Croton Aqueduct opened was submitted on July 30 to the Construction Committee of the Aqueduct Board by Chief Engineer Fteley. In it he explains in detail the progress of the work and the amount of water supplied to New York City daily, which he places at 50,000,000 gallons. As to the alterations which it is proposed to make, and the defects which are to be remedied he makes some suggestions. He proposes to overcome Commissioner Gilroy's objections against cutting off the supply while the repairs are being made by doing the work in sections. He also submits the full correspondence on the subject, and says it is a matter of congratulation that, despite the leakage at Shaft 19, the aqueduct appears to be in excellent condition.

"By agreement with the Commissioner of Public Works," said Mr. Fteley in his report, "the gates at Croton Dam were opened on Saturday evening, July 12, to the extent of furnishing 38,000,000 per day. The water was retained for a while in the aqueduct, as everything was not in readiness in the lower part, and it was desired to let the water in slowly at first. On Tuesday, July 15, the gates were opened at 6 A. M. at the One Hundred and Thirty-fifth Street gate-house, and the water reached the Central Park Reservoir through the five 48-inch pipes. Since that day the flow from the Croton gate-house has been changed from time to time in accordance with the requests made by the Chief Engineer of the Department of Public Works, as per accompanying schedule.

"Schedule of the flow at Croton Dam:

"July 12, 6 P. M., 30,000,000 gallons; July 16, 6.30 P. M., 50,000,000 gallons; July 19, 9.15 A. M., 75,000,000 gallons; July 24, 9 A. M., 50,000,000 gallons; July 30, flow continues at the rate of 50,000,000 gallons per day.

"When letting the water in for the first time the aqueduct was watched with great care, more particularly in the lower part, where the unusual feature of a heavy pressure on the masonry called for especial vigilance. With the exception of Shaft 24, where a leak (not altogether unexpected on account of the unfinished condition of the work at that point), developed itself, the aqueduct appears to be in excellent condition, and, although the saturation of the ground below Shaft 19 must be expected to a certain extent, the present absence of visible signs of it after two weeks of service is a matter of congratulation."



HOUSE AT BROOKLINE, MASS.—ARTHUR LITTLE, ARCHITECT, BOSTON.

COST OF DIFFERENT METHODS OF POWER TRANSMISSION.

THE following comparisons of cost of transmission of power by various methods appeared in the *Revue Universelle des Mines:* (1) Comparative cost on 10 horse-power transmitted 1,093 yards: By cable, 1.77 per effective horse-power per hour; by electricity, 2.21; by hydraulics, 2.90; by compressed air, 2.98. (2) Comparative cost on 50 horse-power transmitted 1,093 yards: By cables, 1.35 per effective horse-power per hour; by hydraulics, 1.87; by electricity, 2.07; by compressed air, 2.29. (3) Comparative cost on 10 effective horse-power transmitted 5,465 yards: By electricity, 2.64 per effective horse-power per hour; by compressed air, 4.66; by cables, 4.69; by hydraulics, 5.29. (4) Comparative cost on 50 effective horse-power transmitted 5,465 yards: By electricity, 2.37 per effective horse power per hour; by cables, 2.65; by compressed air, 2.99; by hydraulics, 3.02. Steam was the prime mover used in each of the above instances, and it appears that for long distances electricity takes the lead in economy over all other systems. The figures are interesting and valuable as comparative measures of commercial efficiencies.

DISINFECTION OF EXCREMENTITIOUS SUBSTANCES.

An account of some experiments on the practical disinfection of excrementitious substances is given by Dr. S. von Gerlóczy in the *Deutsche Vierteljahrschrift für öffentliche Gesundheitspflege*, and is reproduced, in part, in the volume of foreign abstracts of the British Institution of Civil Engineers.

The experiments were carried out in the course of the past year at the Pesth Hygienic Institute, in order to test the real values of the various substances employed as disinfectants, concerning which much difference of opinion had been expressed. The author divided the matters to be disinfected and deodorized into five groups—viz.: (1) Night soil from cess pits; (2) liquids from sewers; (3) solid contents of street gulleys; (4) dry road scrapings; and (5), fresh excreta of patients suffering from acute diarrhœa and typhoid fever. The disinfectants used were: (1) corrosive sublimate; (2) iron sulphate; (3) zinc sulphate; (4) copper sulphate (for comparison); (5) crystallized carbolic acid; (6) raw carbolic acid (two descriptions of which are obtainable, that employed by the author, known as 50 to 60 per cent. solution, actually contained 18.7 per cent. of carbolic acid); (7) carbolized lime, commercially known as 5 per cent., but yielding on analysis 2.1875 grams of carbolic acid per 100 grams; (8) creolin, (9) *α*-oxynaphtoic acid. On the score of their extreme cheapness the author used also: (10) raw concentrated sulphuric acid; (11) freshly slaked lime; (12) boiling water; (13) hot and cold solutions of wood-ash lye (specific gravity of the lye 1.037, equivalent to 4 per cent. of carbonate of potash); (14) solution of common salt, containing 26.1 per cent. of salt. Specimens of the disinfected materials were withdrawn on a platinum needle, and introduced into warm fluid peptone-gelatin. The cultivation took place both at ordinary temperatures, and also at a temperature of from 35° to 37° Centigrade.

The specimens were examined at intervals of 24 hours, 48 hours, and three to four days after treatment.

Group I. *Night Soil.*—Samples for experiment were obtained from a night soil removal contractor; 100 grams were placed in a glass vessel, and treated with weighed quantities of each of the disinfectants enumerated, in various proportions. The results are set forth in detail, and they show that a practical disinfection of night soil is all but impossible, as even 2.5 per cent. of corrosive sublimate is insufficient to render it germ-free; this quantity would entail a cost of 150 gulden ($47.80) per cubic meter. Complete sterilization resulted from the use of a 4 per cent. solution of copper sulphate, and it would appear from this that with this material, one cubic meter of night soil could be disinfected at a cost of 12 gulden ($5). For the purpose of deodorization the use of raw carbolic acid may be regarded as successful.

Group II. *Sewage Water.*—Was treated with the foregoing disinfectants in a similar way, full details of the experiments being given. Here again the author draws attention to the extraordinary value of copper sulphate; a solution of 1 per mille sufficed to destroy all germs, and rendered the liquid clear and inodorous.

Group III. *Sludge from Gulleys.*—The series of experiments recorded shows the extreme difficulty of disinfecting thoroughly this substance. For deodorization, carbolized lime in moderate quantities sufficed, but the author recommends the use of raw carbolic acid diluted to 1 per mille.

Group IV. *Street Sweepings, etc.*—Owing to the last cholera outbreak in Pesth, the authorities ordered that carbolized lime should be freely used in the dwelling houses, and they caused it to be strewn along the roads, against walls, under doors, and over gulley holes. The author therefore carried out special experiments to test the value of this treatment, and to ascertain how far it might be possible to practically disinfect road sweepings. Treated with the foregoing disinfectants it became manifest that complete disinfection was out of the question. Even where thoroughly soaked with solutions of corrosive sublimate, copper sulphate, etc., the road dust was far from sterile; nor did experiments with respect to the strewing of carbolized lime yield satisfactory results. The advantages of this mode of disinfection are illusory.

Group V. *Disinfection of Excreta.*—In certain cases it becomes of the utmost importance to thoroughly and rapidly sterilize the dejections of patients. The excreta used for these experiments were in all cases diluted with three times their weight of water. All the various disinfectants were tried in different proportions, and the results of the experiments are recorded. The conclusions arrived at by the author are: That a strong solution of copper sulphate should be used, at least 1 gram of the disinfectant being added to 100 cubic centimeters of excreta; but still better results arise from the employment of thrice their weight of boiling lye (2 parts of water to 1 part of wood ashes). Milk of lime (1 part of slaked lime in 20 parts of water), used in the proportion of $\frac{1}{8}$ to $\frac{1}{10}$ of the weight of the excreta, likewise disinfects cheaply and well.

MAINS FOR HIGH PRESSURE ALTERNATING ELECTRIC CURRENTS.

In a paper under the above head by C. Jacquin, published recently in *La Lumière Electrique* and abstracted in the Excerpt Minutes of the Proceedings of the British Institution of Civil Engineers, the subject is treated from two points of view: first, as regards loss of current by leakage, and second, as regards loss of energy by induction.

It has been shown by Foederruther that the insulation resistance of a cable diminishes by 10 per cent. if the pressure be increased from 1 to 100 volts, and assuming this ratio to hold good for higher pressures, Mr. Jacquin finds that the insulation resistance of a 2,000-volt cable must be 20 times that of a 100-volt cable. The specification for the cables to be used in connection with the 2,400-volt alternating currents supplied from the Municipal Station at the "Halles," Paris, stated that the insulation shall be 1,000 megohms per kilometer, or about 624 megohms per mile.

The equivalent insulation of a 100-volt cable would, at this rate, be only 26 megohms per mile. Moreover, the insulation of the cable is further reduced by joints, and it was, in the case of the "Halles" installation, specified that the insulation of the cable after laying should not be reduced by more than 10 per cent. The insulation employed by some German and Austrian cable-works is jute impregnated with some resinous compound, and the insulation resistance immediately after manufacture is given as from 310 to 375 megohms per mile. These standards, the author thinks, cannot be maintained, since all fibrous substances are hygroscopic, and with the admission of moisture the insulation must be lowered. As a matter of fact, such cables after laying have never reached even 62 megohms per mile. The author gives the following formula for the insulation resistance of high-pressure cables:

$$M = \rho \frac{l}{E},$$

in which ρ is the total insulation resistance, l the total length in kilometers, and E the pressure in volts. The coefficient M is 400,000 ohms per volt per kilometer of the cables used at the "Halles" installation, and the author considers a cable to have become unsafe if M has decreased to 10,000 ohms per volt per kilometer.

The author next investigates the induction effect of alternating currents in cables. He shows that two simple unarmored cables, laid side by side, are likely to disturb neighboring telephone lines, which disturbance can be avoided by the employment of concentric cables. If single cables are individually provided with iron armor, or if two single cables are placed within the same iron tube, exterior disturbance is also avoided, but a certain loss of energy is incurred, consequent on the magnetization of the iron. The magnetic circuit, in the case of single armored cables, is completely closed, but in the case of two cables within the same iron pipe the lines of force flow partly through air and partly through iron, and the waste of energy is less. The author has made experiments to determine this waste of energy in a cable of 220 yards length, laid in the works of Mr. H. Ménier, at Grenoble. The cable was looped to bring its two ends close together, and these could be joined, by means of a special switch, with the terminals of a dynamo and those of an alternator. There were in circuit a rheostat, a wattmeter and a dynamometer. The experiments were made in the following manner: The switch was placed to the alternator, and the readings of the dynamometer and wattmeter were noted. The switch was next placed to the dynamo, and the rheostat adjusted, until the dynamometer indicated the same current as before. The wattmeter indicated now simply the loss by ohmic resistance, and this reading, deducted from the previous reading, gave the loss due to hysteresis and eddy currents in the previous experiment. Three cables were thus tested, the first having no metallic covering, the second having a lead sheath, and the third being covered by lead and armored with iron wires. The copper conductor of all the cable had a sectional area of 0.0465 square inch, insulated by pure rubber. The frequency of the alternating current was 50 cycles per second. The current was 18 amperes. In the first cable no energy was lost beyond that due to ohmic resistance. With the lead cable two experiments were made. In the first the cable rested on the ground, and the two ends of the lead tube were not otherwise connected; whilst in the second they were short-circuited by a copper wire. The losses were, respectively, 1 and 2 per cent. of the loss due to ohmic resistance. With the armored cable three experiments were made—namely, (*a*), the ends of lead and iron covering insulated; (*b*), lead covering insulated, and iron covering connected; and, (*c*), lead and iron covering connected. The losses in these cases were, respectively, 18, 27.4, and 34.5 per cent. of the loss due to ohmic resistance. With a frequency of 25, all the losses were about 60 per cent. of their former value. The experiments were not repeated with a higher frequency than 50, but the author estimates that, with a frequency of 100, the loss in the most unfavorable case, (*c*), would not exceed 50 per cent. of that due to ohmic resistance, or, say 2.5 per cent. of the total energy flowing through the cable.

DRY AIR REFRIGERATING APPARATUS WITHOUT MACHINERY.

Under the above head London *Engineering* describes what is known as Hill's system of dry air refrigeration, recently shown at the Royal Military Exhibition at Chelsea, England.

The distinctive feature is that no machinery is in use, the cold air being produced from the distillation of ammonia gas, a principle which is not by any means new. The apparatus consists of steam generator, ammonia boiler, separator, and condenser for producing cold, and a refrigerator or cold chamber. This chamber is constructed in most cases of a double casing of wood, lined with charcoal as a non-conductor, and the roof is formed by a tank containing a bath of chloride of calcium liquor in sufficient quantity to store up the cold as produced. The solution of ammonia in the boiler is heated by steam from any boiler, or from a specially constructed slow combustion stove, with a spiral coil giving large heating surface. Alongside it is placed a water separator for drying the steam, which passes to a boiler three-fourths filled with a solution of ammonia. To this the steam entering by several pipes imparts heat, driving the ammonia into the form of gas. Above the boiler is placed a separator for taking off water carried forward in the distillation of the ammoniacal gas. The water thus separated passes by gravitation to the boiler. Alongside it is a corresponding cylindrical vessel into which the dried ammoniacal gas passes, and there it is condensed by its own accumulation of pressure and the latent heat carried off by the circulation of cooling water. This liquid anhydrous ammonia flows into the refrigerators suspended in the tank forming the roof of the cooling chamber. The pressure is then rapidly reduced by opening a communication with a separate chamber, and the sudden evaporation of the liquid anhydrous ammonia takes place at the expense of the sensible heat in the cold storage bath in the tank, which therefore becomes very cold and draws heat from the chamber in which the meat is stored. The bottom of the tank is corrugated, which gives a large increase in the cooling area, and to the lower angles of the corrugation gutters are suspended carrying off the water, so that the atmosphere is dried as well as cooled.

PRESERVING ROPES.

It has been suggested in a French paper that in order to insure greater strength, and consequently more safety in ropes used for scaffolding purposes, particularly in localities where the atmosphere is destructive of hemp fibre, such ropes should be dipped, when dry, into a bath containing 20 grains of sulphate of copper per liter of water, and kept in soak in this solution some four days, afterward being dried; the ropes will thus have absorbed a certain quantity of sulphate of copper, which will preserve them for some time both from the attacks of animal parasites and from rot. The copper salt may be fixed in the fibres by a coating of tar or by soapy water, and in order to do this it may be passed through a bath of boiled tar, hot, drawing it through a thimble to press back the excess of tar, and suspending it afterward on a staging to dry and harden. In a second method the rope is soaked in a solution of 100 grammes of soap per liter of water.

One man was killed and another was hurt seriously by the falling of part of a big chute at the Western Union Building, New York, on July 30. The chute was erected soon after the recent fire, to enable workmen to pass down rubbish from the upper stories to the street. It extended up as far as the eighth story, and its lower end hung over the gutter of the street. Many tons of rubbish were thrown down the chute after it was built, but it became clogged on the day of the accident, because the stuff had not been removed promptly from the lower end. The greatly increased strain thus brought to bear on the structure caused its lower half to give way, carrying two workmen with it.

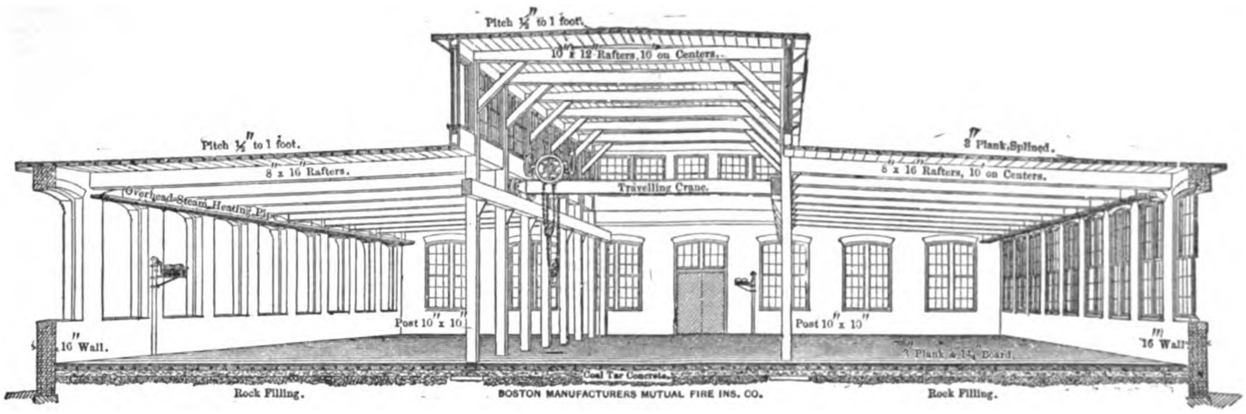


FIG. I.—MACHINE SHOP, SECTION.

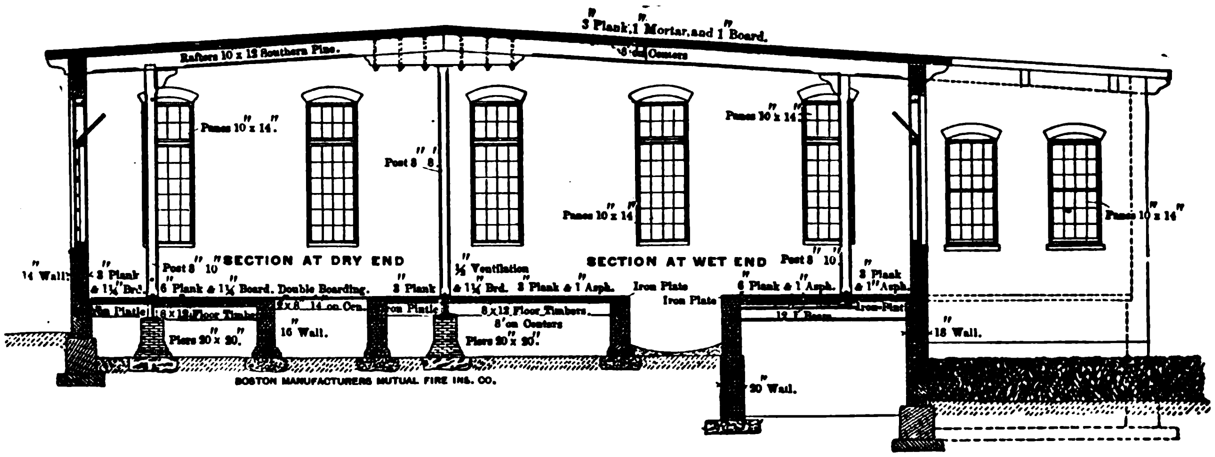


FIG. 2.—PAPER MILL, SECTION OF MACHINE ROOM.

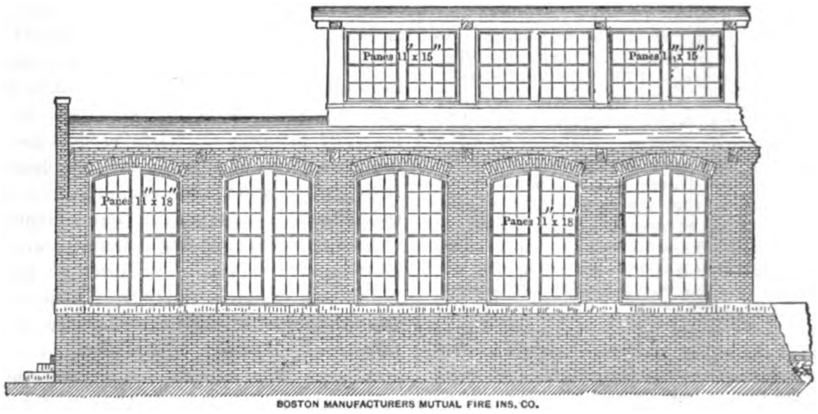


FIG. 3.—MACHINE SHOP, ELEVATION.

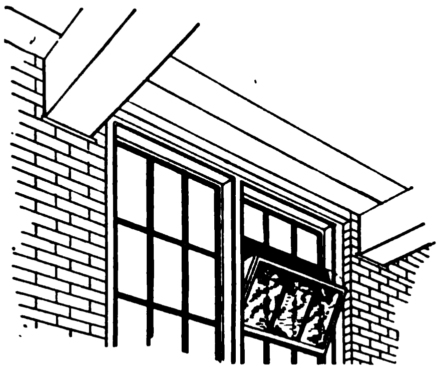


FIG. 4—WINDOW VENTILATOR.

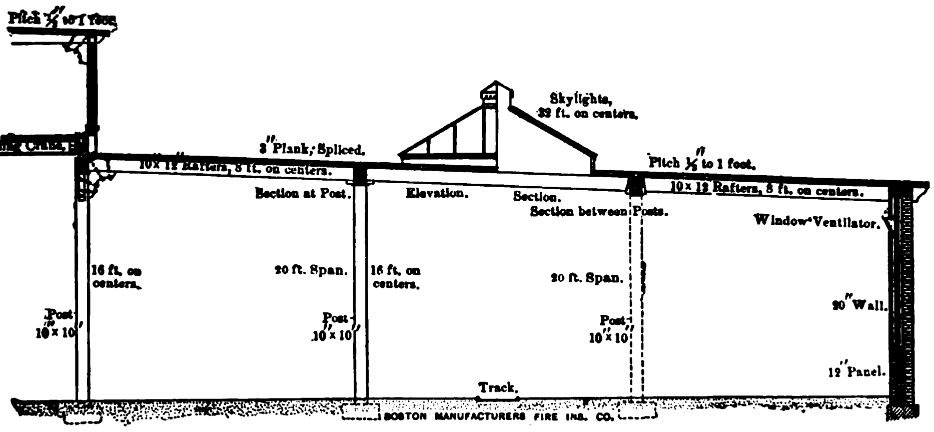


FIG. 5.—FOUNDRY, SECTION.

EXAMPLES OF ONE-STORY SLOW BURNING CONSTRUCTION.

THE accompanying illustrations represent examples of one-story, slow burning construction recommended by C. J. H. Woodbury, for the Boston Manufacturers Mutual Fire Insurance Company, to whom we are indebted for the engravings and particulars. The designs embrace improvements which have been developed by experience in the construction and use of one-story factory buildings up to the present time.

For establishments on cheap, level land, especially where the stock is heavy, one-story buildings have proved to be more economical in cost of floor area, supervision, moving stock in process of manufacture, and repairs to machinery—many kinds of which can be run at greater speeds than when in high buildings. Such buildings are readily warmed and ventilated, and heavy plank roofs are free from condensation in cold weather; the large window area reduces the hours of artificial illumination.

Forced circulation of heated air is a very desirable method of heating a mill, being economical as to maintenance and repairs, and thoroughly under control. Overhead steam pipes are very satisfactory, if used in the ratio of 1 foot of 1¼-inch pipe to 70 cubic feet of air.

It is convenient in machine shops to provide rails extending the length of the building under the roof timbers for the purpose of clamping counter-shafts to these rails as may be desired.

Floors.—Floors over an air space or on cement are subject to dry rot. Asphalt or coal-tar concrete is softened by oil, and the dust will wear machinery unless covered by flooring. Floors made by laying sleepers on 6 inches of pebbles, tarred when hot, then 2 inches tarred sand flush to top of sleepers and covered by double flooring, have remained sound since 1865; but double flooring at right angles can be laid on the concrete without the use of sleepers, and nailed together. It is usually preferable to secure nailing strips to stakes 4 feet apart each way and driven to grade, concrete flush to top of strips, and lay single 1½-inch flooring.

Walls.—Piers reach to roof timbers, and light walls to window-sills are finished with slope on inside. In some instances it is preferable to build brickwork up to window-sills, and support the roof by square posts filling the spaces between the windows, and which are secured to the beams by timber knees or iron brackets Large windows are placed high, and the sashes separated by a mullion. Lower sashes should be stationary and glazed with rough glass, with transom sash or window ventilators above. If the light is too strong apply to glass white zinc and turpentine.

The swinging sashes in monitor can be moved in groups by bell cranks from a shaft turned by an endless screw. The connection should not be rigid, but flexible steel links or springs should be introduced to provide for the sashes being out of line, and also to close them with an amount of yielding pressure sufficient to prevent any jarring.

Columns.—Wooden mill columns, Southern pine or oak, safely sustain loads of 600 pounds per square inch;

a square column is stronger than a round one of the same diameter. They should have a 1½-inch core bored from end to end, and two half-inch holes through the column near to each end.

The columns should be securely held at each end, the base resting on iron plates projecting above the floor level, and the caps at the top bolted to the roof beams.

Roofs.—Double or solid timbers of Southern pine support the roof plank, and the ends pass through the wall, and are finished as brackets to the cornice. The beams are anchored to plates in the walls by means of tongues which project into grooves across the lower side of the beams. Beams should not be painted or varnished until thoroughly seasoned.

The roof planks should be two bays in length, breaking joints every three feet. There is no need of gutters, but a concrete walk, sloping toward drains, will take the water from the roof. Do not drive nails upward into the roof plank, as moisture will condense and drop from the heads.

The form of paper machine room shown in Fig. 2, with thick, solid roof, has proved to be very successful in practical operation, being comfortable and free from vapor, and easily ventilated.

The ventilator shown in Fig. 4 is made by removing a row of lights from a window and securing to the inside an inclined sash in a suitable frame, and with hinged cover having an overhanging edge. It does not interfere with the light, or motion of the sash, can be opened or closed at will, and, the air being directed against the ceiling, does not produce draughts.

The foundry roof (Fig. 5) has no lodging place for dust if a sloping cover is placed on the small portion of beams under the skylights. The stringing beams hold the alternate roof beams by iron stirrups, and should be 10 by 15 inches. The roof plank should be slightly raised at the left of the skylights.

The illustrations are on a scale of 14 feet to the inch.

DESTRUCTION OF LARGE MASSES OF IRON AND STEEL BY BLASTING.*

THE author classes these under three heads—viz.: (1) Bodies which can be broken, or rather blown to pieces, by charges of dynamite laid loosely on or against them. (2) Hollow bodies, where the blasting charge can be placed as in a bore-hole, or whose capacity is sufficiently large to admit of their being filled with water, into which the dynamite charge can be placed. (3) Huge masses of steel or iron which must be bored into as if they were rock and then blasted.

Under the first head is included mainly the destruction of iron railway bridges in time of war, and which the civil engineer therefore seldom has an opportunity to deal with. The author, however, quotes the iron bridge (on the Leipzig-Dresden line of railway) over the Elbe at Riesa which, destroyed by a flood in 1870, fell into the river below, completely blocking the bed, and had to be blasted out.

Under the second head are comprised large guns, press-cylinders, boilers, etc.; and, under the third head, rolled steel and iron plates, and rails, cofferdam piles, blast-furnaces, etc.

The formula adopted by the Corps of Military Engineers, for bodies classified under the first head, is $L = 0.0063ba^2$,

where L = dynamite charge in kilograms.
b = breadth of body in centimeters.
d = thickness " "

and this formula applies to wrought-iron structures solid or riveted, provided the rivets are more than 16 centimeters apart; but wrought-iron plates with rivets less than 16 centimeters apart, and all cast-iron plates require only half the charge given by the formula; cast-steel plates, however, require double this charge. Examples are given of the application of the formula to the case of an iron chain-link, and two girders of different section. Under No. 2 head it is stated that the charge for guns, or other similar bodies filled with water, would be 0.1 kilogram of dynamite per centimeter of diameter; for example, for a gun 16 centimeters in diameter, the dynamite charge would be 1.6 kilogram. The following particulars are given of the blasting of a 21-centimeter breech-loading bronze gun. The tube was 4.425 meters (14.5 feet) in length.

Diameter of bore in the rifled part = 20.9 centimeter (8.25 inches).

Thickness of metal at the breech = 31.3 centimeter (12 inches).

The total weight was 14,169 kilograms (31,171 pounds), and the breech chamber was lined with a copper tube 94.8 centimeters (37.323 inches) long, and 6.6 millimeters (0.025 inch) thick.

The committee which conducted the experiment filled the gun with water, and then exploded a charge of 6 kilograms (13.2 pounds) of dynamite in it. This did little damage, so the water was poured out, and a second charge of 36 kilograms exploded; this only bulged and cracked the tube but did not burst it. A third charge of 94.5 kilograms of dynamite shattered the gun into thirty-four large and forty smaller pieces, of which the largest weighed 1,850 kilograms, and four other pieces 1,500 kilograms each. The committee's referee gave it as his opinion that the charge of 94.5 kilograms was the proper charge to have used at first, the gun having been previously filled with water. Other examples are given of the success of the author's experiments in the Archduke Albrecht's works at Trzynietz, in destroying with dynamite a large press cylinder and two boilers, the charge in each case being less than half that given by the formula above for guns, the reduction being due to the trifling thickness of the metal in comparison with the diameters of the cylinder and boiler. Under the third head, the author confirms the opinion of Engineer Trauzel, Director General of the Nobel Dynamite Works—viz.: That bore-holes from 21 to 30 millimeters in diameter and repeated small charges are the only rational methods of blasting very large masses of iron or steel; and he has found that 1,000 kilograms of these metals can be blasted into pieces sufficiently small for recasting at a cost of about 2½ florins.

The paper is illustrated by diagrams and sections of the various bodies experimented on.

THE PURIFICATION OF SEWAGE.

IN discussing the sewage purification problem, the London *Engineer* of recent date says:

"We are justified in saying that the problem remains to a very large extent as insoluble as ever. It is possible to purify sewage to a certain extent, but only at a very serious outlay; and a gallon of really first-class effluent may easily be made to cost as much as indifferent beer. It is very difficult to decide what process of several contending for patronage gives the best result for a given outlay; and all over the country local boards and town councils are trying experiments, and spending money with more or less inconclusive results. The difficulty of purifying sewage augments with its dilution; the more nearly pure it is to begin with, the more difficult it is to make it purer. Thus, if every gallon of sewage contained a pound of impurity, there would be little trouble in getting out half a pound; but when the impurities are measured by grains instead of pounds, it becomes a difficult task to extract the last dregs of objectionable matter.

"Among several systems claiming attention, there are two which, at all events, promise a great deal. The first of these is the electrical process. Plates of wrought iron are placed in tanks containing sewage, and a current of electricity is made to flow from plate to plate through the sewage. The result is that a very tolerable effluent is obtained. The theory of the process is simple enough. In the first place, the iron plates corrode, and the oxide of iron acts as a purifier in a way not, perhaps, fully understood, although more than one plausible explanation has been advanced. But this action of the iron is only secondary · the efficiency of the process is mainly due to the decomposition of the sodium chloride—common salt—which all town sewage contains to the extent of 50 or 60 grains in the gallon. This salt goes away from our dinner tables. All but a small portion of the contents of our salt-cellars ultimately finds its way into the sewers. The water in which salt provisions are boiled supplies a considerable quantity; the spent brine from the butchers is discharged into the sewers. The wonder is, not that sewage contains so much salt, but that it contains so little. The electric current decomposes the salt. The chlorine is set free, and acts as a disinfectant. It decomposes water, setting free oxygen, which, in its nascent condition, readily enters into new combinations. Chlorine combines with hydrogen present in putrefying matters, and forms hydrochloric acid. It appears that if salt were not present in sewage, the electrical process would have little or no value; and it is not improbable that the addition of sea water to sewage might be found of considerable utility.

"The second process to which we have referred consists in filtering the sewage through a bed of the material known as polarite. A certain amount of mystery is maintained concerning this thing. It appears, however, to be nothing more or less than an oxide of iron found in a spongy condition. Iron oxide has long been celebrated for its purifying action on water, and polarite supplies the oxide in a form mechanically perfect in its adaptability to the intended purpose. The surface exposed in each fragment of polarite is comparatively enormous. There still exists, however, incredulous individuals who assert that polarite does not accomplish as much with sewage as the world has been led to believe. On this point we express no opinion, because we do not think enough is yet known with certainty to permit us to speak positively one way or the other. The representatives of polarite, however, do not, it must be said, trust to it alone, because they treat the sewage as a preliminary with a dose of what they term 'ferrozone,' which seems to be an iron sulphate. Concerning the cost of the process we are unable to say anything. It is urged by the disbelievers in the polarite that just as good an effluent may be got with sand by itself, but they adduce no proof of this. There seems to be no doubt but that with either electricity or polarite an effluent can be obtained which is sufficiently good.

"The unsatisfactory condition of the purification of sewage problem seems to be due, in large measure, to the Protean form it assumes. Nothing, for example, is easier than to send specimens of sewage and effluent to the chemist for analysis; but the examination of a dozen, or even ten times as many specimens may give inconclusive results. Not only is it next to impossible, in many cases, to find two samples of sewage alike on the same day, but from house to house, almost, changes take place in its character. Thus, for example, the sewage from the West End of London is quite different from that discharged by the East End. A process therefore which might answer admirably in the case of a large agricultural town, might be unsuitable to a place where manufacturing processes were carried on. Of course, certain impurities are common to all sewage; but the quantity varies with the district, with the weather, and the water supply. Curiously enough it is the amplitude of the water supply in great towns that has told so heavily against the process of purification. To render a few thousand gallons of, so to speak, concentrated sewage fairly pure is a comparatively simple and inexpensive matter; the treatment of a deluge of weak sewage is quite another thing. The extent of land necessary is enormously increased if sewage farming be attempted, and if chemical treatment is adopted the outlay on tanks, etc., is very greatly augmented. The variations in the quality of sewage render experiments inconclusive, and this leads to delay. Corporations and town councils naturally desire to get the best possible value for an outlay which must, in any case, be high; but, unfortunately, the experience of any one town is seldom conclusive as regards the fitness of a process or a system to the case of another town. Thus, we have experiment after experiment, and meanwhile the effluent is impure."

UTILIZING WASTE AS BUILDING MATERIAL.

IN a paper on utilizing waste products, published in the *Wochenschrift des österreichischen Ingenieur und Architekten Vereins*, and abstracted in Excerpts of Proceedings of the Institution of Civil Engineers, it is pointed out that a good and useful building material may be produced by roasting at a temperature of 302° Fahr. the rubbish obtained from old buildings; that by such process so much water is driven out of the material as to reduce the volume from 20 to 40 per cent., and hence the employment of such a perfectly dry material in a building will prevent the settlements so often observed, resulting from the drying of the material within the walls of the building itself. A further advantage is a sanitary one, for while the original waste product may contain within itself the germs of disease, these are destroyed by the intense heat to which they are subjected in roasting, and the material is therefore completely disinfected.

Another useful building material is manufactured from blast-furnace refuse in the form of bricks and paving slabs, and this has established a new industry in the smelting houses on the Schwechat near Vienna, where the furnace slag is broken up and mixed with hydraulic lime and then molded under steam pressure into bricks. The value of the product consists in the formation of silicate of lime from the combination of the silica in the slag with the lime, resulting in a hard material which increases in hardness on exposure. The brick in this condition is of a uniformly grayish white color of rather coarse grain and very sharp edges, and possesses in a high degree the two valuable properties of permeability and porosity, and thus constitutes an essentially healthy building material The durability of the material, too, has been tested by a 15 years' exposure in some cases, and no signs of wear or weathering have been noticed; in short, the results of its employment have been so favorable that it has been recommended by the Board of Works for general purposes, and to be used with a mortar made from slag, sand and hydraulic lime.

Paving slabs are now made according to a patent process by mixing furnace slag with Portland cement and other constituents, which produce rapid hardening and great strength, and such pavements are now laid down for special purposes in London, Paris and Vienna.

THE determination of the speed at which the air is changed in inclosed spaces is a problem which has frequently to be solved. A plan of measuring it proposed by Pettenkofer, depends upon estimating the decrease in carbonic acid which takes place after a given time in an atmosphere artificially charged with this gas, by which means the amount of fresh external air which has become mixed with that under examination can be calculated. Other methods which depend upon the thermometer and the anemometer may be used to check that of Pettenkofer.

IN the irrigation canals of India the water flows with a velocity of 1¾ feet to 2 feet per second, in light sandy soil. In more stable soils a velocity of from 2½ feet up to 4 feet is adopted.

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* By Hugo Münch in the *Wochenschrift des österreichischen Ingenieur und Architekten Vereines*. Abstract in Excerpts of Proceedings of the British Institution of Civil Engineers.

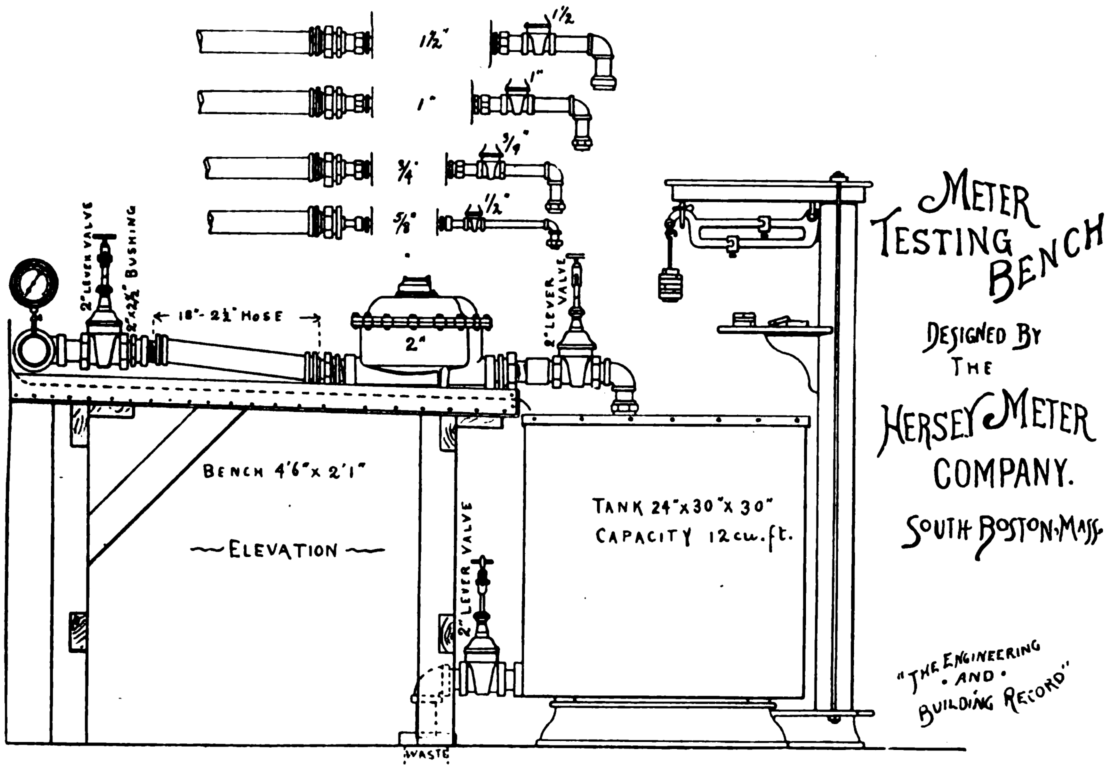
NEW ENGLAND WATER-WORKS ASSOCIATION SKETCHES.

No. XVI.

(Continued from page 121)

WATER METER TESTING BENCH.

THE meter testing bench shown in the annexed illustration was designed by the Hersey Meter Company, of South Boston, Mass., and formed one of the series of subjects of which sketches were presented at the meeting of the New England Water-works Association, at Portland, Me., a few weeks ago.



It will be noted that the arrangement is designed for testing meters of various sizes, connections being shown for meters ranging from ⅝-inch to 1½-inch, with a 2-inch meter in position. The method of testing will at once suggest itself and calls for no further explanation. The bench is covered with No. 18 galvanized sheet iron. The tank has a capacity of 12 cubic feet.

REGARDING CHARGES FOR WATER.*

REPORT OF COMMITTEE ON WATER-WORKS.

IN reply to the following question: Should applicants for extensions of water mains be obliged to guarantee a certain percentage where the property is, or has been, paying water taxes? If so, why? And what is a reasonable percentage?

Answer: Yes. A system of water-works should be conducted on purely business principles. Where the income from water is not sufficient to pay interest on the cost of the works, together with the cost of maintenance, no extension should be made until such a sum is guaranteed, in addition to the regular rates, as will cover the interest on the cost of such extension.

There is not the urgent need for water in the suburban part of a city that there is in the built up portion, and to demand that it be piped on the same scale would ruin any private enterprise.

W. H. RICHARDS,
A. R. WADSWORTH,
HENRY W. AYRES.

Mr. Whitlock: I wish to give you a case—not exactly a supposed case—but is a standing matter of fact with us in Waterbury. We have a system of water-works, owned and run by the city, and there is a clause in the charter which prohibits it supplying any parties outside of the city limits (except where that supply has been given in return for value received from these parties in some manner, such as the right of way through their property). In two cases I think of parties who are supplied under that clause. Otherwise all parties within the city may obtain water by complying with a certain amount of red tape. Now, here is the case:

There is a party, who, owing to certain combinations or circumstances, has been unable to get water. He has lived too great a distance from the supply to make it advisable to get to him until say this year. This year, in the course of extension, the pipe has come within such distance of his house or property that he can, with propriety, ask for water from the city. Now, he has paid water taxes; in other words, he has paid a certain proportion of his city taxes, which has been diverted and used for water-works, pure and simple, and nothing else. Now, is it proper to require him to guarantee sufficient cost to pay the interest and expense of laying 300 feet of pipe?

Mr. Ayres: Yes, it is.

Mr. Whitlock: When he has already paid for 10, 12, or 15 years?

Mr. Ayres: Yes, for he has been paying all this time, as well as his interest toward this water, also for electric lights and police protection.

Mr. Whitlock: He has already had the benefit of the lights, the benefit of the sewers, and the benefit of the police.

Mr. Ayres: And the benefit of the water.

Mr. Whitlock: In what way?

Mr. Ayres: Every way, except for his own direct benefit; the city has been benefited in sprinkling the streets and in fire protection, and he is interested in it, but he has been placed in an unfortunate position, that is all.

Mr. Whitlock: The circumstances rather had the best of him, and your idea is to keep him in the hole.

Mr. Ayres: My idea is to give him the water as soon as you can afford to.

Mr. Whitlock: Does that necessarily imply that he should guarantee he will pay enough to cover the cost.

Mr. Ayres: Yes, I claim that it does; that somebody now is paying for this water that the town of Waterbury is furnishing its water consumers. Now, then, this man asks for water, and if you put water into his place, why somebody has to pay for that pipe you run out. You may get one or two parties additional which will help him out, but because he lives a few feet inside the outskirts, where it costs more to supply him than any amount you can get back, if he wants the water he must pay for it.

Mr. Whitlock: At the same rate as others?

Mr. Ayres: By no means at all. He must pay so that the company will not be the loser, financially, by his taking the water. Don't make any difference whether it is a private company or whether it is a corporation.

Mr. Whitlock: For instance I am at the end of a street 500 feet long; I apply for water on it; I am the last man on the street; my application is granted, and for perhaps six months I am the only man who takes water on it. Is it not a fact that almost as soon as that case exists, it is rectified by other people applying for water and taking it?

Mr. Ayres: Well, when that happens you are free from your responsibility and guarantee.

Mr. Whitlock: How long should you make that guarantee last?

Mr. Ayres: Until there are enough water takers on your additional pipe to pay the interest on the outlay.

Mr. Chandler: Are you not given the benefit of it?

Mr. Ayres: The taxes will give it back to him.

Mr. Chandler: You make him guarantee for the first year the expenses, while you are making money?

Mr. Ayres: No, he is getting the benefit of it. The money is put back in the town sinking fund or something else. It is just exactly on the same principle as where we trade at a grocery store where a number of people don't pay their bills. We folks who do pay our bills have to pay their share too, and that's all there is to it.

Mr. Jarvis: You are pretty solid on the financial question, ain't you?

Mr. Whitlock: It has never seemed fair to me, for a man who is placed in the position I have just described, to be called upon to guarantee a revenue from a pipe in his street when, as in the case in Waterbury, and in many other cases, the water-works are not only paying, but are turning into the public treasury more money than they spend. In such a case as that it doesn't seem to me fair to require a man on the outskirts to guarantee anything of that sort.

Mr. Ayres: Why can't he just as well have an electric light in front of his house, and keep a policeman at the front door, as to take water he didn't pay for?

Mr. Whitlock: This man does pay, and has been paying for ten years.

Mr. Ayres: He pays for watering the streets down town so that the dust shan't blow in his eyes.

Mr. Whitlock: You may be right, but it don't look so to me.

Mr. Chandler: Because all other things run wrong, the water must be run so, too?

Mr. Ayres: You might just as well say that—well, I won't say it.

Mr. Jarvis: What is it, a hardware bill, this time?

Mr. Brinsmade: Should the same rules govern city water as govern a private corporation?

Mr. Ayres: I think just the same basis.

Mr. Brinsmade: You shouldn't expect a private corporation to put pipes out to a man unless he guarantees the interest on the outlay?

Mr. Bunce: That is not the question.

Mr. Brinsmade: The question is, supposing that this man is paying for water in taxes.

Mr. Whitlock: In a private corporation you have got into a different case entirely. A private corporation levies no taxes for water until the water is supplied. They may enforce restrictions, as they not only oblige him to guarantee a sufficient revenue to pay expenses of laying the pipe down there and maintaining it, but they oblige him to lay the pipe himself. That is a case I know of myself.

Mr. Brinsmade: You dont't think both ought to be on the same basis. You don't agree with Brother Ayres?

Mr. Whitlock: No, sir; I don't on that ground, because a man that lives in the city and is supplied by a public water company pays from the moment he takes up his residence in the city and owns property in it; he pays a certain proportion of the running expenses, and gets no direct benefits.

Mr. Ayres: Suppose that the water company is making money enough and assess no taxes?

Mr. Weld: No such case happens.

Mr. Ayres: In our own city of Hartford there has been no tax levied for water-work purposes for years and years.

Mr. Weld: No tax except the water bills?

Mr. Ayres: No tax except the revenue derived from water rents.

Mr. Bunce: Indirectly there is, because the city has been paying interest on a large amount of borrowed money all the time.

Mr. Ayres: The city, no! The water company has been paying their own interest on it.

Mr. Bunce: How long?

Mr. Ayres: It must be ten years. The last I knew about it one-quarter cent tax was paid to help it out.

Mr. Bunce: Indirectly, the city is still paying that, from the fact that if there was no interest on that bonded debt, the water rates, which is the water tax to users, could be diminished. Although the water would and is nominally paying its own interest, it is paid, of course, by the contributions of the citizens of Hartford, who are using the water.

Mr. Weld: The Water Board doesn't furnish water to the city free, or to any of its buildings free, but every man who lives in the city has to pay some certain taxes for the water that is used in the city buildings and for water used in the hydrants, so, as I said before, the case never happens when a man doesn't pay some water tax.

Mr. Ayres: You are not obliged to pay that tax?

Mr. Weld: No, but he has to pay something towards the cost.

Mr. Bunce: He can't escape, because the fact is the city is paying it.

Mr. Weld: He has to pay something into the treasury to pay for water in the hydrants, in the city buildings, etc.

Mr. Ayres: The hydrant tax would be a very small matter.

Mr. Weld: And this man who lives on the outskirts, he has to pay some water tax without getting any benefit.

Mr. Ayres: He is deriving the same benefit that he derives from having his house built up in proper shape. Same as you would if you lived in a school district, because it educates the people around you.

Mr. Whitlock: I would like to ask if any appropriation is made by the city of Hartford for the water department.

Mr. Bunce: The tax, I believe, is derived from the water rates, which are more than the expenses of running the department require. In other words, those taxes or water rates are made high enough so that each year the interest of the bonded debt, and a portion of the bonds are extinguished. The bonded debt, and thereby its interest, being wiped out, of course the water rates may be lowered to the same extent as the expense of running the department.

Mr. Loomis: It seems to me that the water rent business is explained in this shape: Now, for instance, a number of years ago I bought a place; no water in it, and I had to run a surface pipe from the main pipe to connect one or two buildings. In the course of time, when other parties came in and built, they tapped our pipes and drew the water away from us so that we were left without any pressure, although we had paid the expenses of laying our private pipe. In the course of time the city laid pipes. Now, in regard to water rates; the parties that own real estate have to see that the water rate is paid. The bondholders and those parties who own insurance stock, I don't know as they pay taxes, so, it really comes on the real estate holders to pay the water rates.

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* From Transactions of the Connecticut Association of Civil Engineers and Surveyors, February, 1890.

Mr. Chandler: The privileges Mr. Ayres speaks of enjoying do not seem to be any reason why people who chance to get water a little further off from the center than others ought to pay anything additional. They have received these common benefits, so has every one else in equal proportion, and so it is policy to extend the water main to every citizen as soon as convenient. A man should not expect to get water until the main is somewhere near him, but when they do get sufficiently near so that it is convenient, and he has been paying the same tax, it doesn't seem just that he ought to pay any more for his water when he finally does get it, on account of having waited for it so long.

Mr. Wadsworth: It seems to me that this simply illustrates the point that a person residing in the corporate limits where there is a tax for public benefits, and who is so unfortunate as to be so far out that he cannot take advantage of the privileges he pays for, must simply wait the development and progress of the system until it reaches him This is a very common thing. In putting water-works into the towns in this State they charter a company and secure the right to tax all individuals within a certain district, perhaps in the whole town, and they tax every proprietor in the town, and he pays his proportion of the water rates, and has no advantage from it whatever. There has been considerable discussion of this subject during the last year, but I see in spite of it the people with no interest in the water-works are governed by the others, who are in the majority; those interested being leading citizens, willing to pay the tax, and make all others pay. The others receive no benefit whatever in any way, shape or manner. They simply pay taxes without receiving any public benefits that come from the use of the system pipes in the village. And now comes in this man who lives so far out beyond the system of water-works; he must simply pay until his hour comes, and wait until the water pipes come to him, unless he wishes to pay for pipe of sufficient size to furnish water for his place, or compromises with the city in some way by which he can secure that benefit for which he has been taxed this term of years, and I reply "Yes" to the question were it so spoken to me. There is no substantial corporation of intelligence, that I know of, that wouldn't lay pipes to connect with his place as soon as he advanced the funds to do it. I had a case in my system where there was a greenhouse that wished water; said they wished to lay pipes along in front of the place. About half the distance we had no takers of water, and it would cost more than the first year's rents, but there were other houses in that direction who would take water in time. Perhaps between the individual and the city there might be a compromise and each one pay half or a certain proportion, so that this man could actually receive the benefits for which he has been paying taxes.

Mr. Whitlock: I think that Mr. Wadsworth agrees with me, and will say that my method for supplying customers would be about equitable for all. It is this: A customer comes in that is far off, no large street main near him to supply him, which makes it exceedingly expensive. He comes in and says he must have water and is willing to pay for it, to which the water-works say, "If you want the water, you lay your pipe, and when we get so it is required by the city, we will pay you the cost of laying that pipe and take it up; take it off your hands." Would you consider that an equitable arrangement?

Mr. Wadsworth: It would depend upon the size of the pipe.

Mr. Whitlock: He lays one sufficient to supply him and the section between him and the existing main. This is the method I have seen adopted in one or two cases.

Mr. Ayres: Well, if he is willing, that is his lookout.

Mr. Bunce: That would be great deal more of a hardship than under the present arrangement. Mr. Ayres, when you lay a pipe here you pay the expenses, but ask the applicant to guarantee a certain income upon the expense of laying that pipe?

Mr. Ayres: Certainly; then you can lay pipes that fit into your system. You don't let a man put in different sizes of pipes here and there.

Mr. Kunce: The only difference, Mr. Whitlock, in the case you speak of would be this: That in the case where the man guarantees a certain percentage on the cost, he eventually loses that, and in your case he puts out a very much larger expenditure of money at first and some time gets it back. All he loses is the interest on the money in the meantime.

Mr. Whitlock: Yes, and the general result is that he gets it back in the course of two years.

THE Mannesmann process of tube making is to be carried out on a large scale in England. The London Steel Company's works have been bought for the purpose by a syndicate headed by Siemens and Mannesmann.

PLANS for new water-works, estimated to cost $235,000 have been ordered by the Dundee, Scotland, Water Commissioners.

BUILDERS' AND CONTRACTORS' ENGINEERING AND PLANT.

No. XCVIII.

(Continued from page 105.)

RAISING AND MOVING A BRICK FURNACE.

THE Worcester Steel Works, of Worcester, Mass., some years ago built a large 12-ton steel furnace with brick walls braced by the iron rails R R, etc. Figs. 1, 2, 3 and 4, and tie rods B B, etc., having a total estimated weight of from 200 to 250 tons.

In building the foundations excavations were made to what was supposed to be the natural gravel bed and the structure erected thereon. After a time, however, it was noticed that the furnace was settling, especially on one corner, and this settling became so bad that it was decided to rebuild the foundation and at the same time to move the furnace 3½ feet horizontally. It had been ascertained by soundings that what was supposed to be a gravel bed was in reality a gravel filling on top of a lot of cinder. From the heat of the furnace and gas flues this cinder had caught fire and was gradually burning out, causing the settling.

Fig. 3 is a plan of the furnace from X X, Figs. 1, 2 and 4, and shows the brickwork in section and everything else in plan.

Figs. 1 and 2 are elevations from Z Z and Y Y, Fig. 3, respectively, and show the timbering and jack-screws for raising the furnace.

Fig. 4 is an elevation from Z Z, Fig. 3, and shows the timbering, screws and rollers for moving the furnace horizontally.

The first thing was to get a solid bearing on which to support the furnace. To do this the ground around the furnace was excavated 5 or 6 feet, and a double row of 8-inch piles, S S, etc., 20 feet long, were driven each side of the furnace. These carried stringers, T T, and caps, L L, pierced in the center by a 4-inch hole to receive the jack-screws J J, etc. Meanwhile 15 heavy iron I beams, C C, were let through the side walls of the furnace, projecting out some 6 or 7 feet on each side. These were the needles. There were also four hard pine timbers 16 inches deep, laid across parallel with them. All these pieces were to support the side and middle walls. The cross walls were supported by four pairs of rails, D D, etc., laid across the needles under each wall.

Sixteen inclined braces, A, were set up on each side, bearing at F on plank and timbers laid across the ends of the needles and under the second line of horizontal brace rails R. To keep the foot of the braces from slipping out some hooks, H, of inch iron were carried from the planking at F to the lower line of the brace rails R. Thirty jack-screws, J J, etc., were then set on either side and brought to bear on hard pine beams I I, which came up and supported all the needles. The screws were turned up till all the weight was taken off the foundation, and the furnace was brought up to its original position.

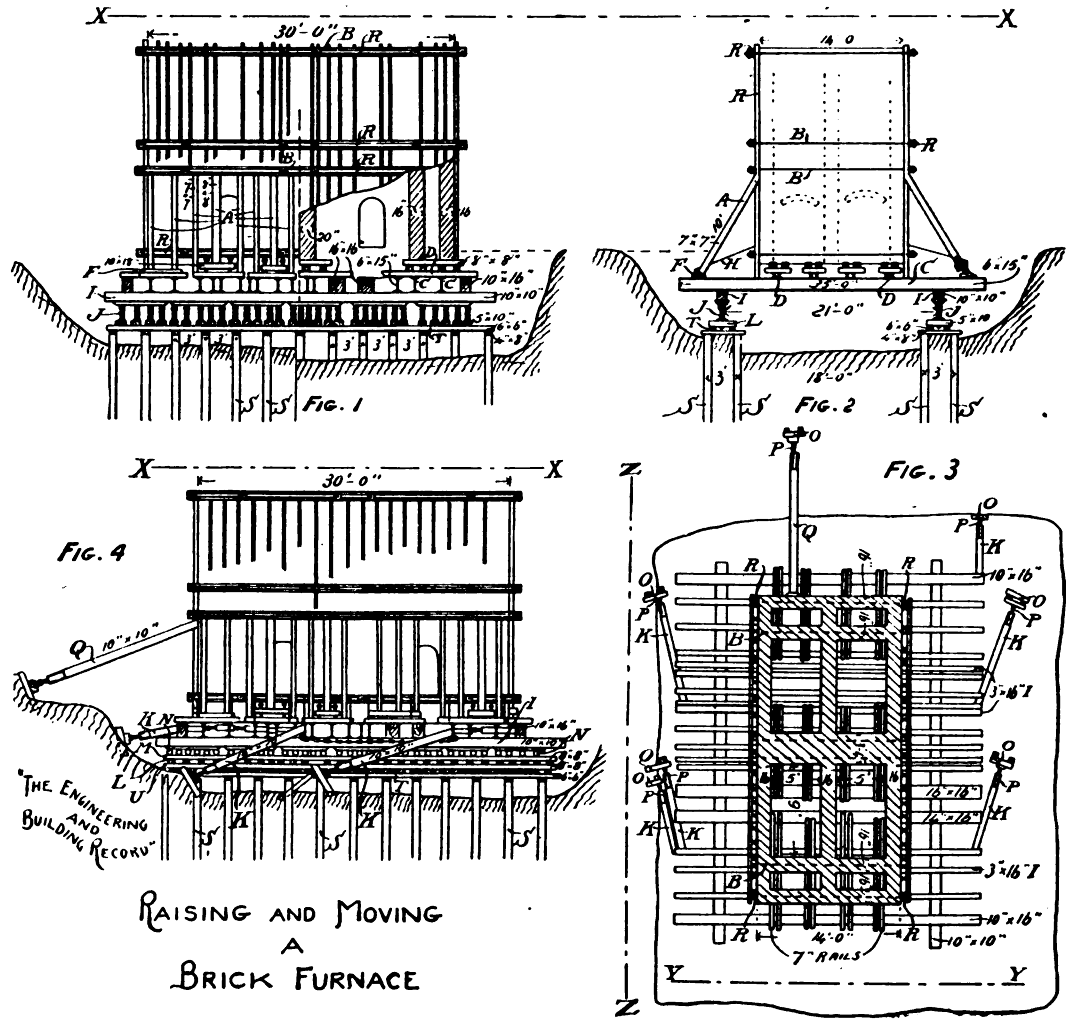
The old foundation was then removed and hydrant water let on for some hours to extinguish the fire in the cinder filling, so that the excavation would be carried down to the natural surface. Here a solid stone foundation was put in and brought up to within 20 inches of the bottom of the needles.

Four open spaces were left in this foundation 3 feet 6 inches by 9 feet to allow the mason to build up under the walls of the furnace; the spaces to be filled after the connections with the old work were completed and the needles taken out. Before this was done, however, the whole furnace had to be brought forward about 3½ feet. A line of timber U, Fig. 4. was laid each side of the jack-screws on the cross pieces L, and short 8 by 8-inch blocking was introduced between the screws, and a second line of stringers M, placed on top. Between these and stringers I were placed 32 6-inch wooden rollers N N, etc., on each side, and then the screws were turned down and removed leaving all the weight on the rollers.

The forward propulsion was obtained by setting braces K K, etc., against the ends of some of the needles, with foot-blocking, O O, etc., for solid bearing against the sides of the excavation. A jack-screw P P, etc., set in a hollow turned block of wood was placed between the end of each brace and its blocking. Blocking was also placed and wedged in between the ends of all the needles so as to carry the pressure uniformly and prevent their slipping. Another brace Q, was placed against the rear of the furnace and directly in the line of movement. When all was ready the jack screws P P, etc., were manned by three men each, and all turned together at given signals, each turn advancing the furnace about ¼ of an inch. The progress was about 1 inch in five minutes when everything was running smoothly, but as the rollers had to be changed and new blocking put behind the screws every time these were run out their full distance (14 inches), the average progress was about 1 inch in 15 minutes.

When the furnace was once in place the work of supporting it on the new foundation was simple and quickly done.

Isaac Blair, of Boston, Mass., executed the work of raising and moving the furnace.



RAISING AND MOVING A BRICK FURNACE

CLEANING A RESERVOIR AT NEW BEDFORD.

THE method used in cleaning the distributing reservoir of the New Bedford, Mass., Water-Works, was recently described by Superintendent R. C. P. Coggeshall before the New England Water-Works Association.

The reservoir has a surface form of a trapezium and covers an area of about five acres. The earthen embankments which compose its sides are 15 feet in width at the top, with slopes inside and outside of two feet horizontal to one vertical. The general dimensions through the middle are about 345 feet by 255 feet. The bottom is the natural surface left after excavation, and is gravel well filled with clay. The vertical height from the bottom to the level of the top of the embankment is 20 feet. A depth of 18 feet constitutes a full reservoir, and that volume contains 14,957,101 gallons.

During the month of April, 1888, this reservoir was drained for the purpose of making extensive repairs to the well of the gate-house, and also to the stone facing on the inside slope walls. While these repairs were in progress, the side walls and bottom were thoroughly cleaned.

At a convenient location on the south inside slope, a runway 4 feet in width was placed. Two-inch planking was used, and a ledge fastened to the sides to prevent the truck from slipping off. At the top of the slope this runway connected with a level plank platform, extending across the top of the embankment and continued to a convenient distance beyond the foot of the outside slope. Near the end of the platform and well beyond the outside slope was a hole of convenient size, through which debris was dumped some 15 feet to the ground beneath.

The runway on the inside slope allowed the use of a truck 2½ feet by 5½ feet, constructed of 2-inch planks, having three cross-pieces underneath 2 inches by 6 inches, and two cross-pieces on top 2 inches by 6 inches placed edgeways—one on the lower edge of the truck, the other in the middle. This allowed the placing of two tubs upon the truck at the same time for haulage up the slope without danger of either slipping. The truck ran on six large casters, having 4-inch wheels.

The haulage was made by means of a single rope spooling over a 4-inch derrick wench without gearing. This wench had a crank on each end and required two men to operate. A third man manipulated the slack of the rope. By this method the truck was operated with ease, and more rapidly than it could be done in any other way.

Six tubs were used. These were made from 50-gallon oil casks cut in two. For convenience in lifting handles were placed on opposite sides.

In eight days from the time the reservoir was discontinued from the distributing system the bottom was in condition for cleaning. Nearly all moisture had then evaporated from the material to be removed. A vegetable deposit, averaging from a quarter to a half an inch covered the bottom. At the foot of the slope walls, especially in the corners, there was found a large quantity of gravel which had become displaced from beneath the stone lining of the slope by reason of the continued wash of years upon it.

All the material to be removed was thoroughly scraped into convenient piles and then transferred to the foot of the runway by means of wheelbarrows. Here it was placed in the tubs, they being upon the truck. The truck was then hauled to the top of the slope and run along the platform to the hole near its end. The material was then dumped, and the truck, together with the tubs, quickly returned to the bottom of the slope The dump heap thus formed beneath the platform was afterwards removed by carts.

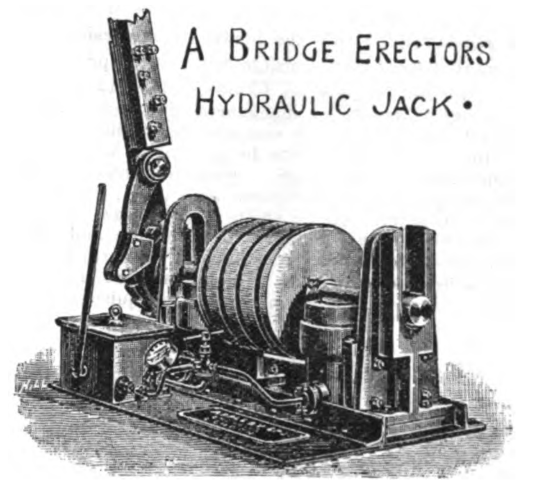
BRIDGE INSPECTION IN AUSTRIA.

ACCORDING to the Paris *Chronique Industrielle*, a decree addressed by the Government Inspector General to all Austrian railroads in regard to bridges, calls especial attention to the following points: Preventing any accumulations of moisture on the structures, search for loose rivets and bolts and opening of built riveted members, repainting around new rivets, special examination of box and plate girders, provision of new and free operation of old drainage holes, the removal at least once during its life of wooden sleepers in iron trough girders, the painting of the girders and the interior inspection of box and tubular girders. Especial care is taken to detect and prevent rust, since it caused the destruction of the Mahrisch-Ostray suspension bridge.

A BRIDGE ERECTOR'S HYDRAULIC JACK.

THE Excerpt Minutes of the Proceedings of the Institution of Civil Engineers contain a description by C. J. Appleby of a special hydraulic jack used in launching a railroad bridge 525 feet long (in three spans), weighing 340 tons, across the Rio Jauchy River in Brazil.

It was much more convenient and economical to deliver the materials and rivet up the bridge complete on one side of the river than to carry on the work on both sides. Staging, or floating lifting arrangements, were alike impracticable, and as the front end of the bridge might "sag" a little, adjustment was made by ten twin hydraulic jacks. Each pair was mounted on a strong wrought-iron bed-plate, with shackles for lifting, and bolts for securing the bed-plates to the staging, abutments, or piers. Each pair of jacks was provided with differential pumps. The pump of larger diameter was, of course, used for running up quickly, or for light loads, and the smaller one for the maximum duty, but could be worked by one man. The object in having one pump to each pair of cylinders was to ensure both rams being maintained at the same height. The heads of the rams were used as bearings for a steel shaft carrying a roller about 2 feet in diameter, which was grooved to take the heads of the rivets and thus give the bottom flange of the girder a fair bearing and good rolling surface; the end standards were merely intended to keep the shaft in its proper position. As there might possibly be a load of 120 tons on the roller each jack was tested to 100 tons, or 200 tons for the pair. The main girders being ready the jacks were set under them and lifted the completed section high enough to allow its packing to be removed and used for the next section. Then two men at each jack, working by signal on the pawl handles, propelled the bridge across the water to its position on the bridge seats.



If the front end was too low to ride over the rollers fixed on the piers or abutment it was quickly raised by the jacks. The bridge was launched considerably under the estimated cost.

Correspondence.

Communications giving information or opinions on matters of general interest to the engineer, the architect, the contractor, or the municipal officer, will be welcomed in this column. Fairness will suggest that when communications are sent simultaneously to this and other journals we should be informed of it at the time. Anonymous letters will not be noticed.

REPAIRS TO MACADAM ROADS.

AUSTIN, TEX., July 19, 1890.

To the Editor of THE ENGINEERING AND BUILDING RECORD:

SIR: I beg to forward the following remarks on Mr. Owen's article on "Repairs to Macadam Roads," published in your issue of the 28th ult.

Mr. Owen states he builds his roads so that "they may wear down uniformly." Uniformity of wear over a road is another phrase for uniformity of traffic over its whole surface; the terms are synonymous. Granted this uniformity of traffic, and uniformity of wear is its natural consequence. There will then be of course no need for patching. As soon as the road under this uniform traffic is worn to the limit of safe bearing, the renewal of its entire surface is in order; and thereafter, even wear and entire renewal will follow in regular order, *ad infin*. The difficulty, however, that presents itself to me is, how on country roads to insure or effect this uniformity of traffic and consequent evenness of wear. It is simply impracticable. The rule of the road, which obliges a driver to keep to his right, will, to avoid the inconvenience of pulling aside for every passing vehicle, cause him to always keep to his right-hand edge of the road. Thus, there will be on all country roads four special lines of wear, corresponding to the space between the wheels, and the ingoing and outgoing traffic. Again, though great attention bestowed on a road surface during its first construction will insure, *cæteris paribus*, greater uniformity of wear, yet it will happen that on a road of many miles in length, a few stones will become loosened here and there per mile, or a few pieces of softer material inadvertently slip in, causing in each instance a tendency to form a hole of more or less size by the action of every wheel passing through it. Thus, from the causes mentioned, ruts and holes will occur and must be repaired, or, in other words, patched, to keep the road in good order. My remarks in regard to ruts do not apply to the streets in a city. Here the continual change in the line of movement of every vehicle produces a more uniform wear of the street surface.

Mr. Owen objects to steam rollers It would be a waste of power to use a 15-ton steam roller on the repair of a rut or patch. For such repairs a 2-ton roller will suffice. But for the original construction of a macadamized road, and for general repairs or entire renewals of the surface, a steam roller is far more efficient and economical than a two or four ton roller drawn by horses.

As to the use of clay or loam instead of broken stone screenings: In this, as in general, the better the material the better the result. Stone screenings will bind better with its own larger material below than will clay or loam. Every shower of rain will soften the clay and destroy its binding effect. At the same time only as much hard screenings should be used as will fill the interstices of an already rolled road. A little experience will determine this quantity. The size of the road metal should be such as to pass through a ring one and a half inches in diameter.

Lastly, as to Mr Owen's method of consolidation. To quote his own words, "the result is at first ruts and unevenness," which, to continue his statement, is overcome and remedied by a great deal of extra care and labor. Whereas by the method of consolidation described by me in my prize essay on Road Making, published in your issue of the 12th and 19th of April, 1890, the road surface will not require the extra care and attention to remedy the evil of "ruts and unevenness" in a newly made road. If Mr. Owen had 200 or 300 miles of road to maintain, in addition to his other duties as civil engineer and architect of all the public buildings in his State, he would not have the time to give this double attention to road construction, but would perfect his road at the first effort. In India road construction, which is here in its infancy, has been reduced to a science under the experience of 100 years of road making. The government there also owns the soil as landlord, and it considers it an economic policy to provide efficient communication throughout its vast estate, containing 275,000,000 of inhabitants, both as feeders to the railroads and for the general traffic and convenience of its vast population. It thereby increases the value of its own property by the enhancement of the value of the land, thus legitimately increasing its revenues and benefiting its subjects. The country roads in India are kept in better condition than are the streets of the great majority of American cities.

I. F. POPE,
Civil Engineer and Architect.

CRESSON SPRINGS, CRESSON, PA., July 26, 1890.

To the Editor of THE ENGINEERING AND BUILDING RECORD:

SIR: I have read with much interest Mr. North's and Mr. Owen's remarks on road building in your issues of June 28 and July 12, and while agreeing with the statements made by both gentlemen in several particulars in regard to the subject at issue, I am obliged to differ from them in some slight respects. The fact is, I think some of the views are somewhat extreme in both cases. Our experience, for instance, in the construction of roads in Fairmount Park would indicate that there are many occasions where a steam roller is an almost indispensable tool for the proper and economical construction of Macadam and Telford roads, and there are other cases where, from local circumstances, a horse roller may be desirable. I do not think that an excessively heavy roller, say 20 tons, is as desirable or as efficient as one of, say about ten tons, for reasons which are obvious now to engineers of experience in road construction. We have found that good hard angular trap rock makes the best road, and that it is not desirable to use such a heavy roller as will round off the angular edges of the metal; a more firm bond is evidently made between the materials forming the road if the edges and angles are wedged into each other than if the stones are crushed and rounded by excessively heavy rolling. In regard to the surfacing with trap rock screenings, we find that by all odds it makes the best finish, but we do not use more than about half an inch of it, and previous to spreading it have found it always necessary to give the stone a slight coating of clay to act as a matrix between the stone. We generally use this clay in the form of a dry powder and sow it over the stones, then sprinkle the road with a watering cart, and then roll either with steam or horse roller depending on circumstances. It is hardly necessary to say that in grading for the road we cut out the cross-section to subgrade in the same form as the finished road surface is to be, and compact the bed thus made by thorough rolling.

RUSSELL THAYER,
Chief Engineer, Fairmount Park, Philadelphia.

Questions and Answers.

All questions relating to building construction, paving, sewerage, water supply, or kindred subjects, will be welcomed in this column provided they relate to matters of general interest and are not such as should properly be referred to a consulting engineer. Answers will be carefully prepared and a proof of both question and answer mailed to the inquirer as early as proper consideration will permit. They will be published for the benefit of other readers as soon as convenient. The full name and address should be given, not necessarily for publication, but as a guarantee of good faith, and to facilitate further correspondence in case the question is not sufficiently explicit.

Inquiries of the Editor, in order to secure prompt attention, should *not be written on the same piece of paper as a communication* to the *Publishing Department.* Letters renewing subscriptions are sent to a clerk in the publishing office, and matter for the Editor, if in the same enclosure, is likely to be overlooked unless it is on a separate piece of paper, so that it may be promptly sent to the Editor.

DRY AIR REFRIGERATION.

REFERRING to our recent reply to an inquiry concerning ammonia refrigeration, F. M., of Jersey City, N. J., writes: "Will you make the necessary calculations for me showing how to determine the amount of air to be compressed and subsequently expanded to get a given cooling effect?"

[Briefly stated, we may proceed as follows: Suppose we wish to freeze water having a temperature of, say, 60° Fahr. The amount of heat to be taken from a pound of water at this temperature to reduce it to ice at 32 degrees is 170 heat units. This becomes clear when it is remembered that the latent heat of fusion of ice, or the amount of heat to be taken from a pound of water at 32 degrees to transform it into ice at 32 degrees, is about 142 heat units, and that cooling of water from 60 degrees to 32 degrees involves the abstraction of 28 units. One pound of air at one atmosphere, and 60 degrees compressed to two atmospheres, is heated through about 116 degrees.* Multiplying this by 0.238, the specific heat of air, we have 27.6 heat units per pound of air. Hence to freeze a pound of water from 60 degrees requires $\frac{170}{27.6} = 6.16$ pounds of air, which is equal to about 81 cubic feet at one atmosphere and at 60 degrees. Now to compress one cubic foot of air to two atmospheres requires about 1,630 foot-pounds of work. Therefore $1,630 \times 81 = 132,030$ foot-pounds, or total required to compress 81 cubic feet to two atmospheres. A horse-power being equal to 33,000 foot-pounds per minute, one horse-power would, therefore, produce $\frac{33,000 \times 60}{132,030} =$ about 15 pounds of ice per hour. If 33 per cent. be deducted for friction of air compressors, etc., and allowing, say, 5 pounds of coal for a horse-power, we would have $\frac{10}{5} = 2$ pounds of ice per pound of coal burnt under a boiler.]

STREETER'S PIPE LOWERING APPARATUS

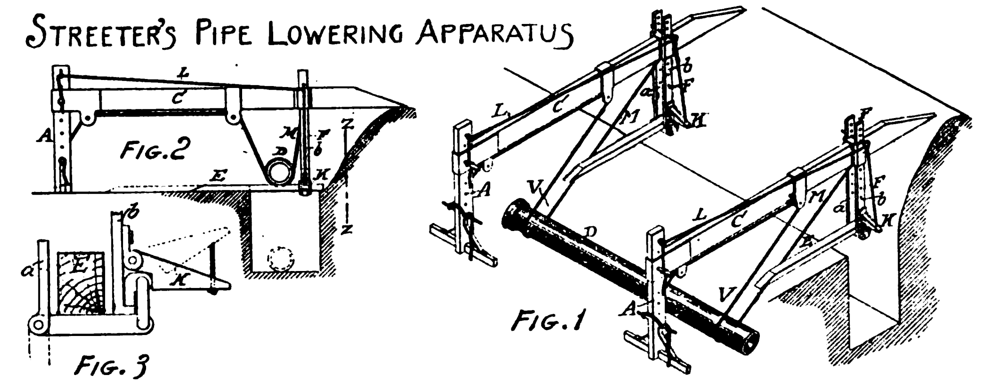


FIG. 2

FIG. 3

FIG. 1

BOOKS ON BUILDING, ETC., WANTED.

A PHILADELPHIA correspondent writes: "I am desirous of receiving a complete book on building houses, factories, etc., one that gives all the technical terms known to the builder; also a book definitely describing the use of the engineer's level and transit. Have you such?"

[Our correspondent would probably do well to begin by providing himself with Kidder's "Architects' and Builders' Pocket Book," price $3.50, and with Trautwine's "Civil Engineers' Pocket Book," price $5. These will most likely tell him all he wants to know about building and architectural terms, and the construction and use of surveying and leveling instruments, and a great many other things besides, as they are standard works in their respective departments. For instruments only, perhaps Gurley's "Manual of Surveying Instruments," price 50 cents, would answer all purposes. In designing and superintending the construction of buildings Hatfield's "American House Carpenter," price $5, (which embraces much more than carpenter work, by the way,) and Clark's "Building Superintendence," price $3, will be found very helpful. Garnsey's "American Glossary of Architectural Terms" would probably tell our correspondent all he wants to know about them. Gillespie's "Surveying," price $3.50, and his "Leveling," price $2.20, describe at length the construction and use of the instruments.

Any of these books will be sent by the Book Department of this journal, postpaid, on receipt of price.]

PAINTING FLOORS.

ACCORDING to a French journal painting floors with any color containing white lead is injurious, as it renders the wood soft and less capable of wear. Other paints without white lead, such as umber or sienna, are not injurious, and can be used with advantage. Varnish made of drying lead salts is also said to be destructive, and it is recommended that the borate of magnesia should be used to dispose the varnish to dry. A recipe for a good floor varnish is given as follows: Take two pounds of pure white borate of manganese, finely powdered, and add it little by little to a saucepan containing ten pounds of linseed oil, which is to be well stirred and raised to a temperature of 360° Fahr. Heat 100 pounds of linseed oil in a boiler until ebullition takes place, then add to it the first liquid, increase the heat, and allow it to boil for 20 minutes. Then remove from the fire and filter the solution through cotton cloth. The varnish is then ready for use, two coats of which may be used with a final coat of shellac, if a fine polish is required.

DE SAINTIGNON'S DIFFERENTIAL PYROMETER.

BEARING on the recent inquiry in our columns concerning a pyrometer for high temperatures, the following particulars of De Saintignon's differential pyrometer will prove interesting. They are taken from the Excerpt Minutes of the Proceedings of the British Institution of Civil Engineers, and were originally given in *Le Génie Civil.*

The pyrometer in question determines the temperature of a furnace by exhibiting the rise in temperature of a constant stream of water made to circulate through a copper pipe inserted in the furnace. It consists briefly of a short copper pipe called the "explorer," which is inserted into the furnace, and into which a stream of water descends from a reservoir through an india rubber pipe, passing on its way through a filter. From the explorer the water is taken off by another india rubber pipe to a small glass stand-pipe, from which it is discharged by a cock. The object of the stand-pipe is to enable a constant flow to be maintained by adjusting the cock so as to keep the water-level in the stand-pipe constant. The stand-pipe is graduated so that instead of altering the cock the level may, if preferred, be read off and the proper corrections made. Before and after entering the explorer the water passes around thermometers. If the zero of the second thermometer is made to coincide with the reading of the first, then the desired temperature of the furnace can be read off directly, for with a constant flow of water the rise in temperature for the same instrument is proportional to the difference of temperature of the furnace and of the water, and one experiment will suffice to determine the scale for the second thermometer. To avoid the influence of the furnace walls the explorer should be inserted through an "isolator," which is a tuyère supplied from the same reservoir as the pyrometer.

The pyrometer may also, by means of a thermo-pile, be made to transmit its indication by electricity to a distance, and exhibit them on a graduated galvanometer.

Novelties.

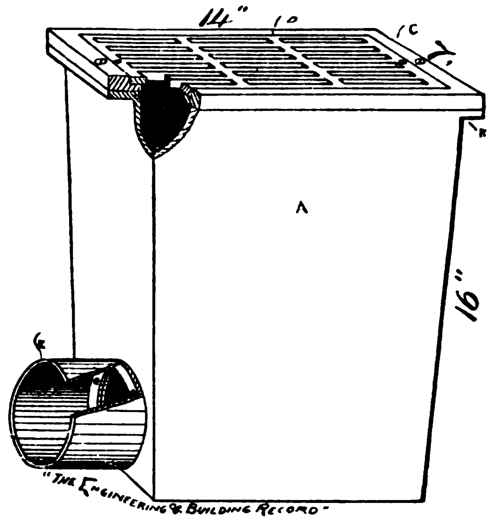
Devices are described under this head purely and strictly as news; because believed to be new and calculated to interest readers.

In no case is pay accepted, directly or indirectly, for publishing a novelty notice.

As the subjects are selected for their supposed novelty and interest merely, it will, of course, be understood that the selection does not imply indorsement.

A FRESH AIR INLET.

THE sidewalk inlets for fresh air to sewer traps frequently consist of a small brick chamber with an iron grating over it into which the end of the vent pipe is cemented or loosely inserted. The brickwork is likely to be poor and perishable, and almost sure to be injured or destroyed by sidewalk repairs, etc., sooner or later. For greater convenience, tightness and durability than the brick construction usually affords, a cast-iron box A, shown in the accompanying illustration, has been designed, which rests by its flange B in a hole cut through the pavement. The top plate C is cast separate from the box and is galvanized, as is the grating D, which can be easily removed. The flange thimble E is bolted to the box and receives the vent pipe, which is firmly calked in.



FRESH AIR INLET

This box is made by the J. L. Mott Iron Works, 88 Beekman Street, New York, and was first used by Paul S. Bolger, master plumber, Madison Avenue, New York.

STREETER'S PATENT PIPE-LOWERING APPARATUS.

FIGURES 1, 2 and 3 show the apparatus designed by Daniel A. Streeter, Waterbury, Conn., as an improvement on his methods of pipe laying that have been described in this journal on pages 262 and 273, Vol. XX. Figure 1 is a general view of the apparatus in position ready to begin moving and lowering the pipe; Fig. 2 is a cross section of the trench with the pipe sustained over it ready to be lowered, and Fig. 3 is an elevation from Z Z, Fig. 2, of the latch detail. The main beams C C are adjustable on standards A A, and each carries a sliding frame F composed of two iron straps *a* and *b*. These beams C C are placed across the trench as shown, and frames F are set just beyond the center of the trench and support the ends of the short skids E and E. The ropes M M are fast at one end to frames F and F, are led through snatch blocks under beams C C, and have the other end free. The ends of the pipe D are slipped into the bights V V, and, when the free ends of the ropes are hauled in, the bights shorten and roll the pipe up on the skids E, as shown in Fig. 2. If the latch rope L be now pulled it will trip the catch K and, releasing the cross-piece G, allow the skid E to drop or be removed while the pipe remains suspended in the bight of the rope L, by which it can easily be lowered by slacking off the free end.

MEASURES for smoke prevention are just now attracting a good deal of attention in Germany also. The united architects' and engineers' societies have taken the matter under consideration. In Saxony a government appropriation of $1,700 has been made for practical tests of smoke preventing apparatus.

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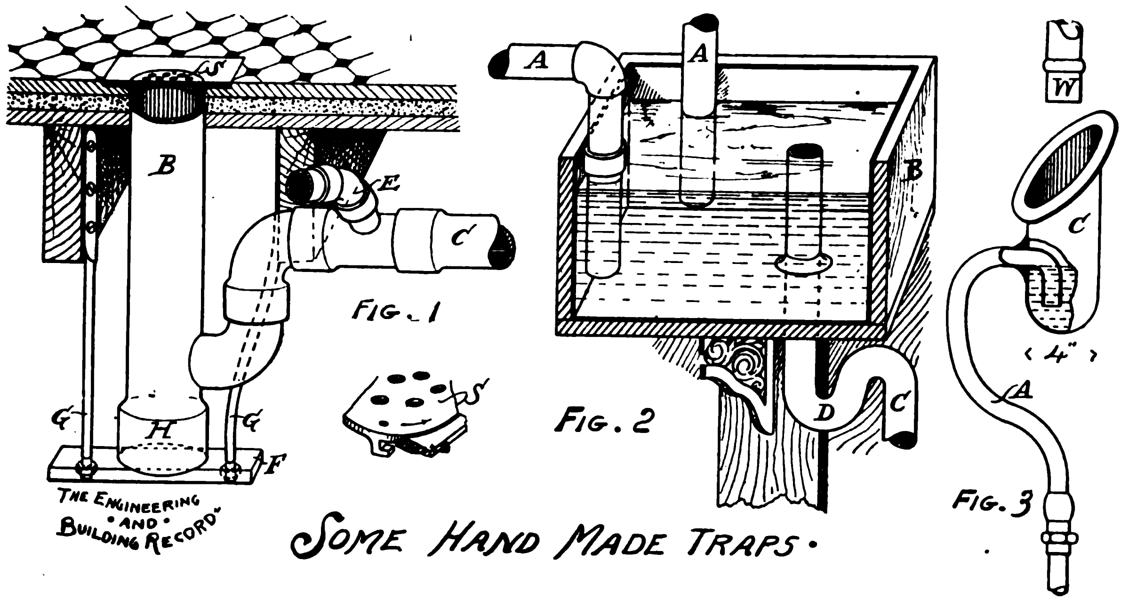
* Tables in engineering hand-books will give the temperatures for certain degrees of compression. They may be calculated, if desired, by different formulæ.

DOMESTIC PLUMBING HEATING LIGHTING & VENTILATION ENGINEERING

• SOME HAND-MADE TRAPS.

ILLUSTRATIONS of simple traps made by hand from the commonest materials, and adapted for special requirements, may give some hints to plumbers who are accustomed to find almost every fitting ready-made and catalogued, or may suggest devices for isolated places where special fittings are hard to get.*

Figure 1 shows a trap made to receive the floor drainage from a saloon. The 5-inch strainer plate S is daily removed, and cigar stumps and other rubbish swept into the trap, which therefore needs special provision for cleaning and for free discharge. This was secured by using a 6-inch Y bend B 22 inches long for the barrel. The 4-inch waste pipe C was calked to the elbow D, and had calked joints for the tee and ⅛-inch bend connection with the 2-inch vent pipe E. The lower end of the bend B had a calked stopper, and was supported from the floor joist by the 4 by ¼-inch iron plate F and ½-inch gas pipes G G. This trap had a very deep seal, and below its outlet a space at H to hold the sediment and heavy rubbish which could be readily removed when the strainer plate was taken off.



SOME HAND MADE TRAPS.

Figure 2 shows the double trap protecting the refrigerator drips A A in the same building. These drips discharge into a small copper lined box B fastened to the cellar wall. This box is emptied through a pipe C to the sewer. Sewer gas is trapped at D, while the pipes A A discharge below water level so that their ends are sealed against an upward current that would permit the circulation of cellar air in the refrigerator.

Figure 3 shows a drip cup on the basement wall of a down town office building. W is a waste pipe from a toilet-room floor safe, and A is the discharge to the sewer. The cup C is made of 4-inch lead pipe, flanged out at the top and closed at the bottom. The outlet is placed so as to discharge the water without taking either sediment or floating scum, both of which can be conveniently removed through the open top.

The above described articles were made by Colin Campbell, 158 East Forty-fifth Street, New York City.

HEATING AND VENTILATING SCHOOL-HOUSES.

SEVERAL months ago a series of papers describing some of the prevailing methods of heating and ventilating school-houses was presented to the Boston Society of Civil Engineers by William E. McClintock, Theo. P. Perkins, and Prof. S. H. Woodbridge. The papers are given in full in a recent issue of the *Journal* of the Association of Engineering Societies, from which the extracts given below have been made. Mr. McClintock, among other things, says:

"The normal amount of carbonic acid in the air is from three to five parts to the 10,000, while an addition of two to four parts makes a perceptibly bad impression. While we may not arrive at perfection in this matter, we can approach to a point that may be said to be safe. On authority of such able men as Dr. Parks, of London, and Surgeon Billings, of our own country, the general practice of to-day is to call ten parts of carbonic to the 10,000 the maximum allowable amount in a room where many persons are assembled together. The air as it is exhaled from the lungs leaves the mouth at a temperature of about 100 degrees; and although the carbonic acid in the exhaled air is great, yet the loss in density caused by the increase in temperature is sufficiently great to cause the air to rise toward the top of the room, where it rapidly mixes with the other air, gradually lowering the standard of the whole room.

"This carbonic acid gas has at times been a stumbling block to many, and has, in the past, given rise to a theory that the only way to ventilate a room was to furnish openings at the floor and allow the heavy gas to flow off like water. Although such a condition might exist in a room very near air-tight and with a temperature unchangeable, yet where the temperature is at all changeable the different gases must mix thoroughly. It strikes me that the problem sought is rather one of how much of the bad can we take mixed with the good and how shall we introduce the good and get rid of the bad. I find, after wading through long arguments, where all the conditions are considered, that if we can get from 25 to 30 cubic feet per minute per scholar we are getting very good results, and we can keep the carbonic acid to the required ten parts in 10,000.

"It is the purpose of my paper to rather give some of the methods of heating and ventilating to be found at the present time than to theorize. I shall first refer to a church which has a seating capacity of 750 and an air space of about 150 cubic feet per person when full. There is a round ventilator in the center of the ceiling connected by a box with a brick tower having a window on each of its four sides. The box has a cross section of 3¼ square feet, and with the ordinary velocity of, say 3 feet per second, would allow about 35,700 cubic feet per hour to pass off. This amount, with the air space above referred to in the room, would seem to give very fair results; but on several occasions that I looked at the outlet box I found the damper in it closed. I at last succeeded in inducing the sexton to keep this damper open, but even then the results did not change. I then went to the tower and found that the large windows before referred to were entirely boarded up on the inside, leaving no chance for air to pass either in or out. By removing the boards from these windows we now have a fair flow of air. I find on an examination that most of our churches have this method of ventilation, which must be very extravagant, to say the least, as the heat passes from the registers in the floor directly up and through the roof, to the extent of the capacity of the outlet box. In addition to the extravagant feature of this method as to fuel, there is the worse feature of leaving all the corners with but very little pure, or even warm, air in them.

"I call to my mind some school-houses that I have looked over. A brick building having 12 rooms was actually planned to have two 20-inch flues for ventilation, having a 15-inch iron smoke-pipe passing up the center to give the needed power or draught. Each room was to be connected into the common flue, with no means of preventing the air from passing from one floor to another. The heat was to be direct steam. To get any decent change of air would require a velocity in the flues of about 50 miles per hour, even provided there was any air in the rooms to take out. After long discussions this plan was so changed by the committee having charge as to give good-sized flues from the rooms, while fresh air was taken direct from outside and passed over steam radiators located in the room to be heated. I am unable to give any figures at this school, but do not think they would be wholly satisfactory.

"A wooden four room building I examined had 8x12 brick flues for the lower floors, while the upper floors used the unfinished breasts beside the chimney for ventilators. On closer examination the breasts were found to end in the attic with no openings from attic to outer air. In these cases the air flowed through the registers at a velocity of about two feet per second, which, taken with the size of the flues, would give only 5 or 6 cubic feet per minute per scholar.

"A two-story four-room brick building seemed to have small registers into brick flues 8x12 inches, two rooms using a common flue. The air here was simply unbearable, and an inspection in the attic showed that the brick flues were built on the same principle as a cannon—viz., with hole at one end only. A two-story wooden building of two rooms had a very small flue and a still smaller register. The theory in all the older types of buildings seemed to be to get a register at any cost, and never mind the flue.

"I shall now have a word to say of some of our more modern buildings—buildings that have very pleasant exteriors as well as interiors, buildings that have been planned by so-called architects who should never have been permitted to foist such abortions on a long-suffering public. A fourteen-room brick building, with hall, was heated by hot-air furnaces, with no extracting flue worth mentioning. Much fault was found with this building by the parents on account of headaches and other ailments among the children attending the school.

"A two-story four-room building of wood, as originally planned by the architect, showed a 10-inch square wooden flue that could not be built on account of the valley rafters; and even if it could have been built it was to end in the open attic without openings of any kind to the outer air. The changes in original plan delivered the four flues from the rooms into a cupola with no more than one-half the sums of the four sections. This building was heated by direct steam by the use of lines of pipes around three sides of the rooms.

"A building of exactly the same plan as the last was planned to be heated by hot-air furnaces, with plaster-finished extracting flues ending in a close attic, which later on were carried into a cupola. Direct steam was put in instead of hot air.

"An eight-room two-story wooden building, located in a beautiful spot, with cheerful and finely finished and furnished rooms, was heated by the same lines of steam pipes on the three sides of each room. The ventilation is by tin pipes in each of the outer corners of the building and registers at the top and bottom of each room. The lower rooms have 8-inch pipes extending to the attic floor. The upper rooms have 12-inch pipes starting at the second floor and placed outside the smaller pipes. The outer pipes from one-half of the building join into a pipe of the same size (12-inch) and end in a brick flue having a 12-inch glazed pipe passing through the center for a smoke-pipe. The required velocity of the air in this 12-inch pipe, as it enters the brick flue to change the air of its part of the building in, say, 20 minutes, is 45 feet per second. The required velocity in same pipe to ventilate but *one* room is a little more than 10 feet per second. The actual observed velocity in the pipe was from 2 to 3 feet per second.

"A four-room two-story wooden building has the same line of steam pipes on three sides of the rooms. The ventilation in this building is by 12-inch tin pipe from each room, the same entering a common brick flue 3 feet by 2 feet in the attic and having a glazed smoke-pipe passing through the flue. The main defect here is the entire lack of any means of admitting fresh air.

"A twelve-room two-story building, heated by hot-air furnaces, had no extracting flues except some old and disused chimney flues about 8x10 inches with registers near the top of the rooms. The basement of this building was partitioned off into a series of rooms, and a large quantity of rotten wood added its smells to the water-closet tanks to sweep through the whole building.

"I could easily cite many other cases equally bad as the ones already referred to, many of which will probably continue to exist until some power other than the local boards order the changes made. There is no doubt but that heating and ventilating must go hand-in-hand; they cannot be separated; and no great improvement can be made unless one conforms to the other.

"*First.*—We cannot introduce fresh air in any quantities into a room without first removing an equal quantity of the air already in the room.

"*Second.*—We cannot take air out of a room unless we introduce an equal volume.

"*Third.*—We cannot keep the air of a room good unless we introduce enough fresh air to mix with the air already in to thoroughly dilute the same and keep it to a certain standard.

"*Fourth.*—In the introduction of fresh air we must avoid cold draughts, which means the introduction of large quantities of air at about the required temperature and through a flue of sufficient section to give a low velocity.

"*Fifth.*—The warm-air inlet and cooled outlet must have such relation to each other as to compel the air to thoroughly mix and intermingle in all parts of the room with but slight variations in temperature."

(TO BE CONTINUED.)

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* Original and ingenious little details of handwork are alway interesting to the mechanic and designer, and this journal would be glad to receive such pencil sketches and descriptions from journeymen readers for publication in this column, as specimens of handwork.

STEAM-HEATING IN THE MECHANICS' BANK BUILDING, NEW YORK.

PART I.—ARRANGEMENT OF EXHAUST MAINS, BOILER-FERD HEATER AND WARMING FRESH-AIR BLAST.

THIS building* is heated throughout by direct radiators, supplied mainly from the exhaust steam from the various pumping, elevator and dynamo engines.

The board room and bank offices or the first and second floors are supplied in winter with warm air, besides their radiators.

Figure 1 shows the general arrangement ot steam-pipes in the engine-room. Exhaust steam from all the engines is collected in the main A, whose branch B connects with the Berryman feed-water heater Z, and whose branch C connects with exhaust main D, which terminates at one end in the smoke-stack, and at the other in the distribution main F that supplies all the radiators. A branch, not shown here, from F to the boiler, is controlled by a valve *t*, and can supply live steam to any part of the system.

Ordinarily, the heater Z and all the radiators are supplied by the exhaust steam, and the back-pressure valve *e* is set at ten pounds, valves *b*, *f* and *g* are open, and valve *c* is closed, then steam passes through heater Z and into main F, any pressure above ten pounds escaping direct to stack through valve *e*; if the exhaust pressure falls below ten pounds, the regulating valve *t* opens and admits live steam until the pressure reaches ten pounds. Closing valves *b* and *g*, and opening *c* cuts out heater Z, and supplies steam to the radiators only; closing *f* and *c* and leaving *b* and *g* open, cuts off the radiators (as in very warm weather), and supplies the heater only, and closing *b*, *g* and *f*, and opening *c* and *e*, cuts out both heater and radiators, and discharges exhaust directly into the stack. The heater receives cold water through pipe Y, and delivers hot water to the boilers through pipe X. *q* is a safety valve, *a* a hand-hole, and U a steam trap.

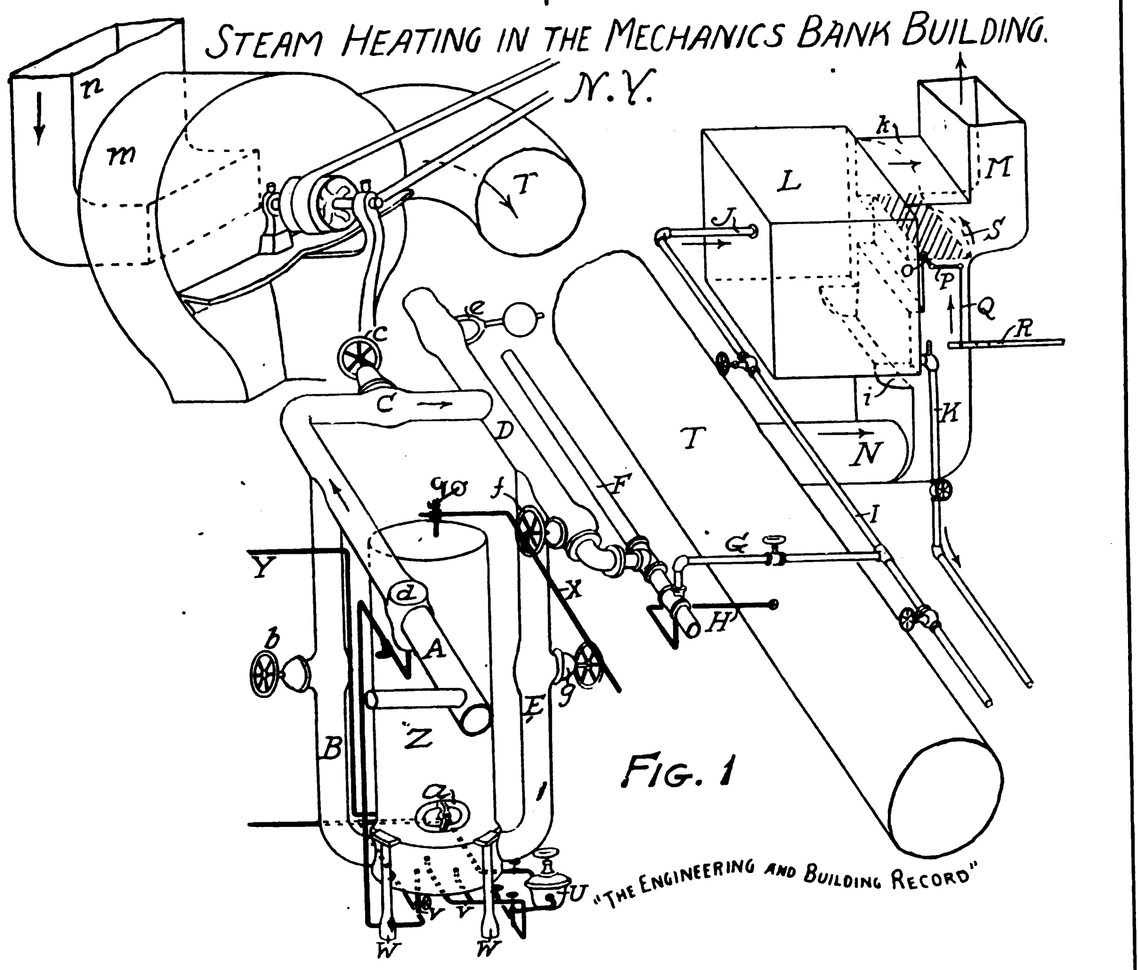
Fig. 1
STEAM HEATING IN THE MECHANICS BANK BUILDING. N.Y.
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W
"THE ENGINEERING AND BUILDING RECORD"

V V are drip and sediment pipes, and W W are the legs supporting the heater. *d* is a grease trap. *m* is an 80-inch Sturtevant blower which receives air from above the roof through the galvanized iron conduit *n* and delivers it at a pressure of about one ounce through conduit T and branches N N, etc., to the board rooms and bank offices on the first and second floors. There are several branches N, each of which opens freely at *i* into a box L which contains a steam radiator that takes steam through J and discharges it through K.

Box L communicates at *k* with the conduit M to the room which constantly receives the fresh-air blast, whose temperature is regulated by the damper S, that is automatically controlled by a thermostat and electric pneumatic valves, to be described hereafter. The blast from N always enters freely into box L; if the damper S is down, as shown, the blast passes out of box L (where it has been warmed) through *k* to conduit M; if S be turned straight up it closes branch *k*, and though the blast can enter L it cannot escape, and so passes outside of it, from N to M, and is delivered cold; if S is partly raised the hot and cold air is mixed, and different temperatures may be secured in M. H is a relief pipe.

Figure 2 is a section through the Berryman heater, to show its connections more clearly. *o o* is asbestos jacketing.

The figures are not drawn to scale, being intended only to illustrate the system. Pipes A B C D and E, Fig. 1, look disproportionately large on account of being shown jacketed, while the others are not covered.

(TO BE CONTINUED.)

STEADY progress is being made in the raising of the tracks of the Pennsylvania Railroad above the street level, at Jersey City, N. J.

Notes and Queries

on Domestic Engineering.

Communications relating to the practical details of plumbing, heating, lighting and ventilation will be welcomed in this column. The writer's true name and address must always be given, but an assumed name may be used for publication if preferred.

WHEN IS IT ECONOMICAL TO USE EXHAUST STEAM FOR HEATING?

J. H. B., Beckleysville, Md., writes: "Have just been reading Baldwin's work, "Steam Heating for Buildings," and find it interesting reading, though not giving much relative to exhaust steam for boiling purposes. This, however, may not be relative to the subject, and if not objectionable to you may I ask the following of your paper: I have been somewhat puzzled as to using exhaust steam for boiling stock in our paper mill in open tubs, and wish to know,

(1) If all exhaust would be necessary to maintain circulation, would it be cheaper than using live steam?

(2) Would it be cheaper if a condenser were used on the engine and live steam used for heating?

(3) Could exhaust be used economically in a rotary boiler?

(4) In mill are two tubs about 8 feet diameter and about 9 feet high, nearly two-thirds filled with cold water. In center of movable bottom was an upright trough covered on top but perforated near top with large openings and smaller ones below water level. Water was forced up by the exhaust steam and out over contents of tub and thus a circulation and distribution of hot water was maintained. Check valve prevented water going back to engine cylinder. Have been using, however, only plain slide valve engine."

[(1) If you can do your work with the exhaust steam, it is nearly always cheaper to do so than to take live steam directly from the boiler. A pound weight of exhaust steam has practically the same heating value as a pound weight of live steam. The only case in which it can be cheaper to use live steam is when the quantity of exhaust steam required is very small, for instance, to warm a small radiator in an office, or a glue kettle, or some such trifling apparatus, it would be foolish to throw two pounds back-pressure on a large engine, say 100 horse-power, when the two pounds back-pressure would be equivalent to the loss of about four horse-power in the engine. When the steam required for heating exceeds the four horse-power, however, from this point on the economy of using the exhaust steam becomes greater and greater.

(2) The reply to your second question is somewhat similar to your first one. If you use a condenser you will make the average engine from one-fifth to one-third more powerful, according to the point of cut-off and the mean-pressure of steam in the cylinder. So that assuming your engine to be 100 horse-power (non-condensing), you may make it develop 125 horse-power by the condenser, or, you may get 100 horse-power out of it for eight-tenths of the steam you formerly used, and assuming the latter to be the fact you will save 20 horse-power by the condenser, and should the amount of steam required for heating be considerably less than 20 horse-power, why then, use a condenser and use live steam for heating. If, however, it is greater than 20 horse-power, from that point onward it would be as foolish to run your exhaust steam into the atmosphere, when you require it for heating air or warming water, as it would be to throw your fuel in the river.

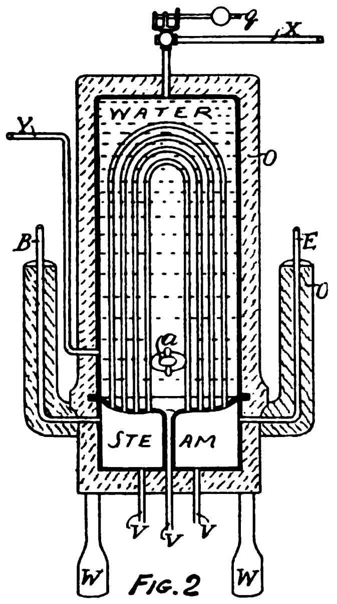
Fig. 2

(3) Exhaust steam can be used in a rotary rag boiler if the temperature is sufficiently high to disintegrate the rags. There is no other objection.

(4) We would arrange the connections from engine to tubs in such a manner that the condensation would not flow back on engine, by carrying the pipe first upwards and then down to the tubs. We would also use a back-pressure valve on the roof connection, so the excess of exhaust steam would pass off by that direction.]

TRADE PUBLICATIONS.

SEWER VENTILATION.

ARCHIBALD FORD, Assoc. M. Inst. C. E., and E. G. Wright, Portsmouth, England, have sent out a pamphlet, entitled "Sewer Ventilation," in which they illustrate and describe their patent ventilating sewer and drain pipe, and system of sewer and drain ventilation. The nature of the invention is presented in an interesting manner and the advantages claimed for it are pointed out.

THE work of laying the cable for the Broadway Railroad will be commenced at an early date. Plans and specifications have been filed.

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* A general description of the building was given on page 11.

CONTRACTING NEWS DEPARTMENT.

A WEEKLY RECORD

OF SPECIAL INTEREST TO CONTRACTORS, BUILDERS AND MANUFACTURERS OF ENGINEERING AND BUILDING SUPPLIES.

ARCHITECTURAL COMPETITIONS.

VALPARAISO, IND.—The German Lutheran congregation will erect a church at a cost of $10,000. Plans have not been made. Architects may address Claus Specht, as above, for particulars.

CONTRACTING INTELLIGENCE

Our readers will oblige us by notes, clippings, or any information which will put us in the way of obtaining early and reliable news for our "Contracting Intelligence." *Information of importance sent to us exclusively, and not elsewhere published will be liberally paid for.*

For works for which proposals are requested see also the "Proposal Columns," pages i-ii-142.

WATER.

For Additional Water Items see Proposal Column

ALGONA, IOWA.—City Clerk W B Quarton writes: "The city is now sinking a well for water supply, and as soon as completed will then need the other necessary things to complete the system, such as water mains, pumping machinery, etc. We will then issue bonds for $10,000 and negotiate the same. The city has no other indebtedness and therefore bonds will be first-class."

HOQUIAM, WASH. — John Richardson, Chairman of the Committee on Fire and Water, writes: "We contemplate putting in a water-works plant, but as yet have not got plans and specifications. Making a rough estimate, we think it will cost something like $30,000 or $40,000. If the town puts them in we shall have to issue bonds for the payment by three-fifths vote of the voting population."

ALEXANDRIA, LA.—The Town Clerk at this place writes: "An ordinance was passed July 11, 1890, granting a franchise to Henry Sour & Co., of Shrevesport, La., for the purpose of constructing, maintaining and operating a system of water-works and a system of sanitary and domestic sewerage for the term of 30 years."

BANGOR, ME.—The Eastport Water Company will largely increase the water supply at their reservoir. Work will be commenced at once.

VENICE, ILL.—The water mains at this place are to be extended. The Village Clerk can furnish details.

NEVARRE, O.—There is a movement at this place favoring establishing a system of water-works.

CENTRALIA, ILL.—The City Clerk at this place writes: "The proposition of submitting to the vote of the people the question of granting a franchise to erect a system of water-works in this city was voted down at the last meeting of the Council. There is some talk of the city erecting a system of its own, but no steps in that direction have yet been taken."

RUTLAND, VT.—Town Clerk C. B. Mann writes: "We have bought four acres more land and will enlarge the water storage soon, cannot state how soon."

RICH HILL, MO.—The Rich Hill Water, Light and Fuel Company will establish a water-works system at this place.

FROST, TEX.—The people of this place will soon establish a system of water-works. For further particulars address J. H. Galbreath, as above.

CINCINNATI, O.—The B. P. I. have given Superintendent Sharp of the water-works instructions to prepare plans and specifications and estimate of cost for four new pumps of ten million gallons capacity each. Proposals will be asked for as soon as the plans are finished.

FULTON, KY.—This town has voted to bond itself in $25,000, to build water-works.

CANTON, DAK.—It is reported that the people of this place have voted to establish a system of water-works.

WELLSTON, O.—This place has issued and disposed of bonds for the purpose of establishing a system of water-works.

NORTH BROOKFIELD, MASS.—The water-works system at this place is to be improved.

NEENAH, WIS.—It is probable that the water-works system projected for this place will be established at an early day.

GRAND RAPIDS, MICH.—It is probable that the projected improvements to the water-works system at this place will be made very soon, as the City Attorney now has the matter in hand.

WEBSTER, MASS.—The people of this place want water-works, and a system to cost about $75,000 is talked of.

SEATTLE, WASH.—The report of Consulting Engineer B. Williams, regarding the distribution system, has been adopted and the City Clerk has been directed to advertise for proposals for furnishing the following materials: Cast-iron pipe—8,000 lineal feet 30-inch pipe, 5,600 lineal feet 24-inch, 13,800 lineal feet 20-inch, 2,700 lineal feet 16-inch, 5,900 lineal feet 12-inch, 9,700 lineal feet 10-inch, 24,000 lineal feet 8-inch and 60,000 lineal feet 6-inch. Wrought-iron pipe—12,000 lineal feet 12-inch pipe, 6,000 lineal feet 8-inch, 4,000 lineal feet 6-inch; 300 fire hydrants, valve and valve boxes. About 170 tons of special castings will also be required.

ASHLAND, KY.—M. M. Tidd, C. E., of Boston, Mass., has been consulted in the matter of building a new system of water-works for this place.

HAMPTON, IOWA.—Regarding the contemplated water-works at this place, Recorder Charles Kray writes: "No action will be taken by the City Council until the question where to get the water is settled. When that is determined, and the city is ready to issue its bonds and let the contract, I shall write you."

SOUTH ORANGE, N. J.—Reports say that the authorities of South Orange have contracted for a supply of drinking water with the Commonwealth Water Company. The daily supply is to be 50,000 gallons.

WATER-WORKS.—See our Proposal Columns for information regarding water-works and water-works furnishings at the following place: Goshen, Ind.

THE Editor of THE ENGINEERING AND BUILDING RECORD is always glad to receive items of news for the Contracting News Department. But such items are not considered news except when the prices and particulars of the award of a contract are given.

The announcement that ——— has sold ——— to ——— without giving the *prices* and particulars concerns only the buyer and seller. Such notices are always excluded, except in the case where a certain firm is stated to have taken a certain contract, the execution of which would require that they should buy certain materials. Such an item would be used if deemed of more than local interest, because it would suggest to some readers the possibility of their making a sale or securing a sub-contract.

SEWERAGE.

For Additional Sewerage Items see Proposal Columns

RICHMOND, VA.—The city will probably issue $75,000 of bonds for the construction of sewers.

NORTH BALTIMORE, O.—Two miles of pipe sewers are to be laid here soon. Address John P. Force, engineer in charge of the work.

GENEVA, N. Y.—The Geneva *Advertiser* is advocating the need of a thorough system of drainage and sewage.

GLOVERSVILLE, N. Y.—The following bids for the construction of certain sewers were received by F. E. Abbott, City Engineer, July 21: McDonald & Skinner, Little Falls, N. Y., $6,230.30; Frank Dwyer, Gloversville, N. Y., $6,732.35; Van Vranken & Duell, Schenectady, N. Y., $7,488.20; Salmon & Gray, Albany, N. Y., $7,778.65; Bennett & Doll, Utica, N. Y., $8,019.85; S. C Ferguson, Gloversville, N. Y., $8,128.55; A. P. Bovier & Beardsley, Elmira, N. Y., $8,162.15, John C. Miller, Amsterdam, N. Y., $8,210.00; M. J. McCann, Albany, N. Y., $8,755 00; Adam Miller, Saratoga, N. Y., $8,810.80; Troy Public Works, Troy, N. Y., $9,307.00; George W: Barlow, Seneca Falls, N. Y., $9,670.90; Wm. Huggett, Gloversville, N. Y., $3,407.47.

BOSTON, MASS.—The following proposals for the improved sewers, Section 3, outfall sewer, Squantum to Moon Island, were opened July 24:

BIDDERS.	ITEMS AND ESTIMATED QUANTITIES:										Total.
	a Earth Excavation and Refilling in Trench. 2,100 lin. ft.		*b* Brick Masonry in American Cement. 1,475 cub. yds.		*c* Brick Masonry in Portland Cement. 550 cub. yds.		*d* Concrete Masonry. 8,450 cub. yds.		*e* Dimension Stone Masonry. 2 cubic yards.		
H. P. Nawn, Boston	$10 86	22,806.00	$12.80	18,880 00	$14.00	7,700.00	$4.40	37,180.00	$20.00	40.00	$86,606.00
National Construction Co., Boston	10.20	21,420.00	12.80	18,880.00	14.85	8,167.50	4.65	39,292.50	45.00	90.00	87,850.00
Thomas A. Rowe, Newton	8.17	17,157.00	13.80	20,355.00	16.10	8,855.00	5.18	43,771.00	40.00	80.00	90,218.00
Aaron A. Hall, Boston	10.80	22,680.00	12.00	17,700.00	13.12	7,216.00	5.04	42,588.00	60.00	120.00	90,304.00
Perkins & White, Boston	13.00	27,300.00	11.80	17,405.00	14 00	7,700.00	5.00	42,250.00	35.00	70.00	94,725.00
James Killen & Neil McBride, Boston	11.00	23,100.00	13.00	19,175.00	14.50	7,975.00	6.00	50,700.00	25 00	50.00	101,000.00
Collins & Ham, Boston	13 00	27,300.00	12.60	18,585.00	15.00	8,250.00	5.75	48,587.50	50.00	100.00	102,822.50

Awarded to H. P. Nawn.

LEXINGTON, KY.—Our correspondent here writes: "This city wants plans for a complete system of sewers, pipe system." Address W. J. Hulihan, as above.

FAR ROCKAWAY, L. I.—Investigations are being made regarding the adoption of a system of sewerage for this place. President Jones, of the Sewer Commissioners, can furnish particulars.

KANSAS CITY, KAN.—The Kansas City *Times* of July 26, prints the following: "Alderman Kimball's plan to bond the city for $1.500,000 to pay for constructing within the present city limits a sewerage system commensurate with the pressing needs of the rapidly growing city for properly constructed sewers, is bearing fruit. He has not as yet formulated all the details of the plan and it is yet in embryo, but notwithstanding this, the Board of Public Works is at present discussing the sewerage question on the line of the plan proposed by Alderman Kimball, and it is probable that steps looking to the formulating of even more extensive plans will be taken by the Board in the near future."

SEWERS.—See our Proposals Columns for information regarding sewer construction at the following places: La Salle, Ill ; Poughkeepsie, N. Y.; New York City ; Tiffin, O.; Rogers Park, Ill.; Boston, Mass.; Greensboro, N. C.; Key West, Fla.; Para, Brazil; Galion, O.

BRIDGES AND IRON STRUCTURES.

For Additional Bridge Items see Proposal Columns.

FOREST CITY, PA.—There is some talk of erecting a bridge over the river at this place.

SOUTH ST. LOUIS, MO.—A pontoon bridge is proposed for South St. Louis, across the Mississippi, to cost $170,000, and have a draw 500 feet long.

ZANESVILLE, O.—T. C. Connar, County Surveyor, writes: "I have prepared plans for a bridge to be erected over the Muskingum River, at the north end of Fifth Street, this city, the cost of which will be from $104,000 to $108,000."

LEAVENWORTH, KAN.—The Leavenworth and Platte Bridge Company will substitute a pivot draw bridge over the Mississippi River in place of the pontoon bridge at this point.

EUREKA, CAL.—The following bids for bridge over Eel River at Alder Point were received by O. D. Stern, Clerk Board of Supervisors, July 15: San Francisco Bridge Company, San Francisco, combination, capacity 800 pounds, $31,780; California Bridge Company, San Francisco, combination, capacity 800 pounds, $35,900; Bay City Iron Works, San Francisco, combination deck, capacity 800 pounds, $37,610; Pacific Bridge Company, San Francisco, combination, capacity 800 pounds, $35,800; Randall, Hunt & Co., San Francisco, combination, capacity 800 pounds, $38,993; American Bridge and Building Company, San Francisco, combination, capacity 800 pounds, $33,600; Pittsburg Bridge Company, Indianapolis, wrought-iron bridge, capacity, 500 pounds, $28,780, superstructure only. Contract awarded to San Francisco Bridge Company at above figure. Bridge to be completed December 1, 1890.

BROWNSVILLE, TEX. — The Continental Bridge Company has been incorporated, with F. C. Roman, President, Enrique Viscaya, of Mexico, Vice-President, and J. A. Brown, Secretary, to build a railroad and wagon bridge across the Rio Grande River to Mexico. The capital stock is $1,000,000.

OTTAWA, ONT.—The New York *Star* of July 31 prints the following: "It is reported that the rival promoters of the Ottawa, Morrisburg and New York Railroad, and the Ottawa, Waddington and New York Railroad, have arrived at an agreement to combine their forces on the scheme to build a bridge across the St. Lawrence. The first-named company is willing to co-operate with any company to build the southern half of the proposed bridge and the line to Albany to give the required New York connection, and it is believed the latter company will agree to this plan."

COLUMBUS, O.—The third lot of bids for the superstructure of iron work on the proposed Rich Street bridge has been considered by the County Commissioners, and the contract awarded to the Columbus Bridge Company at $27,853. The Columbus Bridge Company was also awarded the contract for the iron work on the Fishinger Mill bridge and the Mound Street superstructure work at their bid, respectively, of $14,850 and $22,000.

JERSEY CITY, N. J.—The Delaware, Lackawanna and Western Railroad Company has decided to rebuild its long bridge over the Delaware River two miles below Portland. It will be a steel structure carrying two tracks. Work is to begin immediately, and it is expected that the new structure will cost about $300,000.

NASHVILLE, TENN.—The Nashville, Chattanoogo and St. Louis has submitted a proposition to the Charlotte Turnpike Company, looking to the construction of an iron bridge over the Nashville, Chattanooga and St. Louis tracks at the Charlotte crossing.

WHEELING, W. VA.—The following proposals for building the 158-foot span stone arch foot-bridge, over Wheeling Creek, at Main Street, have been received by the sub-committee of the City Council: Page, Carey & Co., New York City, $109,583.50; Hallock Bros., Rootstown, O., $107,985.47; S. Harrold & Campbell, Beaver Falls, Pa., $112,185.75; B. B. Harris, Greensburg, Ind., $127,802.75; J. LeDuke & Co., Berea, O., $132,274.10; Jutte, Stratton & Foley, Pittsburg, Pa., $139,941.02; Jolly Bros., Pittsburg, Pa., $144,299.50. The contract was awarded to Page, Carey & Co. Two of the bids were irregular, and were not considered. The bid of Hallock Bros. was withdrawn by the firm before the work was let.

Elmira, N. Y.—The Lake Street bridge in this city is to undergo extensive improvements. Alderman Cotton can furnish information.

New London, Conn.—Extensive improvements are to be made to the Niantic draw bridge.

Bridges.—See our Proposal Columns for information regarding bridge construction at the following places: Roanoke, Va.; Easley, S. C.; Toledo, Wash.; Montgomery, Ala.; Beeville, Tex.

NEW DEPOTS.

Brooklyn, N. Y.—Reports say that a mammoth railroad depot is to be built at Sixty-fifth Street; and that the New York and Sea Beach Railroad is behind the project. The Brooklyn and Brighton Beach and the Brooklyn and West End roads are, it is said, also interested in the plan, which contemplates a union depot.

Philadelphia, Pa.—Plans are being prepared by Wilson Brothers & Co., architects, for a large freight station at Camden for the Reading Railroad. The new station will be equipped with extensive sheds, platforms, and siding for 100 cars. A float ship wharf and transfer bridge will be built and a coal yard established.

STREET-WORK AND PAVING.

Buffalo, N. Y.—Paving contracts aggregating over $400,000 have been awarded to the Barber Asphalt Company, by the Common Council of this city.

St. Louis, Mo.—The Board of Public Improvements will soon decide on a date for awarding the contract to put down granitoid sidewalks on Pine Street; estimated cost, $8,000.

Flushing, L. I.—Thomas F. Tuohy & Co., of this place, were the lowest bidders for the contract for rebuilding the North Hempstead turnpike, their figure being $62,500. Thomas Willetts, of Roslyn, was the only other bidder and offered to do the work for $67,000, but since the bids were opened he withdrew his offer. The Town Board of North Hempstead will meet this week to award the contract.

Lexington, Ky.—All the principal streets of this city are to be paved with brick. Estimates are wanted for doing the work.

North Baltimore, O.—A small lot of macadamizing and curbing will shortly be done here. Address John P. Force, engineer in charge.

GAS AND ELECTRIC-LIGHTING.

Slatington, Pa.—This place is about to abandon the incandescent and substitute the arc lights for street illumination.

Lawrence, Mass.—The Committee on the Streets, of the Board of Aldermen, met recently to consider proposals for street lighting. Two bids were submitted, both of which were accepted, that of the Lawrence Gas Co., to furnish 70 or more 2,000 candle-power arc lights at $100 each per year, and of the Edison Illuminating Co., for 500 or more 20 candle-power incandescent lights at $1.00 each per night, to burn until midnight, and at least 150 of these to burn all night, at $3.04 each. A proposition by the former company to furnish 90 or more 1,200 candle-power lights of the divided arc system, at $85 per year, was not acted upon.

Hulings, W. Va.—It is probable that the Hulings Lumber Co. will establish an electric lighting plant at this place.

Laurel, Md.—This place is to have electric lights. Address John Chollar for particulars.

Beatrice, Neb.—The Beatrice Gas Company will soon want proposals for laying two miles of additional gas pipes.

San Francisco, Cal.—In this city bids for street lighting for the years 1891 and 1892 have been received as follows: San Francisco Gas Company, for lighting each gas lamp per night, 55 cents. California Electric Light Company, for each 16,000 candle-power mast, $4.40 per night; for each 2,000 candle-power lamp per night, 55 cents. The bids have been placed in the hands of the Lighting Committee.

Tecumseh, Mich.—The people of this place will have an electric lighting plant at a cost of $50,000.

Newark, N. J.—About four miles of additional gas mains will be laid at this place.

Oil City, Pa.—By authority of the City Council the Comptroller will soon advertise for bids for lighting this city with electric light for ten years, the plant to have a capacity of not less than 100 arc lights of 2,000 candle-power, and 1,000 incandescent lights at 16 candle-power each.

Batesville, Ark.—For important information regarding a projected electric lighting plant for this place, address J. W. Hamilton, as above.

Dawson, Ga.—It is probable that immediate steps will be taken towards establishing an electric lighting plant at this place.

Lansing, Mich.—The National Fuel Gas Company has been incorporated here with a capital stock of $500,000.

Birmingham, Ala. — The Birmingham Fuel, Gas and Heating Company has been incorporated here with a capital stock of $250,000. The incorporators are Lewis M. Parsons, J. M. Crowder, and others.

Tremont, Pa.—This place is to have an electric light plant.

Clinton, Mass.—Improvements are soon to be made to the plant of the Clinton Gas Light Company.

Dallas, Tex.—The Dallas Electric Company has been incorporated at this place, and will establish a lighting plant at an estimated cost of $300,000. Address J. P. Smith, as above.

Port Angeles, Wash.—An electric light company has been incorporated at this place and a plant is to be established at once; estimated expenditure, $20,000.

Fresno, Cal.—The officials of this place have granted a franchise to Robert Barton to erect and maintain for fifty years an electric light plant. Operations will begin at once.

Logan, Utah.—This place is to have electric lights.

Fort Worth, Tex.—The Citizens' Electric Light and Power Company has been incorporated here, with a capital stock of $20,000. Incorporators, Henry Wells, Harris Schulze and others.

Cleveland, Tenn.—Reports say that W. S. Beckner, of this place, desires to purchase an electric light plant.

Selma, Ala.—An incandescent electric lighting plant will be established at this place by the Selma Gas and Electric Light Company.

Electric Railways.—New electric railways will be established and improvements will be made to those already built at the following places: Little Rock, Ark.; Belleville, Ill.; Springfield, Mo.; Boston, Mass.; Oakland, Cal.; Tacoma, Wash.; Puyallup, Wash.; San Bernardino, Cal.; Colton, Cal.; Bellingham Bay, Wash.; Grand Rapids, Mich.; Rockland, Me.

The Contracting News Department of **THE ENGINEERING AND BUILDING RECORD** is edited with a view of giving space to no item that does not indicate where professional services or supplies may be needed in the near future, the prices bid for work or supplies, and the correction of false or misleading reports in some papers, that may subject readers to needless trouble and expense in going after something that does not exist.

BIDS OPENED.

Dallas, Tex.—Robert L. Jones, of this city, has been awarded the contract, at $276,967, for the construction of the new Court House. Red sandstone from Pecos, and white limestone from Honey Grove, all Texas material, will be used.

New York City.—At the meeting of the Dock Board July 31, the contract for supplying 15,000 cubic yards of cobblestones and 20,000 cubic yards of common stone for filling in bulkheads was awarded to Andrew A. Bowker, of New York City, his bids being 97 cents per cubic yard for the cobble and 67 cents for the common stone.

GOVERNMENT WORK.

Washington, D. C.—The following proposals for the work specified, were opened on the given dates by the Supervising Architect of the Treasury Department:

Pittsburg, Pa.—Iron stairways and iron work of interior finish for the United States Court House and Post Office at this place. Advertisement of June 28. Bidders: The Champion Iron Co., $31,880; Hough, Ketcham & Co., Iron Works, $56,222.39; The Samuel J. Creswell Iron Works, $60,994; Tacony Iron and Metal Co., $61,500; Poulson & Eger, $63,923; McHose & Lyon Co., $63,986; Fred J. Meyers M'f'g Co., $80,900; The Snead & Co., Iron Works, $81,868; L. M. Morris, $86,662.

Bedford, Mass.—General and trench excavation for the United States Post-Office building at this place, opened July 29. Advertisement of July 7. Bidders: Brownell & Markland, $1,705.20; Charles J. Place, $2,500.

Pittsburg, Pa.—Plumbing and gas piping for the United States Court House and Post-Office at this place, opened July 18. Advertisement of June 27. Bidders: Montgomery & Pattison, $33,500; Standard Plumbing Co., $34,000; Charles H. Humbert, $40,046.74; James Hay, $45,264; I K. Becker, $47,380; John M. Tate, $49,896.86.

INDUSTRIAL.

Geneva, N. Y.—On July 12 the New York Central Iron Works Company completed its organization by the election of the following officers: President, Wm. B. Dunning; Vice-President and Treasurer, O. J. Cammann Rose; Secretary and Manager, Edward H. Squires; Superintendent, Charles H. Huke. Mr. Squires, it will be noticed, retains the place held by him so many years.

Elizabeth, N. J.—The Singer Sewing Machine Company will make numerous improvements to their plant here, including the erection of additional buildings and putting in new machinery.

Long Island City.—At a joint meeting of the Boards of Supervisors of Kings and Queens Counties, held at this place on July 31, a committee was appointed to visit Chicago for the purpose of studying the tunnel under the Chicago River, with a view to the construction of a similar work under Newtown Creek.

PROPOSALS.

(Continued from page ii.)

JULY 26, 1890.

SEALED PROPOSALS WILL BE RECEIVED at the office of the Supervising Architect, Treasury Department, Washington, D. C., until 2 o'clock P. M. on the 19th day of August, 1890, for supplying and delivering at freight depot at place of designation, the Post Office lock boxes, lock drawers, locks, pulls, plates, etc., for U. S. PUBLIC BUILDINGS as may be ordered during the fiscal year ending June 30, 1891. Copies of the specification and any additional information may be had on application at this office. Each bid must be accompanied by a certified check for $100. The Department reserves the right to reject all bids received after the time fixed for opening the same; also, bids which do not comply strictly with all the requirements of this invitation. Proposals must be sealed and indorsed "Proposal for Lock Boxes, Lock Drawers, Lock, Pulls, Plates, etc., for U. S. Post Offices," and addressed to JAS. H. WINDRIM, Supervising Architect. 10

PROPOSALS FOR MILITARY SUPPLIES. Office of the Quartermaster, U. S. Military Academy, West Point, N. Y., July 9, 1890. Sealed proposals, in duplicate, subject to the usual conditions, will be received at this office until 12 o'clock, noon, on the 8th day of August, 1890, for Gas Coal, Anthracite Coal, Hardwood, Charcoal, Building Materials, Paints, Plumbing Materials, Gas and Steam Fittings, Pulleys, Belting, Arch Plates for Steam Boilers, Fire Brick, Fire Clay, Stationery, Printing Materials, Office Furniture, Brooms, Soap, Brushes, Range Parts, and other miscellaneous stores specified on schedules to be had upon application here. Preference will be given to articles of domestic production or manufacture, conditions of quality and price (including in the price of foreign productions or manufactures the duty thereon) being equal. Inclose proposals in envelope marked "Proposals for Military Supplies," and addressed to the undersigned, CHAS. W. WILLIAMS, Captain and A. Q. M., U. S. A. 9

SEWERS, Tiffin, O.—Proposals are wanted until August 16, for constructing about seven miles of sewers. Address P. J. Wilson, of the Street Committee, 126 Washington Street, as above.

STREET WORK, Clifton, O.—Proposals are wanted until August 16, for the improvement of numerous streets. Address S. G. Sterling, Village Clerk, as above.

WELLS, Carthage, O.—Proposals are wanted until August 7, for sinking two wells. Address Harry Simms, Secretary Board of Trustees, as above.

PROPOSALS.

PROPOSALS FOR THE ERECTION OF Buildings.—Office of the Quartermaster, U. S. Military Academy, West Point, N. Y., July 24, 1890.—Sealed proposals, in triplicate, subject to the usual conditions, will be received at this office until 12 o'clock, noon, on the 13th day of August, 1890, for the erection of ten sets of enlisted men's quarters and one Quartermaster's storehouse, as per plans and specifications to be seen at this office. Inclose proposals in envelope marked "Proposals for Erection of Buildings," and addressed to the undersigned, CHAS. W. WILLIAMS, Captain and A. Q. M., U. S. A. 10

JULY 31, 1890.

SEALED PROPOSALS WILL BE RECEIVED at the office of the Supervising Architect, Treasury Department, Washington, D. C., until 2 o'clock P. M., on the 26th day of August, 1890, for all the LABOR AND MATERIALS required for the marble work, etc. for the U. S. Court House and Post Office building at PITTSBURG, PA.,* in accordance with the drawings and specification, copies of which may be had on application at this office or the office of the Superintendent. Each bid must be accompanied by a certified check for $500. The Department will reject all bids received after the time fixed for opening the same; also, bids which do not comply strictly with all the requirements of this invitation. Proposals must be sealed and indorsed, "Proposal for the Marble Work for the U. S. Court House and Post Office building at Pittsburg, Pa.," and addressed to JAS. H. WINDRIM, Supervising Architect. 10

PAVING, Tiffin, O.—Proposals are wanted until September 10, for constructing about half a mile of brick paving. Address P. J. Wilson, of the Street Committee, 126 Washington Street, as above.

LIGHTING, Watkins, N. Y.—Proposals are wanted until August 5, for lighting the streets of this village by electricity. Address the Board of Trustees, as above.

BRIDGE, Easley, S. C.—Proposals are wanted until August 7, for rebuilding the bridge over George's Creek at this place. Address Elias Day, as above.

SEWERS, Greensboro, N. C.—Proposals are wanted until August 21, for constructing a portion of the proposed system of pipe sewers for this place. Address William M. Houston, Chairman Sewer Committee, as above.

FLAGGING, New York City.—Proposals are wanted until August 12, for flagging certain streets. Address the Department of Public Works, as above.

PAVING, Akron, O.—Proposals are wanted until August 23, for constructing one mile of brick paving. Address S. W. Parshall, City Engineer, as above.

BRIDGES, Johnstown, Pa.—Proposals are wanted until August 7, for the construction of four bridges. Address John Downey, City Engineer, as above.

PAVING AND SEWERS, Dennison, O.—Proposals are wanted, no date specified, for doing certain paving and constructing certain sewers. Address the City Clerk, as above.

BRIDGE, Beeville, Tex.—Proposals are wanted until August 22, for the construction of an iron bridge over the Medio River. Address the Town Clerk, as above.

STEAM HEATING, Toronto, Canada.—Proposals are wanted until August 6, for the steam heating and fire engines, pumps, tanks and piping in connection with the water supply for the Upper Canada College buildings. Address Stuckland & Symons, 18 Toronto Street, as above.

Building Intelligence.

We solicit from each and every one of our readers information relating to projected buildings in their locality, and should be glad to receive newspaper clippings and other items of interest.

ABBREVIATIONS.—*b s*, brown stone; *br*, brick; *br st*, brick store; *b s dwell*, brown-stone dwelling; *apart house*, apartment-house; *ten*, tenement; *e*, each; *o*, owner; *a*, architect; *b*, builder; *fr*, frame.

NEW YORK.

216–18 Mott st, br stable; cost, $7,500; lessee, H Hermann; a, Kurtzer & Rohl.

21st st, s s, 250.8 w 9th av, two br dormitories; cost, $18,000 each; o, General Theological Seminary; a, C C Haight; m, Andrus & Son; c, D Hepburn.

304 w 29th st, br and s flat; cost, $18,000; lessee, R Beggs; a, J W Coles.

90th st, s s, 200 e 2d av, four s flats; cost, $18,000 each; o, King & Higgins; a, Thom & Wilson.

90th st, n s, 125 w 3d av, br flat; cost, $20,000; o, Elizabeth Johnston; a, Ogden & Son.

115th st, n s, 288 e Pleasant av, br factory; cost, $15,500; o, Standard Gas Light Company.

116th st, s s, 160 w Madison av, six br flats; cost, $23,000 each; o, D Lyon; a, R R Davis.

85th st, n s, 105 e 10th av, 16 br and s dwells; cost, $16,000 each; o, D Willis James; a, J G Prague.

BUILDING INTELLIGENCE.

NEW YORK.—Continued.

93d st, s s, 225 e 10th av, 6 stone dwells; cost, $12,000 each; o, a and b, W P Anderson.

9th av, e s, 50 s 75th st, 2 br and s flats; cost, $60,000 all; o, F J Hillenbrand; a, R R Davis; b, Irvine & Co.

127th st, n s, 70 e Park av, 3 br and s flats; cost, $18,000 each; o, F Yost; a, A Spence.

143d st, s s, 175 e Grand Boulevard, 3 br dwells; cost, $7,000 each; o, J M Cahill; a, C M Youngs.

St Nicholas av, bet 169th and 170th sts, br hotel; cost, $15,000; o, M Rock; a, Harding & Goode.

N s 108th st, 115 e First av, iron gas tank; cost, $50,280; o, Standard Gas Light Co.; a, J Flannery.

549 W 156th st, br dwell; cost, $7,000; o, Anna L Outwater; a, W M Grinnell.

N s 118th st, 100 e 8th av, 6 br flats; cost, $120,000 all; o, J S Scott; a, J C Burne.

N s 96th st, 200 w 8th av, 4 br dwells; cost, $100,000 all; o and a, E Kilpatrick.

W s Vanderbilt av, 169 n 176th st, br stable; cost, $7,000; o, C Heylman; a, J J Vreeland.

N w cor Washington and Perry sts, br flats; cost, $50,000; o, W Broadbelt; a, J C Burne.

E s Tellar av, 163d to 164th sts, 17 fr dwells; cost, $59,500 all; o A Doopen; a, A Pfeiffer.

E s St. Ann's av, 25 n 161st st, 4 br tens; cost, $48,000 all; o, J W Decker; a, M J Garvin.

303 E 82d st, br church; cost, $7,500; o, Congregation Alereth Israel; a, Cohen & Rondel.

N s 88th st, 125th w 10th av, br stable; cost, $75,000; o, J McNiece; a, G H Guebel.

10 w 51st st, br dwell; cost, $18,000; o, S H Benedict; a, Carrere & Hastings.

ALTERATIONS—NEW YORK.

7 W 30th st, basement, sub-basement and 1-story extension; cost, $12,000; o, I Walker; a, C J Perry; m and c, Taussig & Co.

20 West 46th st, br dwell; cost, $7,000; o, J A Mitchell; a, Carrere & Hastings.

131 East 16th st, br dwell; cost, $10,000; o, Mary A Buel; a, G M Huss.

43 West 54th st, br dwell; cost, $15,000; o, Chauncy M Depew; a, J E Ware.

N e cor 50th st and Broadway, br stable; cost, $15,000, o, American Horse Exchange; a, D & J Jardine.

97–99 Park av, interior alterations and houses connected; cost, $10,000; o, Chas Parsons; a, E B Wells; b, J B Squier.

23 Pike st, extension, walls altered and new cornice; cost, $25,000; o, L Goodman; a, C Rentz.

BROOKLYN.

S s North 11th st, 75 w Wythe av, fr dwell; cost, $7,000; o, A Huestadt; a, H Vollweiler.

N s Grove st, 225 e Central av, 9 fr dwells; cost, $36,000 all; o, Christina Lohrentz; a, same as above.

E s Howard av, 161 s Herkimer st, 6 fr dwells; cost, $7,200 all; o, S Appett; a, A Hill & Son.

N s Fulton st, 125 w Washington av, 3 br dwells; cost, $30,000 all; o, D H Schult; a, W Thomas.

S s Pulaski st, 475 e Throop av, 6 br dwells; cost, $36,000 all; o, Cora Waldron; a, J E Dwyer.

S s McDonough st, 205 w Tompkins av, br dwell; cost, $35,000; o, C A Betts; a, F B Langston.

S s Vernon av, 33 w Tompkins av, 3 br dwells; cost, $12,000 all; o, Thos Walling; a, same as above.

S s Myrtle st, 250 e Hamburg av, 4 fr dwells; cost, $18,000 all; o, A Annan; a, D Acker & Son.

S s Myrtle st, 200 e Hamburg av, 2 fr dwells; cost, $9,000 all; o, Peter Braun; a, same as above.

E s Bushwick av, 149 s Troutman st, 2 fr dwells; cost, $9,000 all; o, Peter Eisenman; a, B Finkenseiper.

W s Bushwick av, 100 n Franklin Place, br dwell; cost, $20,000; o, Brooklyn Elevated R R Co; a, O F Nicholls.

BUILDING INTELLIGENCE.

BROOKLYN.—Continued.

W s Carroll st, 569 e 8th av, br dwell; cost, $20,000; o, W R Webster; a, N Le Brun & Son.

S s Prospect av, 250 e 7th av, 2 br dwells; cost, $21,000 all; o, A Belitz; a, G R Dietrick.

N s St Mark's av, near Kingston st, br dwell; cost, $12,500; o, N Toerge; a, P J Lauritzen.

189–91 Montague st, br office bldg; cost, $250,000; o, Brooklyn Real Estate Exchange; a, G H Edbrook.

516–18 Washington av, br dwell; cost, $10,000; o, M Lang; a, J G Glover.

S s Putnam av, 295 w Stuyvestant av, 3 br dwells; cost, $27,000 all; o, E H Bishop; a, J E Dwyer.

W s 6th av, 25 s 20th st, 2 br dwells; cost, 10,000 all; o, Payne & Westover; a, W M Coots.

N e cor McDonough st and Ralph av, br dwell; cost, $16,000; o, J R Pitt; a, A J Warren.

N s Vernon av, 187 e Nostrand av, 2 br dwells; cost, $12,000 all; o and a, J Parkin.

S s McDonough st, 382 e Tompkins av, 3 br dwells; cost, $30,000 all; o, J Fraser; a, not given.

Siegel st, n s, 98.6 w Ewen st, 3 fr tens; cost, about $14,000 all; o, Jules Jollon; a, F J Berlenbach, Jr; b, not selected.

N 8th st, n s, 150 w Havemeyer st, 3 fr (br filled) tens; cost, $20,000 all; o, E Holliday, on premises; a, Henry Vollweiler; b, not selected.

300–02 Jefferson av, 2 br dwells; cost, $10,000 each; o, Arthur G Stone; a, G A Schellinger; b, A G Stone.

264 Penn st, br dwell; cost, $7,000; o and b, G Lehrian's Sons; a, Th Engelhardt.

Vernon av, s s, 100 w Throop av, br dwell; cost, $8,000; o, A Schauf; a, Frank Holmberg; b, not selected.

MISCELLANEOUS.

BOSTON, MASS.—Townsend st, near Humboldt av, fr dwell; cost, $15,000; o, A W Crossley; b, G W Murray & Co.

158 and 160 Columbia st, 2 fr dwells; cost, $12,000; o, A G Pray et al; a and b, John Bass.

Rear 13 Prospect st, 2 fr dwells; cost, $9,000; o and b, William Sullivan; a, C A Halstrom.

Bower st, near D st, 3 fr dwells; cost, $13,000; o, a and b, Thomas Howard.

22 and 24 Bower st, 2 fr dwells; cost, $10,000, o and b, Henry J Wright: a, A S Drisko.

Florence st, near Hawthorn st: fr additions; cost, $8,000; o, City of Boston; a; City Architect; b, Hersey Bros.

Ashmont st, near Ocean st, 2 fr dwells; cost, $8,000; o, Chas N Mellen; a and b, H H De Lorie.

CAIRO, ILL.—J S Jenkins, architect and superintendent, will make plans for brick store building to cost about $10,000, for Harry W Schuh, druggist. He will also make plans for a residence to cost $5,000 adjoining, to be heated by hot water and have all the latest sanitary improvements.

J S Jenkins, the Cairo architect, has completed plans for remodeling the residence of E E Ellis, proprietor of the *Daily Telegram*.

The same architect will also very probably make plans for a school-house at Bardwell, Ky.

CHARLESTON, S. C.—Cor King and Calhoun sts, 3-story, br and galvanized iron; cost, $40,000; o, Mr Marks; a, plans drawn in New York; b, T D Murphy.

CHICAGO, ILL.—Michigan av and Park pl, hotel; a, Burnham & Root.

237–39 N State st, br store and flats; cost, $55,000; o, Louis Biegler; a, Jud H Huber; b, W Walk.

283–91 W Congress st, br bakery and stable; cost, $17,000; o, Moody & Walter; a, Thal & Lang; b, Geo Lehman & Sons Co.

783 Maplewood av, fr church; cost, $10,000; o, Maplewood Avenue M E Church.

Belmont pl, near lake shore, br and stone dwell; cost, $12,000; o, Ed E Gray; a, Maber & Corwin.

BUILDING INTELLIGENCE.

CHICAGO, ILL.—531 W Monroe st, 3-story parsonage; o, Third Unitarian Church; a, W A Arnold.

Rush st, 4-story stone barn in rear; cost, $12,000; o, R H McCormick; a, C J Warren.

Cor Oshkosh st and Center av, br school house of St Vincent's Church; cost, $40,000; o, R C Archbishop of Chicago; a, A Druiding.

Berkley av, near 44th st, fr dwells; cost, $50,000; a, M L Swift.

Hyde Park av, fr dwell; cost, $10,000; o, David Quigg; a, M L Beers.

Drexel boul, cor 47th st, stone dwell; cost, $50,000, o, Albert Wisner; a, L G Hallberg.

Drexel boul, rear of same, stone barn; cost, $4,000; o and a, same as above.

Morgan and 57th, br cottages; cost, $10,000; o, E L Kendall.

Harbor and 92d, planing mill; cost, $14,000; o, A R Beck; a, T Deithalen; b, Jno Lauretzen.

Calumet River and 95th, casting house, boiler house, etc; cost, $100,000; o, Iroquois Furnace Co.

4413 Drexel boul, br dwell; cost, $20,000, o, Mrs L Day; a, H H Evans; b, A Meagner.

748–56 W Chicago av, 4-story stores and flats; cost, $35,000; o, F J Dewes; a, Bettinghofer & Herman; b, Earnshaw & Son.

174–76 S State, br addn; cost, $10,000; o, Victor Faldenar.

108 Wells, br store and flats; cost, $9,000; o, Wm Stark; a, Koster; b, Kramer.

428 N Robey, br flats; cost, $8,000; o, Chas Kraatz; a, H Kley; b, H Riefer.

379 Ashland av, br dwell; cost, $12,000; o, C K Offield; a, Jno Warner; b, A Bewolt.

156 Center, br store and flats; cost, $12,000; o, Pat O'Connell; a, A Warner; b, C J Westphal.

698–700 N Hoyne, br dwell and barn; cost, $14,000; o, A Borgmier; a, Hy Kley; b, H Hesse.

3610–16 Ellis av, br dwell; cost, $10,000; o, Mary A Walker; a, Palton & Fisher; b, J Boydell & Son.

3464 Halsted, br store and flats, cost, $9,000; o, Richd Healey; a, L H Heinz; b, M McCarthy.

294–96 Center av, br flats; cost, $10,000; o and b, C E Carson; a, W G Barfield.

2934 Michigan av, br dwell; cost, $33,000; o, Emma B Corneau; a, L B Dixon; b, E Sturtevant.

2911–49 Butler, 13 br flats; cost, $25,000; o, Turner & Bond.

2914 Butler, br flats; cost, $12,000; o, same as above.

815 W Madison, br store and flats; cost, $15,000; o, B Murciel; a, W T Lesher.

3401 Michigan av, br dwell; cost, $50,000; o, Horace G Chase; a, Edbrooke & Burnham; b, Jos Sherwin.

109 Hammond, br dwell; cost, $8,000; o, F H Prince; a, Holabud & Roche; b, A Meagher.

303 W Indiana, br addn, cost, $8,000; o, L Nelson; a, Jno T Long; b, A Nelson & Son.

225–27 W Erie, br flats; cost, $18,000; o, Halvor Hanson; a, Lutken & Thieslen.

191 Townsend, br flats; cost, $18,000; o, Walfred T Ekland; a, Jno Otto; b, Jno Mountain.

Chalmers pl nr Halsted; br dwell; cost, $30,000; o, McCormick Presbyterian Theological Seminary; a, A M F Colton.

Cor Michigan av and 21st, 10-story hotel; cost, perhaps, $1,000,000; o, N K Fairbanks.

Cor Michigan av and Van Buren, apartment house revamped from the Beaurivage flats; o, L G McCormick.

Irving Park boul, stone church; cost, some $60,000; o, Presbyterian Church.

Irving Park av, stone club house; cost, some $200,000; o, Club.

181 bldgs costing less than $7,000 each.

DUNMORE, PA.—A $28,000 school building will be erected here. Address J A Duckworth, as above.

BUILDING INTELLIGENCE.

DENVER, COL.—Broadway, bet 17th and 18th, interior finish in theater; cost, $90,000; o, W H Bush; a, L M Wood.

Ashland av bet Mary and Burt, br block; cost, $30,000; o, Wheeler & Brown; b, as above.

Penn av bet 18th and 19th, d'ble br dwell; cost, $7,000; o, I F O'Brien; a, Jas Murdock.

Cor 23d and Logan avs, s and br church; cost, $40,000; o, Swedish church; a, Barressen Bros.

Penn. av bet 7th and 8th avs, br terrace; cost, $36,000; o, Sam McClair; a, Huddart & Jocobsin.

Logan av bet 10th and 11th, stone dwell; cost, $30,000; o, A C Dake; a, Varian & Sterner.

Grant av cor 18th, stone dwell; cost, $30,000; o, S L Holzman; a, as above.

Penn. av bet 14th and 15th, stone terrace; cost, $70,000; o, C H Smith; a, as above.

15th cor Chestnut; br factory; cost, $8,000; o, John Winch; a, W G Riddock.

Franklin bet 38th and 39th, br terrace; cost, $7,600; o and a, Wm Noltie.

Gray bet Beagle and Fay, br dwell; cost, $7,000; o, J C Marshall; a, W S Campbell.

Montclair, br dwell; cost, $10,000; o, Mrs Pells; a, Varian & Sterner.

DETROIT, MICH.—N e cor 2d av and Ledyard st, s church; cost, $25,000; o, Central Church of Christ; a, Malcomson & Higginbotham; b, not let.

S e cor Randolph and Larned sts, 6-story br hotel; cost, $25,000; o, Capt S B Grummond; a and b, same as above.

S w cor St Aubin av and Canfield av, 3-story br parochial res; cost, $8,000; o, St Albertus R C Society; a, Peter Dederichs, Jr; b, not let.

N w Buchanan st and Wesson av, br church and rectory; cost, $19,000; o, St Francis R C Society; a, H Engelbert; b, not let.

187 Elizabeth st East, 3-story br asylum, cost, $12,000; o, House of Providence; a, G W Lloyd; b, A Chapoton, Jr.

492–98 Baker st, block 4 2-story br stores; cost, $16,000; o, J F Weber & Co, a and b, same as above.

GENEVA, ILL.—3-story br and st court house and jail; cost, $50,000; o, Kane County; a, F E Edbrooke & Co, Denver, Col; b, not let.

GRAND RAPIDS, MICH.—College av, nr Cherry, fire br, s and fr res; cost, $25,000; o, Mrs W S Hull, a, Mason & Rice, of Detroit; b, Campball & McNabb.

HOLYOKE, MASS.—Main st, 5-story 16 ten br block; cost, $36,000; o, A E Crosby; b, T St Martin & Son.

MERIDEN, CONN.—Center st, br factory bldg; cost, $7,700; o, The E Miller Co; a, H M Jones; b, not let.

MARSEILLES, ILL.—Two school buildings will be erected here at a cost of $20,000. Address A Smith, architect, as above.

MILWAUKEE, WIS.—Ogden & Astor sts, dwell; cost, $7,000; o, Ed Barber; a, Ferry & Clos; b, M Neff.

Lake av and Wyoming st, dwell; cost, $7,000; o, Albert Cunningham; a, James Douglas; b, T Prepenhager.

Mitchell st and 4th av, school-house; cost, $8,666; o, St Anthony Cong'n; a, H Messmer; b, Bentley & Strachota.

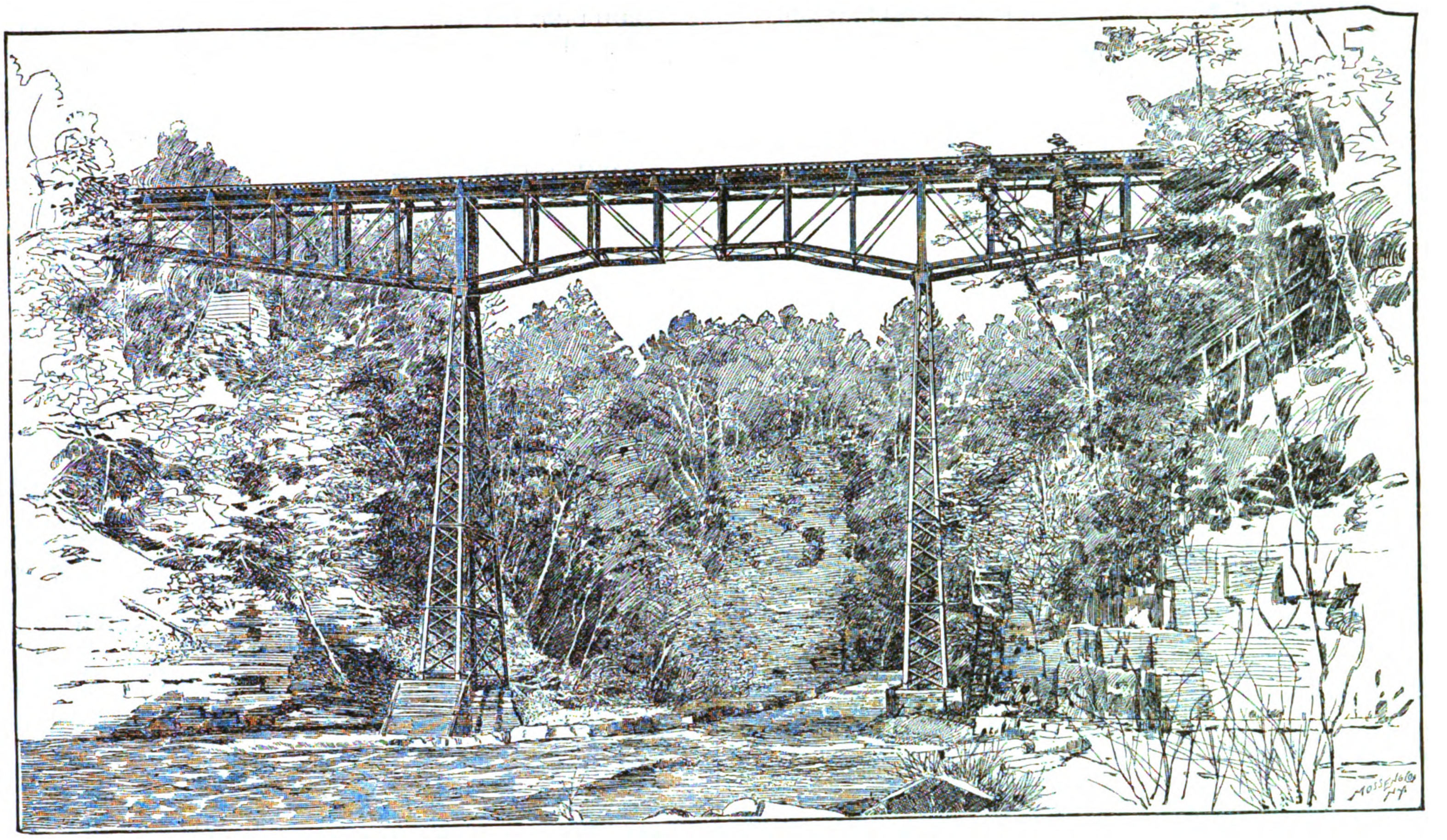
Greenfield av, convent; cost, $21,000; o, St. Vincent Society; a, E J Mit & Co; b, H Schlingsted.

MINNEAPOLIS, MINN.—Long & Keeys, architects, are making plans for an immense warehouse for storage purposes, to cost, it is said, $500,000. The parties interested are located in Chicago.

The recently burned Security warehouse will be rebuilt, at a cost of $50,000.

The permit for the new Y M C A bldg has been issued. The cost is $137,000. It will be of brick and stone, 5 stories high.

MADISON, WIS.—Alterations in the Brown block on S Pickney st, to cost $15,000, have been planned by Conover & Porter.



CANTILEVER BRIDGE,

DESIGNED AND BUILT BY

THE BERLIN IRON BRIDGE CO., EAST BERLIN, CONN.

FOR THE K. & A. C. R. R. CO., AT KEESEVILLE, N. Y.

BUILDING INTELLIGENCE.

PROVIDENCE, R. I.—Stinson av, fr dwell; o, R A Robertson, Jr; a, W E Chamberlain.

Westminster st, br and s banking bldg; cost, $100,000; o, R I Hospital Trust Co; a, R W Gilson; b, Darling Bros.

Alumni av, fr dwell; cost, 8,000; o, Thomas Chase; b, H W Goff.

PORTLAND, ORE.—Van Brunt & Howe, of Kansas City, have drawn plans for a union depot to be built at this place by the Northern Pacific Terminal Co. It will cost $1,000,000.

ST. PAUL, MINN.—Lee st, near Warsaw st, 2-story fr dwell; cost, $7,000; o, John Bergstrom.

E Congress st, near Ada st, 2-story br dwell; cost, $25,000; o, Peter Rothauser.

E 6th st, near Sibley, 2-story br store; cost, $8,000; o, L E Reed.

Victoria st, near Goodrich st, 2-story br and stone block; cost, $60,000; o, G H Schickler.

Work will soon be commenced on the wing to the new City Hospital. It will cost $50,000.

The Town and County Club will build a club house at the corner of Marshall av and Summit av boul, at a cost of $22,000.

ST. LOUIS, MO.—Pine st and Grand av, br hall; cost, $10,000; o, Marquette Club; b, Bryan Brady.

14th st and Sullivan av. br church; cost, $15,000; o, Salem Reformed Church; b. E Wind & Co.

Lafayette and Ohio avs, br store and dwell; cost, $9,600; o, W F Gebhardt; b, Chas Busch.

S w cor 9th and Angebrodt sts, br stable; cost, $7,000; o, H Gerke; b, Wm Kerksick.

15th and Locust sts, br store, cost, $23,000; o, L C Nelson; b, Cook & Casey.

DeKalb and Arsenal sts, br cooperage; cost, $9,700; o, Anheuser-Busch Brewing Association; b, Wm Reiwe & Son.

BUILDING INTELLIGENCE.

SAN ANTONIO, TEX.—Navarro st, office bldg; cost, $50,000; o, Alamo Fire Insurance Co; a, J R Gordon; b, not let.

SHEBOYGAN, MICH.—2-story br veneered school-house; cost, $8,000; o, Board of Education; a, F W Hollister; b, A B Troup.

WORCESTER, MASS. — Belmont st, fr church; cost, $7,000; o, Armenian Society; a, S C Earle; b, A E Bigelow.

Wachusett st, fr house; cost, $7.000; o, F E Williamson; a, Barker & Nourse; b, not let.

Water st, br factory; cost, $20,000; o, W H Hill; a, Fuller & Delano; b, A M Kelley.

Tainter st, br factory; cost, $15,000; o, S Forehand; a, E Boyden & Son; b, not let.

S Worcester st, fr dwell; cost, $7,000; o, A Thomas; a, J B Woodworth; b, F H Holland.

WALTHAM, MASS.—Prospect st, n w cor Highland st, 2-story br bus block; cost, $12,000; o, C H Bill; a, Samuel Patch; b, not let.

W s Moody st, nr Crescent, 3-story br block; plans not completed, but cellar commenced; o, Handy & Lincoln; a, O C Shepherd; b, not let.

Elm st, alterations on interior of theater; cost, $5,300; o, W D Bradstreet, manager; a, H W Hartwell.

WILKES BARRE, PA.—S Franklin sts, br dwell; cost, $8,000; o, Harry Stoddart; a, Kipp & Podmore; b, W H Pethica.

S Franklin st, br dwell; cost, $7,500; o, Wm Stoddart; a and b, as above.

BUILDINGS.—There is nothing over $7,000 in value to report at the following: Geneva, N. Y.; Harrisburg, Pa.; Little Rock, Ark.; Ogdensburg, N. Y.; Lancaster, Pa.; Columbus, O.; Reading, Pa.; Springfield, Mass.; Canton, O.; Baltimore, Md.; Pottsville, Pa.; Saginaw, Mich.; Fitchburg, Pa.; York, Pa.; Dayton, O.; Oil City, Pa.; Springfield, O.; Zanesville, O.; Findlay, O.; Topeka, Kan.; Akron, O.

Some Details of Water-Works Construction.

By W. R. BILLINGS, Superintendent of Water-Works at Taunton, Mass.

WITH ILLUSTRATIONS FROM SKETCHES BY THE AUTHOR.

INTRODUCTORY NOTE.

Some questions addressed to the Editor of *The Engineering and Building Record and The Sanitary Engineer* by persons in the employ of new water-works indicated that a short series of practical articles on the Details of Constructing a Water-Works Plant would be of value; and, at the suggestion of the Editor, the preparation of these papers was undertaken for the columns of that journal. The task has been an easy and agreeable one, and now, in a more convenient form than is afforded by the columns of the paper, these notes of actual experience are offered to the water-works fraternity, with the belief that they may be of assistance to beginners and of some interest to all.

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CHAPTER IV. — PIPE-LAYING AND JOINT-MAKING—

Laying Cement-Lined Pipe—' Mud" Bell and Spigot—Yarn—Lead—Jointers —Roll—Calking—Strength of Joints—Quantity of Lead.

CHAPTER V.—HYDRANTS, GATES, AND SPECIALS—

CHAPTER VI.—SERVICE-PIPES—

Definition—Materials—Lead vs. Wrought Iron—Tapping Mains for Services—Different Joints — Compression Union — Cup.

CHAPTER VII.—SERVICE-PIPES AND METERS—

Wiped Joints and Cup-Joints—The Lawrence Air-Pump—Wire-drawn Solder—Weight of Lead Service-Pipe—Tapping Wrought-Iron Mains—Service-Boxes—Meters.

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FIREPROOF CONSTRUCTION.

MR. EDWARD ATKINSON's letter on the recent Western Union Building fire, at New York, extracts from which are published elsewhere in this issue, furnishes decidedly instructive reading and deserves every architect's attention. The points to which he refers as being frequently overlooked in the construction of what are called fireproof buildings are well taken, and illustrate, in a striking manner, the strange inconsistencies which every one interested in the subject must have noticed at some time or other. Where buildings are erected with the view to making them as nearly safe as possible from destruction by fire there is frequently no excuse for filling them with a mass of such highly combustible substances as is found in the shape of many decorative materials and articles of furniture. Experience has shown that whatever safety is secured by the main features of construction of such buildings can be completely neutralized by their inflammable contents.

A matter of special interest, to which Mr. Atkinson refers, is the profit to be derived from investigations of the cause and course of every considerable fire as conducted by the Factory Mutual Insurance Companies. Experience, in this as in all other things, teaches valuable lessons, and such investigations, if conducted generally and conscientiously, would do much to advance the science of fireproof building.

STORAGE BATTERY SYSTEMS FOR STREET CAR PROPULSION.

CONSIDERING the lively underground electric wire agitation which has been going on in the City of New York for the last few years, the proposed electric street car systems in Brooklyn, just across the river, cannot fail to attract attention. The overhead wire system is there proposed, and the three railroad companies contemplating it have their plans all made, and are only waiting for official consent to begin work.

However much the displacing of horses for street car propulsion is to be commended, it cannot be maintained that the system which will probably go into effect in Brooklyn is in any sense advisable or an improvement. The dangers of overhead electric wires, carrying high tension electric currents, which must, of necessity, be employed for street car work, have been demonstrated in striking and unfortunate ways on numerous occasions. Only a week or two ago two horses were instantly killed at Boston by coming in contact with a broken guard wire dangling from the overhead structure of an electric car line. The system there is essentially the same as that contemplated in Brooklyn. To avoid dangers such as this there is only one way which would prove practically successful, and that is to prohibit such overhead installations. They are not entitled to a place in any community, least of all in a crowded one, and they have nothing to favorably commend them that cannot be claimed for some other means of propulsion, except possibly cheapness of construction, and consequently profitable working. In this, however, the public has no interest. The street car companies alone reap the benefits.

What is wanted is an efficient and a safe substitute for horse power, and this is not offered by the overhead electric system. Even cable traction is a much more desirable means of locomotion though it, too, is not without objectionable features. The whole solution of the street car problem, as we pointed out on a former occasion, is found in the practical application of a storage battery system. There is, of course, some consideration to be given to the matter of cost. This has always been figured so high as to be fatal to a successful storage battery enterprise, and has almost invariably been brought up as the stumbling block supposed to lie in the way of its realization. The appended figures are, therefore, interesting, being represented as the results of calculation made some time ago for the Fourth Avenue street car line in New York, on which the Julien storage battery is used:

	Electric.	Horse.	Cable.
Cost of cars	1	.54	.81
Cost of motive power	1	1.45	1.06
Construction of roadway	1	.53	2.09
Depreciation and repairs	1	1.47	2.04
Operating expenses	1	3.38	1.71
Total	5	7.37	7.71
Average	1	1.47	1.55

We do not know just how closely these figures correspond with those since found in every-day work. And it is, of course, not to be assumed that each of these items is of equal importance, or, in other words, that each represents 20 per cent. of the total annual expense; but even if an appreciable percentage be added to the given cost of the electric traction, it is probable that there would still be a margin for profit as compared with horse and cable power. In any event, the entire absence of overhead and underground work in the storage battery system is an advantage of great importance. On the Fourth Avenue line in New York, the system has been in use for more than a year, and if success there be attained, as it seems to have been, there is no reason why it should fail on other lines. Judging from present indications the system is the only one which gives reasonable assurance of safety to life and property.

VACUUM STEAM PUMPS.

THE question of economy in the use of steam pumps involves several considerations, such as the particular kind of work to be done, the first cost of the pump, cost of running and maintenance, the length of time for which the pump is to be used, and several others. It is not steam or coal consumption alone that is to be taken as the measure of economy of a pump, but the result of a careful comparison of the relative values of steam and of simplicity of construction, and it thus frequently becomes an interesting problem to determine which of these two values is properly entitled to the greater share of attention. If we take the comparatively simple case of flooded excavations to be pumped dry, the choice of a pump to do the work is easily governed. A cheap pump, even though comparatively wasteful in the use of steam, will generally be selected and will successfully meet the requirements of the service.

It is natural that under these circumstances the different forms of pumps of the vacuum class, such as, for example, the pulsometer, the pulsator, the aqua-thruster, the Simplex pump, and others are coming into more prominence, though the recent advances made in the design and construction of such pumps may be held to partially account for their growing popularity. All these pumps have the obvious advantages of simplicity and low cost. Of course, as compared with some other forms of pumps, their figures for steam consumption are often, in fact, generally, pretty high. Still, the demand for simple pumping machinery, capable of handling large quantities of water will keep them in favor, and as, in the course of time, means will probably be found to make them more economical without sacrificing their simplicity, better performances may be expected.

It has been well suggested that a partial remedy for the great waste of steam in these pumps may be found in the adoption of a lining for their steam and water chambers, to consist of a metal having a comparatively low specific heat, as, for example, lead, or of some good non-conducting substance. Taking, say, lead as the lining material, the following figures, which we find in some miscellaneous data on the subject, show very strikingly what degree of saving may be effected by it. We will assume that the pump chambers are alternately heated and cooled through a range of temperature of 200° Fahr., and also that sufficient time is allowed to elapse between each stroke or discharge for the whole of the metal to pass through this range of temperature. The specific heat of lead may be taken as 0.0314, that of water being 1, while that of iron is about 0.12. These figures represent the respective losses caused by condensation proper to lead and cast iron. For every 314 pounds of steam condensed by the lead, 1,200 pounds will be condensed by the iron, showing that by the use of the former instead of the latter metal about 74 per cent. of the steam wasted could be saved. This is an important item, and it seems strange that builders of this type of pump do not appear to have recognized it as such and, so far as we are aware, have not yet taken it into account. In a great measure this prevailing disregard of economical considerations may be ascribed to the absence of reliable test figures, and experimental investigation of the performances of such pumps may, therefore, be appropriately urged. The information which it would yield might lead to changes in construction from which appreciable benefits could be realized.

WORKING BURMESE OIL WELLS.

DR. NOETLING, of the Indian Geological Survey, in his report on the petroleum deposits of Burmah, gives an interesting description of the native method of digging the wells. As soon as a native has made up his mind where he is going to have a new well, the workmen, usually four in number, begin to dig a square shaft, the sides of which measure between 4 feet and 4 feet 6 inches. Over this pit a cross beam, supported on stanchions at either side, is placed, in the center of which is a small wooden drum, or cylinder, which, with its axis, is made of a single piece of wood, the latter runing on coarse fork-shaped supports. The leather rope used in hauling up the oil passes over the drum, and on it is fastened the workman who is going to be lowered down, as well as the common earthenware pot in which the oil is drawn up. If possible, the well is so placed that the men or women drawing the rope walk down an inclined plane along the slope of a hill. The tools employed in digging are quite primitive, and can only be used in soft strata. Timber is used to support the walls of the shaft, and the latter is lined with wood. This wooden wall has considerable strength, but it has to be carefully watched lest it should give way.

The workmen are lowered in an ingenious way. The man sits on two slings formed of strong rope running between his legs and knotted over his left shoulder. To prevent sliding, a thin rope runs down from the knot, across the breast, underneath the right shoulder to the back, where it is fastened to the rope forming the slings. A second rope for the same purpose is fastened round the hips. On account of the explosive gas filling the shaft no light can be taken down; the workman, therefore, ties up his eyes previously to descending, so as to enable him to see during the short time he is in the well, otherwise it would take him longer to accustom his eyes to the darkness than he is able to stay down, on account of the gas which renders breathing difficult. The data obtained by Dr. Noetling as to the time occupied in the ascent and descent, and the period during which the laborer can remain below, show that not 25 per cent. of the total working time is really spent in extracting the oil. Two hundred and ninety seconds is the longest time any man, however strong, can remain below without becoming unconscious, while in some he can only remain 60 seconds. With increasing depths the difficulties in obtaining the oil after the Burmese methods become insuperable. Hence the limit is 310 feet, and the workers object to more than 250 feet.

The drawing up of the oil is as primitive as everything else. The rope is fastened round the neck of the ball-shaped pot, and, being lowered, is allowed to fill by sinking in the oil below. The oil thus raised is poured into another pot of the same shape, but much larger, and twelve of these are packed on each country cart.

ARCH WORK IN EARTHQUAKE COUNTRIES.

IN a paper entitled "Building in Earthquake Countries," read before the British Institution of Civil Engineers a short time ago, John Milne pointed out that while an ordinary arch is undoubtedly stable for vertically applied forces, it is most unstable for horizontal stresses. Arch work has so often been the cause of ruin, when shaken by an earthquake, that in Italy and Manilla special rules have been drawn up respecting such structures. Thus in Manilla intersecting vaults are not allowed, and ordinary vaults are only permissible when strengthened in a particular manner by iron. In Liguria vaults can only be used in cellars, but even there the rise must be at least one-third of the span. The law of Norcia also only permits the use of arch work in cellars, and the thickness and method of construction is defined. In Ischia arch work with a rise of one-third of the span, and with a thickness of 0.25 meter (0.82 foot) at the crown, may be used, but only in cellars.

Speaking generally, the use of arch work above ground has been prohibited, and if it has existed after an earthquake, all governments who have paid attention to building have ordered its removal. Underground its use is permitted, provided the arches are not too flat. This, however, only indicates that the motion beneath the surface is too small to destroy even a bad form of structure, and therefore such a form, if it be underground, is al-allowable.

There are instances where arch work in Tôkiô has been cracked by exceedingly slight earthquakes. If, for architectural reasons, it is a necessity that arches should exist, they should not be too flat; they should have a specified thickness, be protected by an iron or a wooden beam, and curve into the abutments. The Ligurian regulations provide that above windows there shall be two iron bars.

ON July 26, Judge Blodgett of the Circuit Court of the United States for the Northern District of Illinois, gave judgment in favor of the American Road Machine Company, of Kennett Square, Pa., in the suit brought August 16, 1888, against Goulds & Austin, now F. C. Austin Manufacturing Company, for patent infringement.

ACCORDING to the latest accounts concerning the Cincinnati, O., water-works, the situation is now much brighter than for a month past. Nothing in the way of permanent improvement, however, will be available for about two years, so it is stated. The present temporary arrangement works in a reasonably satisfactory manner.

PUBLICATIONS RECEIVED.

REPORT ON THE OPERATIONS OF THE SANITARY DEPARTMENT OF THE CITY OF GLASGOW, for the year ending December 31, 1889. By Peter Fyfe, Sanitary Inspector; pp. 26.

ORDINANCES OF THE CITY OF LEAVENWORTH, KAN., Relating to the Preservation of the Public Health. Compiled by C. F. W. Dassler, City Attorney, and W. D. Bidwell, M. D., Secretary of the City Board of Health. June, 1890; pp. 20.

SECOND ANNUAL REPORT OF HEALTH DEPARTMENT OF THE CITY OF MANSFIELD, O., for the year commencing March 1, 1889, and ending February 28, 1890; by R. Harvey Reed, M. D., Health Officer; pp. 42.

SEVENTEENTH ANNUAL REPORT OF THE BOARD OF WATER COMMISSIONERS OF THE CITY OF PORT HURON [Mich.]; April 1, 1890; pp. 45.

UNEQUAL TEMPERATURE OF WATER IN A BOILER.

HENRY LEE, in his recent presidential address before the Manchester (England) Steam Users' Association, said:

"It is very generally known that in getting up steam in a boiler the temperature at the top of the water is very much higher than at the bottom, and it was thought that it would be of interest to take a series of observations from various boilers in work to ascertain what the difference in temperature amounted to, and what was the effect of conical water pipes or cross water pipes in promoting circulation and reducing this inequality of temperature.

"For this purpose a series of observations was taken at the mills of Messrs. Richard Haworth & Co., Salford, and Messrs. Sir Elkanah Armitage & Sons, limited, Pendleton, as well as at the works of Messrs. Beyer, Peacock & Co., limited, Gorton, each of whom kindly placed one or more of their boilers at the disposal of the Association for the purpose of the experiments. The report thereon has been drawn up.

"Under these circumstances I will not anticipate the report further than to make the following brief extracts:

"'When the water at the bottom of the boiler was at a temperature of 212 degrees only, the steam at the top of the boiler had risen in three cases to above 70 pounds pressure, and in two cases to above 80 pounds, while in one case as great a difference in temperature was observed as 236 degrees.' The report goes on to show that 'the inequality between the temperature of the water at the top and at the bottom when getting up steam is practically the same whether in a Lancanshire boiler with four cross water pipes in each flue tube, or in a Lancashire boiler without any cross water pipes at all, or in a Galloway boiler with 33 conical water pipes and two pockets, or with 30 conical water pipes and two pockets.' From this the conclusion is drawn 'that neither conical water pipes nor cross water pipes are as efficient in promoting the circulation of the water throughout the boiler as the public has generally supposed.'"

OBITUARY.

WILLIAM H. ADAMS, who many years ago was one of the foremost contractors in New York, and who afterward went to Washington, D. C., died in Elizabeth on the 4th inst., aged 58 years. Mr. Adams contracted malaria in Washington, and his health failing he came back to Elizabeth.

ALEXANDER CAMERON, a prominent architect for the past 30 years, of St. Louis, Mo., died after a brief illness, August 3. He was born in Halifax, Nova Scotia, in 1829, and began the practice of his profession at the age of 21. From 1849 until 1859, he lived in Rhode Island, and became a resident of St. Louis the following year. Among the most important buildings constructed by him was the St. Louis U. S. Custom House.

PERSONAL.

S. C. MACKAYE, Superintendent of Repairs of Water-Works in Rochester, N. Y., has been succeeded by Daniel O'Neil.

LOUIS GRANER has been reappointed City Engineer of Belleville, Ill., having already served the same city 17 years in this capacity.

OTTO WILHELM, architect, of St. Louis, Mo., leaves this week for Monterey, Mexico, to arrange for building a $160,000 stone brewery there for Jacob Schneider, of the same city, who accompanies him.

GEORGE R. BURNETT, C. E., was recently elected President of the Board of Public Improvements, St. Louis, Mo., Colonel Henry Flad, C. E., the former President, having been appointed a member of the Mississippi River Commission.

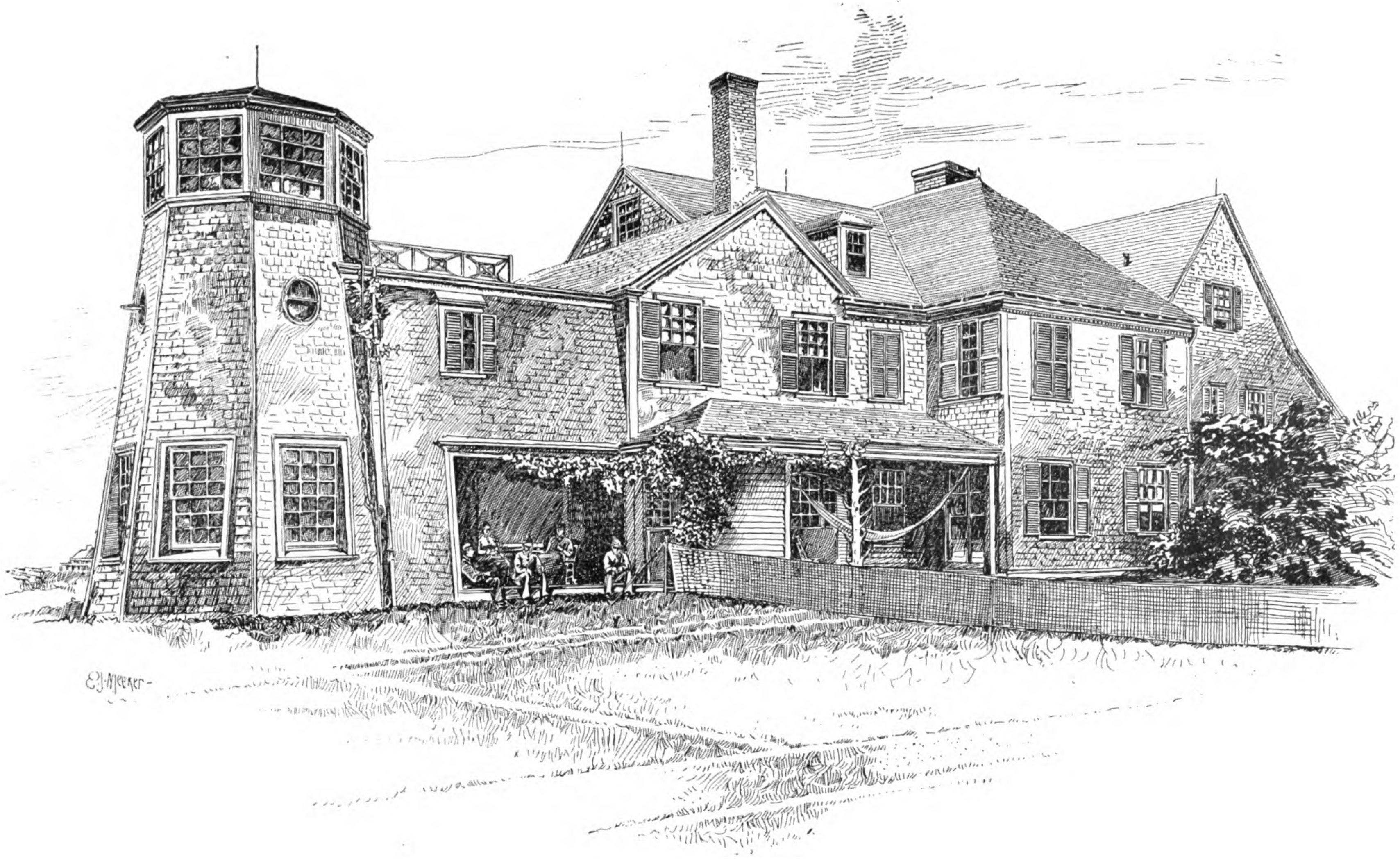
J. NELSON TUBBS, for many years Chief Engineer of the Rochester, N. Y., Water-Works, has resigned that position, and George W. Rafter, Assistant Engineer in charge of additional water supply, has been made Acting Chief Engineer.

THE consulting engineers, F. P. Stearns, of Boston, and Samuel M. Gray, of Providence, have made their report on the plans for the proposed sewerage system for Orange. They approve in the main the plans prepared by Carroll Ph. Bassett, the Engineer for Orange, but make many recommendations which will largely add to the cost of the work.

OUR ARCHITECTURAL ILLUSTRATIONS.

HOUSE AT SWAMPSCOTT, MASS.
ARTHUR LITTLE, ARCHITECT, BOSTON.

HOUSE AT ORANGE, N. J.
E. T. HAPGOOD, ARCHITECT.



THE ENGINEERING AND BUILDING RECORD ILLUSTRATED SERIES.

HOUSE AT SWAMPSCOTT, MASS.

ARTHUR LITTLE, ARCHITECT, BOSTON, MASS.

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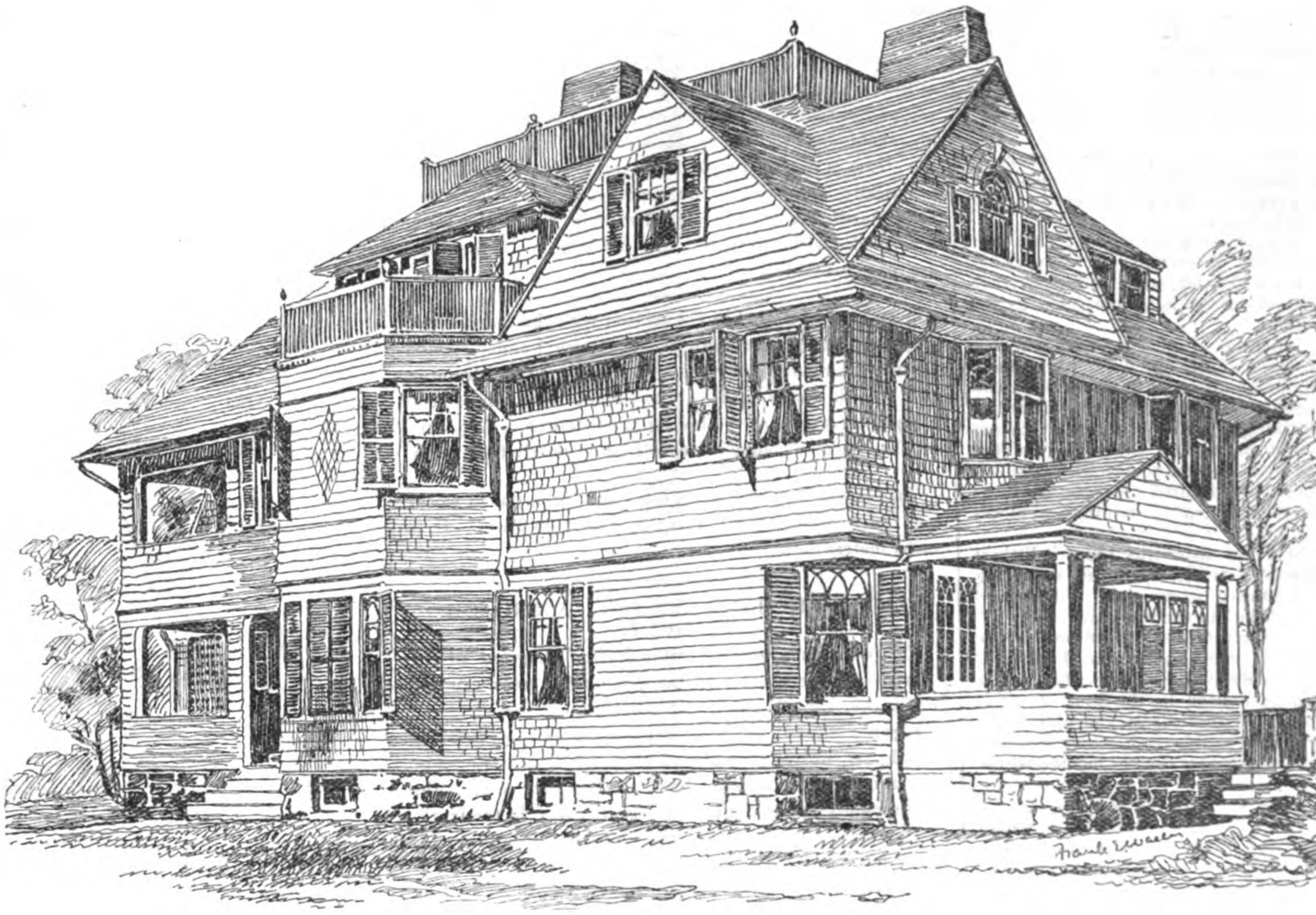
ENGINEERING SOCIETIES.

F. W. CAPPELEN, Secretary and Treasurer of the Engineers' Club of Minneapolis, Minn., writes, under date of July 30, that the old society of Civil Engineers of Minneapolis was disbanded and reorganized May 7, under the above name, with twenty-two charter members. Through the kindness of the Board on Public Library, the club has permission to hold its meetings in the public library. The Librarian of the public library, Mr. Putman, has offered to subscribe for any technical periodical the club may desire, both American and foreign, and will also buy any desirable works on engineering topics the club or individual members may ask for, and put them on file for general use in the library.

The club has had two well attended meetings under the new management. Papers were read on "Ventilation of Public School Buildings" and "Efflorescence on Brick." The club will make some experiments in regard to the two above mentioned subjects, and hopes to be able to publish these papers in an interesting and complete form this fall. At present everything points to a bright active future.

The present officers of the club are: Wm. A. Pike, President; Wm. de la Barre, Vice-President; F. W. Cappelen, Secretary and Treasurer; W. W. Redfield, Librarian; Andrew Rinker, member Board of Managers of Association of Engineering Societies.



HOUSE AT ORANGE, N. J.—E. T. HAPGOOD, ARCHITECT.

SECRETARY BOGART, of the American Society of Civil Engineers, announces the following meetings, papers and discussions: Meeting of September 3.—Paper on "Notes on a Mountain Slide," by William G. Curtis, M. Am. Soc. C. E. Meeting of September 17.—Discussion on paper by W. Barclay Parsons, M. Am. Soc. C. E., on "Railways in Mexico," by Max E. Schmidt, M. Am. Soc. C. E. Discussion on Paper by F. W. Watkins, M. Am. Soc. C. E., on "Tunnel Surveying on Division No. 6, New Croton Aqueduct," by O. F. Nichols, M. Am. Soc. C. E.

SECRETARY HUTTON, of the American Society of Mechanical Engineers, has issued a circular, specially intended for the newly elected members, inviting them to make use of the house and professional library of the society at 12 West Thirty-first Street, New York. The library was inaugurated at the beginning of the Society's existence by a system of exchange of its transactions with the leading journals and with sister societies at home and abroad. Sets of such society transactions and files of the journals, both current and former issues, will be found on its shelves. In addition to this department of the library, in 1884 a fund was started and is still maintained for the formation of a reference library of engineering. This fund has been judiciously expended for the purchase of standard and recent works, and this department is regularly added to both by purchase and by gift from interested members and others.

The society's house, beside a home for its growing library, is intended also to be a professional center for the use of its members while in New York. Private rooms can be put at the service of members for conferences, and drawing-room facilities can be provided if any one should want to use them for a short time.

LETTER FROM ENGLAND.

(Regular Correspondence.)

LONDON, July 25, 1890.

THE Plumbers' Company is to be congratulated on the evidence that it is beginning to feel its footing. The long disuse of its powers and influence had resulted in the said influence becoming an unknown quantity; it was a matter of congratulation, therefore, in 1886 when they, under pressure of certain leading plumbers throughout the kingdom, inaugurated the system of registration. It has previously been urged in the columns of THE ENGINEERING AND BUILDING RECORD that, inasmuch as this registration is optional, there is no power to prevent an unregistered plumber calling himself a registered plumber, and that there is no punishment for scandalous and "botch" plumbing. It is necessary and, indeed, incumbent upon the Plumbers' Company to get legislation enabling them to prevent uncertificated men from calling themselves registered plumbers, and, further, and more particularly, to mete out punishment for scandalous and dangerous work. At a public meeting held in the Town Hall, Kensington, on July 23, when the Hon. and Rev. Car Glyn, the Vicar of the Parish of Kensington, presided, there were present, among others, the Marquis of Lorne, Mr. W. H. Bishop, Master of the Plumbers' Company, Sir Algernon Borthwick, Dr. Farquharson, M. P., Mr. Leng, M. P., and Capt. James, Chairman of the Sanitary Committee of the London County Council. It was moved by Mr. Bishop that the report of the Court of Plumbers should be adopted. This report stated that the Court had been urged to apply for statutory powers to consolidate and enforce the registration system, and to obtain the necessary power for punishing in the case of defective work on the part of registered plumbers; further, to render it penal for people falsely to represent themselves as sanitary plumbers. Sir Algernon Borthwick seconded the adoption, stating as a matter of personal knowledge that the Local Government Board were most willing to promote anything for the furtherance of the objects of the Plumbers' Company. The Marquis of Lorne supported the motion, holding that the Company was justifiably putting forward a very drastic programme. The Plumbers' Company has gone so far that it will be a great pity if it will not be able to get the compulsory powers of registration and punishment for bad work, which alone will safe-guard it in its endeavors to do justice to the public.

The fact that a hopper dredger, "The Manchester," constructed by Messrs. Simons & Co., of Renfrew, has just been launched for service on the Manchester Ship Canal is indicative of the progress and near completion of the work. The special duty called for has caused Messrs. Simons to introduce new features into the vessel. The stern is forked allowing the ladder to work between to enable the vessel to be handled with greater facility. She is steered by three large rudders, one of which is situated at the bow. The buckets will dredge out 850 tons in one hour, and provision is made for dredging at a depth of 35 feet. The propelling power is given by four screws, situated, two each, at the bow and the stern.

Trouble of subsidence of the ground in the salt district is again in evidence, and inasmuch as there is now a salt union and a consolidation of the various interests in that industry, it would seem to simplify the matter of legislation. Appeal has been made to the Local Government Board for the appointment of a Royal Commission to go into the question of this subsidence, but the President has written, pointing out that a Royal Commission could be of very little service in the matter, the principal method of dealing with the question being by legislation.

The question of the purification of the Irwell, of course, presented itself when the Manchester Ship Canal was designed, that stream being one of the chief tributaries absorbed into the canal. With this view the drainage of Pendleton, a suburb of Manchester, which was formerly discharged in its crude state into the river, has been reconstructed, the engineers in the first instance being Mr. Vawser, and at his death Mr. T. S. McCalhun, A. M. I. C. E. The sewage is precipitated in four tanks under the International Water & Sewage Purification Company's system. The sludge is then treated by filter-beds and the effluent passed into the Irwell.

FIREPROOF CONSTRUCTION.

REFERRING to the recent Western Union building fire at New York, Edward Atkinson, President of the Boston Manufacturers' Mutual Fire Insurance Company, addressed an interesting letter on fireproof construction to the New York *Evening Post.* From this we extract the following:

> The points which are customarily overlooked or not considered in the construction and occupancy of what are called fireproof buildings are:
>
> *First.*—The liability to the very rapid destruction even of incombustible materials when subjected to the heat of a fire which is consuming the combustible contents.
>
> *Second.*—It is very commonly assumed that because most of the materials which are used in the construction of the building are incombustible, it may be entirely safe to make use of combustible material in the finish of the building itself, and to face the wall with moldings, dados, etc., generally varnished woodwork from which a great deal of heat may be suddenly generated, varnish being especially hazardous.
>
> *Third.*—It seems never to occur to owners or occupants that private fire apparatus cannot be effectively made use of without a thoroughly organized fire department or under the direction of well drilled men.
>
> The most complete destruction about which I have ever known, either from personal observation or hearsay, has occurred in buildings made of brick, stone and iron, where the iron has been exposed to the heat generated by the combustion of the contents.
>
> In respect to many buildings of otherwise excellent construction, the whole expenditure intended to promote safety has been lost by finishing around the windows and doorways with varnished woodwork; by placing varnished wooden dadoes or sheathing against solid walls; by not giving proper attention to cutting off the passage of fire from floor to floor, and by filling the rooms with combustible furniture sufficient when ignited to cause such expansion, torsion or flexure as to tear the building to pieces without burning it.
>
> With respect to private fire apparatus there is little if any which is of use unless it be self operating, excepting in factories or other premises where there is a trained private fire department, drilled in the use of it.
>
> From what I have learned of the conditions of the Western Union Building, it would appear that the shell of the building had been well devised for safety, but that a great deal of wood had been used in the finish where it was entirely out of place, and that the greater part of the furniture had been of a combustible sort, where it would have been far better and safer had it been of incombustible material.
>
> The accounts of the fire speak of the spread upon the "switchboards," and from "table to table" on which instruments had been placed. The difficulty of choosing incombustible material on account of electric conductivity is admitted, yet there are very many materials which are perfectly suitable for such service that are not combustible or ignitable.
>
> The private hose within the building is said to have been rotten, as it usually is when not under the care of the private fire department well trained in its use. The passage of fire from floor to floor was wholly unobstructed; a useless exposure in such a building in which the only open way should have been the elevator shaft. There were no roof hydrants or other appliances by which the building could have been flooded from above, and finally, there were no automatic sprinklers. There are some admitted difficulties in placing automatic sprinklers for the protection of buildings to which high tension electric currents are admitted, lest the water itself should make cross arcs on which the high-tension current of electricity might be spread. On this point we have as yet no experience, as all the electric apparatus in our risks has been so carefully put up and is so constantly guarded that we have never met a loss from an electric current, except those which are generated in the clouds during thunder storms. There were no high-tension currents in this service in the Western Union Building, if I am rightly informed; therefore an equipment with automatic sprinklers in the electric department would doubtless have saved the entire loss.
>
> One of the most useful functions of the officers of the Factory Mutual Insurance Companies is to investigate the cause and course of every considerable fire which comes under their notice, even if they have no policy out upon the risk, and then to review their own risks in order to see where the same danger may exist which has caused the fire under consideration, and to take measures to avoid that danger or to guard against it.
>
> I can hardly imagine a method which would be likely to save as much property from destruction as a combination of property owners in the city of New York, who should select and employ the most competent person or persons whom they could find, at whatever price might be required to secure competent services, to keep their buildings under constant inspection, to study every fire, and to advise owners how to adopt suitable safeguards on the basis of experience. Such private inspectors should have no interest in any insurance company or in any of the property under their supervision. If a few owners would combine and hire one such competent man for a single year I think they would be astonished and shocked at the dangers which they now tolerate from mere ignorance of the hazard which can yet be guarded against at very small expense. Sometimes the danger is due to indifference rather than to ignorance.

IT is thought likely that a serious brick famine will result in New York and Brooklyn from the boycott of the brick manufactured by O'Brien & Vaughey, King & Lynch, Avery & Mackay and Silas Travers, the four firms at Verplanck's Point, by the boards of walking delegates of New York and Brooklyn, and the resolution of the Brick Manufacturers' Association of New York and New Jersey, not to continue shipping bricks to these cities until the boycott is raised on the products of these four firms, who are members of the Manufacturers' Association. The Building Material Exchange has appointed a committee to try to secure a settlement of the trouble.

EXPERIMENTS by Prof. J. E. Denton, of Stevens Institute, Hoboken, N. J., have shown that when a steam jet is discharging freely into air from a nozzle, if a gap is observable between the visible cloud and the nozzle, then the steam is practically dry, and may also be considered practically dry even if the vapor is very faintly visible; but immediately it becomes distinctly white the water present has risen to from 1 to 2 per cent. These facts are most valuable.

THE longest tunnel in connection with the Manchester, England, water-works scheme—the Raise Tunnel—which extends from near Townhead, Grasmere, to the straining well at Thirlmere, and is 5,225 yards long, has been completed, so far as the boring is concerned. The tunnel has been in course of construction nearly four years.

THE largest barometer yet made has been put in working order in the Saint Jacques Tower in Paris. It is 12.65 meters high.

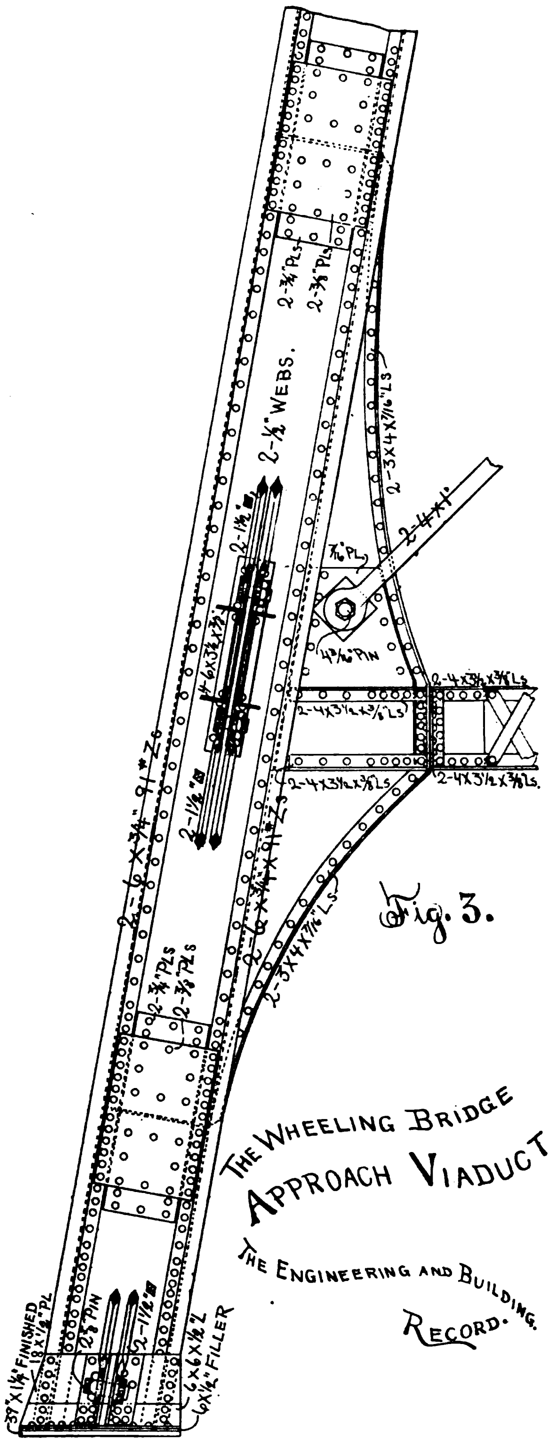
THE WHEELING BRIDGE APPROACH VIADUCT.

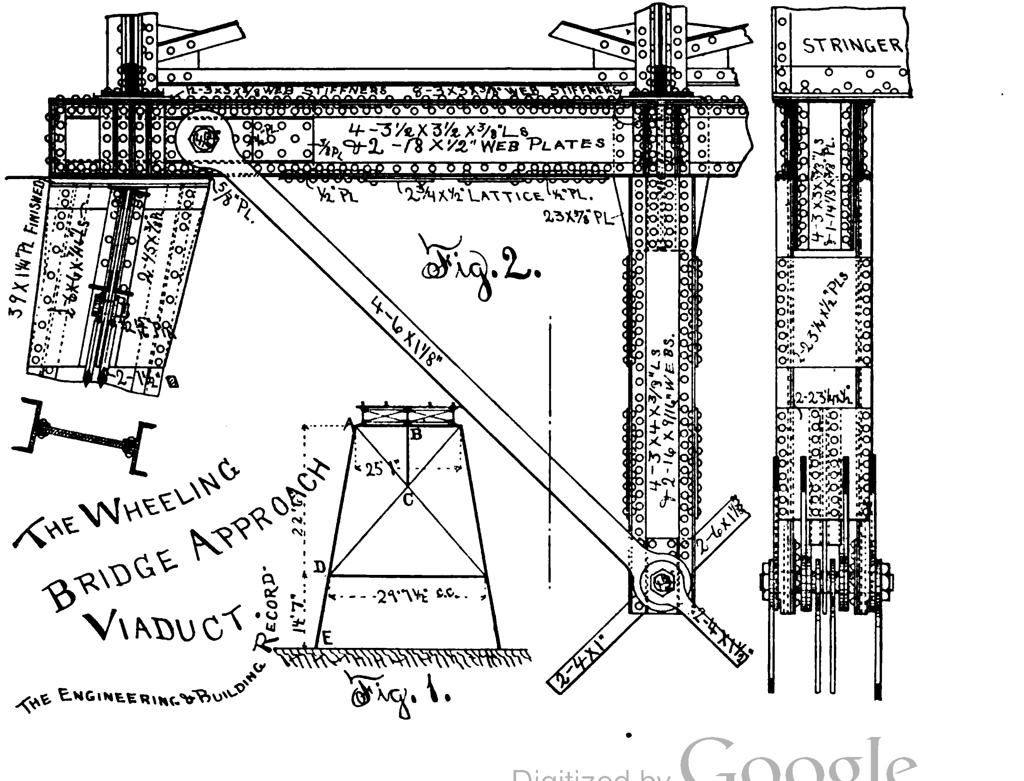
FIGURE 1 is a general cross-section diagram of the approach trestle viaduct of the new double track railroad bridge over the Ohio River at Wheeling, W. Va.

Figure 2 shows details of the connections at A B and C, Fig. 1, and Fig. 3 shows them at D and E. The special features of construction were designed to meet the requirements imposed by a 13-degree curve in the track, and the necessity of preserving clear headway for street traffic under the lowest transverse struts.

The viaduct is proportioned for a load of two 140-ton consolidation engines on each track, which is assumed to create a centrifugal force at 2 per cent. per degree of curvature. The tension members and pins are steel, the rest of the structure is iron.

Job Abbott, of New York City, is the Chief Engineer of the bridge, which is being built by the Edge Moor Bridge Company, of Wilmington, Del.





THE VICTORIA, B. C., SEWERAGE SYSTEM.

Mr. Rudolph Hering, in his recently submitted report on the most desirable system of sewerage for the city of Victoria, B. C., reviews the several plans which have been handed in for the work, and makes some valuable suggestions.

As to the disposal of the sewage, he points out that the first question to be considered is the way in which the sewage can be rendered harmless, after having been removed from the city. In the present instance, there is but one way practicable—viz.: A discharge into the Straits, where dilution in the large bodies of water will cause the sewage to disappear.

The many instances of sewage disposal have given an approximate measure of the least dilution which is found to be acceptable. For instance, in a running stream of fresh water in temperate climates, we try to have a flow of from 150 to 250 cubic feet of water per minute for every 1,000 inhabitants. If the water is cold and exposed to abundant aeration a smaller quantity will suffice. In salt water, on the other hand, a much greater dilution is necessary, mainly because the sewage water is much lighter, tending to spread out over the surface, and also because oxidation is less rapid.

When discharging sewage into any water except a running stream it is desirable to screen it before reaching the outlet. The large particles of floating matter are thus prevented from stranding at the shores by the action of the wind and waves. The quantity of matter retained by the screen will amount to perhaps a bucket full per day, but even this small quantity, in stranding and accumulating along the shores, might become objectionable. It can be disposed of with the garbage. In order to obtain the greatest possible dispersion of the sewage through the water the outlet should also be as deep below the surface as practicable.

Holding the above points in view, there are two localities where the sewage of Victoria can be safely discharged for some time. One is Clover Point, and the other Emily Island in Oak Bay. Soundings taken off Clover Point about 200 or 300 feet from shore, show a depth of water from 8 to 10 fathoms. There is a good current at this point during both tides, assuring sufficient dispersion of the sewage and rendering the quantity which can be economically delivered to it entirely unobjectionable. Mr. Hering, therefore, considers Clover Point as the proper outfall for the territory now requiring sewerage. To ascertain the actual degree of dispersion at flood and ebb tides, he recommends dumping several barrels of sawdust, previously well soaked in water, near the proposed point, and as far below the surface as practicable. It will be found to scatter over a large area; but, unlike sawdust, most of the suspended particles of sewage, when scattered in clear water will be consumed by fish and other aquatic animals. Discharging sewage merely into deep water does not guarantee against a nuisance, because, if the water is comparatively still, the sewage will rise and gradually permeate the entire body.

The next point to consider is the elevation at which the sewage can be discharged at Clover Point As it is not advantageous to allow back water in the sewers on account of deposits occurring at such times, and as no better discharge is secured by having the sewer below water, the available data led Mr. Hering to conclude that there should be a free discharge of sewage at the level of mean high water. The water rarely rises much above this height, and when it does, stays there but a few hours. Assuming that the outfall sewer at ordinary times will run one foot deep, the invert, or bottom of the sewer, can therefore be safely placed at one foot below mean high water. The sewage may be carried from the shore into deep water by a steel pipe, well coated to prevent corrosion, and well anchored to keep it in place. The chamber containing the screen should be placed below the last junction where sewage enters.

Owing to the necessity of giving sewage sufficient velocity to remove both the heavy and suspended matter carried along with it, the slope of a sewer is limited. With the lightest one that will answer, it is impracticable to carry all the sewage by gravity to the Clover Point outfall. A few locations are so low that their sewage will have to be pumped. If pumping were needed only in one locality, it would probably be most economical to use a gas or steam engine; but as in Mr. Hering's opinion it is needed in several localities, to avoid pollution of the harbor and the shores, the Shone Ejectors seem to offer the greatest advantage. They consist of a peculiar form of pump operated by compressed air, which is carried to them in a special pipe from a central station. Mr. Hering says that with good management these ejectors ought to give entire satisfaction. The conditions under which they are found to be economical rarely occur, because it is generally practicable to concentrate the sewage to a single locality. This is the only reason why they are not more used. As multiplication of machinery is always combined with more or less disadvantage, it is well, however, to have as few ejectors as possible, even at a greater first cost of the system.

As to the capacity of the sewers Mr. Hering says:

> "There has been some controversy in this city, I understand, as to whether the combined or separate system should be used, that is, whether the sewers should be large enough to take the rain water or not. This controversy, which was started in eastern cities years ago, mainly by parties interested in patented systems, is largely due to misapprehension. There are comparatively few cities in the world where all rain water is taken into the sewers, and still fewer where none at all is taken into them. The vast majority of systems are between these extremes while all cities need sewers for all of the sewage, the above character of the system is, therefore, decided by the quantity of rain water which can be allowed to run off over the surface. The larger the city, as a rule, the more inconvenience and damage is caused by surface removal. In most of the larger cities all, or nearly all, of the rain water is, therefore, taken into the sewers. In small cities the inconvenience and damages are less great, and the tax for the larger sewers is relatively heavier, resulting in the adoption of smaller sewers and in letting more rain water flow over the surface. As the city grows, supplementary sewers or drains for rain water are gradually built as needed. This gradual building of large drains is obviously a great advantage to younger cities which otherwise, on account of the expense, would often be debarred from the benefits of foul water sewerage for many years.
>
> "There is another advantage in not providing combined sewers in small cities. The streets are generally unpaved, and the rain water washes a large amount of mud and silt into the sewers in spite of all precautions. This unites with the sewage, and, in light grade sewers, causes it to deposit when it might otherwise flow off. This objection is greater in America than in Europe, because our streets, as a rule, are not kept in as good a condition as in the Old Country.
>
> "On the other hand, there is no reasonable objection to the removal of roof water through the foul water sewers. It is clean, and therefore helps to cleanse them as it reaches the main sewers simultaneously from the branches, it causes them to be flushed by every rain, and more thoroughly than can be done by automatic flushing or other artificial means. The house plumbing is often simplified and cheapened by letting the roof water enter the sewer pipe.
>
> "Again, the water falling upon roofs runs off without any loss by soakage, while that falling upon open ground or unpaved streets is much reduced in quantity when reaching the gutters. The removal of roof water, therefore, relieves the streets of a larger proportion of water than is commonly supposed, and postpones the day when drains for street water become necessary.
>
> "For these reasons it is usual in the smaller cities of England and in the United States to admit at least some water from the roofs into the sewers of the so-called 'separate' system. A difficulty seems to arise in ascertaining the proper quantity to be admitted; but this is overcome by restricting the roof water conductors above the ground so that a limited amount of water only will pass down to the sewer, and during very heavy rains the surplus flows out on the surface."

For Victoria Mr Hering finds the quantity of sewage to be very nearly equal to the water supply. Making an allowance for subsoil water, he thinks it safe to estimate for the present area of the city, the average quantity to be 15 cubic feet per day per inhabitant. Assuming that this area may eventually contain a population of 40,000 persons, the outfall sewer would have an average flow per day of 600,000 cubic feet. The maximum flow during the day is usually found to be 30 to 50 per cent. greater than the average. Assuming it, therefore, at the rate of 846,000 cubic feet, we obtain a maximum flow of sewage for 40,000 inhabitants of 10 cubic feet per section. It is of great advantage in several respects, particularly for keeping the sewers clean, to have the sewage not fill the sewer more than half full. At the exceptional times of flushing, or during rains, it can run full without harm.

Concerning the depth of the sewers below the street surface, Mr. Hering says that this is partly dependent upon the depth of the outfall and of those sewers which skirt the city and collect the sewage from the laterals. Besides the depths thus fixed by the plan, it is immaterial, from an engineering point of view, how deep they are placed, unless the cellars are dampened by ground water. Some cities have cellar drainage; others not. Some prefer to have it even at a large extra cost. In Victoria there should be deep drainage in the business districts, placing the sewers from 9 to 12 feet below the street. But the districts which will remain residential in the future, particularly on the higher grounds, a depth of from 3 to 6 feet will answer all the requirements. In some instances the main sewers are obliged to be very shallow in order to carry the water across a depression. The usual remedy for this is to raise the street at the depression. It is generally the cheapest and most satisfactory way of overcoming the inconvenience.

The estimated cost of the sewers for the entire city, according to the proposed plan, is $450,000.

A MILLION-DOLLAR SUIT DECIDED.

According to a Detroit, Mich., dispatch, dated August 2, a suit for $1,000,000 has just been decided there in favor of Cofrode & Saylor, Philadelphia, Pa., civil engineers and contractors, and against Brown, Howard & Co., New York City. In 1886, the latter received a contract to build 200 miles of a railroad between Duluth and Sault Ste. Marie, at $20,000 per mile with $500 per mile additional for accessories. Fifty-four miles were subsequently sublet to F. C. O'Reilly & Co., and 22 miles to Cofrode & Saylor, who began an action against Brown, Howard & Co., alleging that the specifications were not in accordance with the character of the country, the contract specifying hard pan where there was loose rock, together with other discrepancies. O'Reilly & Co., assigned their claims to the plaintiffs, and the suit embraced invalidity of contract regarding the building of 54 miles of road. The case was before the court 130 days, the testimony taken covered 8,000 type-written pages, and will cost the county $10,000. Don M. Dickinson, of Detroit, and J. A. Deady, of New York, were among the attorneys for the plaintiff, and ex-Governor Hoadley, of Ohio, and Ashley Pond, of Detroit, for the defence.

COST OF ELECTRIC POWER.

On the cost of power from electric motors the *Electrical Engineer* says: "It is to be borne in mind that the motor business depends largely for its success upon the rates at which the consumer can secure his current. We have received within the last few days the new schedule of power rates recently adopted by the Brush Company, of Baltimore, 'after a very careful consideration.' It is as follows: $\frac{1}{10}$-horse power, $2.50; $\frac{1}{4}$-horse power, $3; $\frac{1}{2}$-horse power, $5; 1-horse power, $10; 2-horse power, $16; 3-horse power, $21; 4-horse power, $26; 5 horse power, $30; 6-horse power, $33; 8-horse power, $42; 10-horse power, $50. This scale, which goes into effect on July 1, seems reasonable for a city presenting such conditions as Baltimore does, with a large population engaged in a variety of pursuits, but not distinctly of the industrial type, and not presenting so great a diversification of small industries as one finds, for example, in Boston or Newark. Still, the motor business has been fairly well worked up in Baltimore, and there are now 375 motors representing about 200-horse power of daily consumption of current. With the revised schedule this number and quantity should increase quickly."

STREET CAR LINES AT MADRID.

According to the Excerpt Minutes of the Proceedings of the British Institution of Civil Engineers, Madrid, notwithstanding the very uneven ground on which it is built, is traversed by tramways from one extremity to the other, with branches to most of the suburbs. The first line was constructed in 1871, from the fine suburb of Salamanca, which skirts the fashionable Prado, through the chief streets of the city, the Calle de Alcalá, and the central square, called the Puerta del Sol, to beyond the Royal Palace at the other extremity. The several routes are altogether 24 miles in extent, and for two-thirds of this distance the line is a double one. Terminal stations, coach houses, stables, and repairing shops have been built on a handsome scale, and the stock consists of 220 comfortable cars, and 1,396 mules and horses. Upwards of 1,000 men are employed in the service of the companies.

Electric drills are now being successfully used in connection with the work on board the monitor "Miantonomah" in the Brooklyn Navy Yard. A large amount of drilling must there be done around the turrets and in positions where the use of a power drill would entail considerable difficulty.

The city of Albany, N. Y., is going extensively into the asphalt paving experiment. The Albany *Evening Journal* says that taking contracts let and to be let they amount to a total of 128,000 square yards. The cost is estimated at nearly $400,000.

THE COVERED RESERVOIRS OF MONTMARTRE.

THE reservoirs which have just been built on the summit of Montmartre to supply water to the city of Paris are illustrated and described at length in a recent issue of *Le Genie Civil*, from which the accompanying cuts are reproduced.

The reservoirs occupy an area of 2,300 square meters, and consists of two distinct and entirely separate parts, one of them being two and the other three stories high. The first story of each reservoir has a storage capacity of 4,800 cubic meters and contains river water. The second story, of 4,200 cubic meters capacity, receives and distributes water direct from the source. The third story of the large reservoir holds also 2,000 cubic meters of spring water, and can be made to supply the old Chateau Reservoir, which has a capacity of only 150 cubic meters, and serves as a distributing reservoir for the higher sections of Montmartre. The whole quantity of 11,000 cubic meters of water is raised by works at the foot of the hill.

NEW COVERED RESERVOIRS • OF • MONTMARTRE

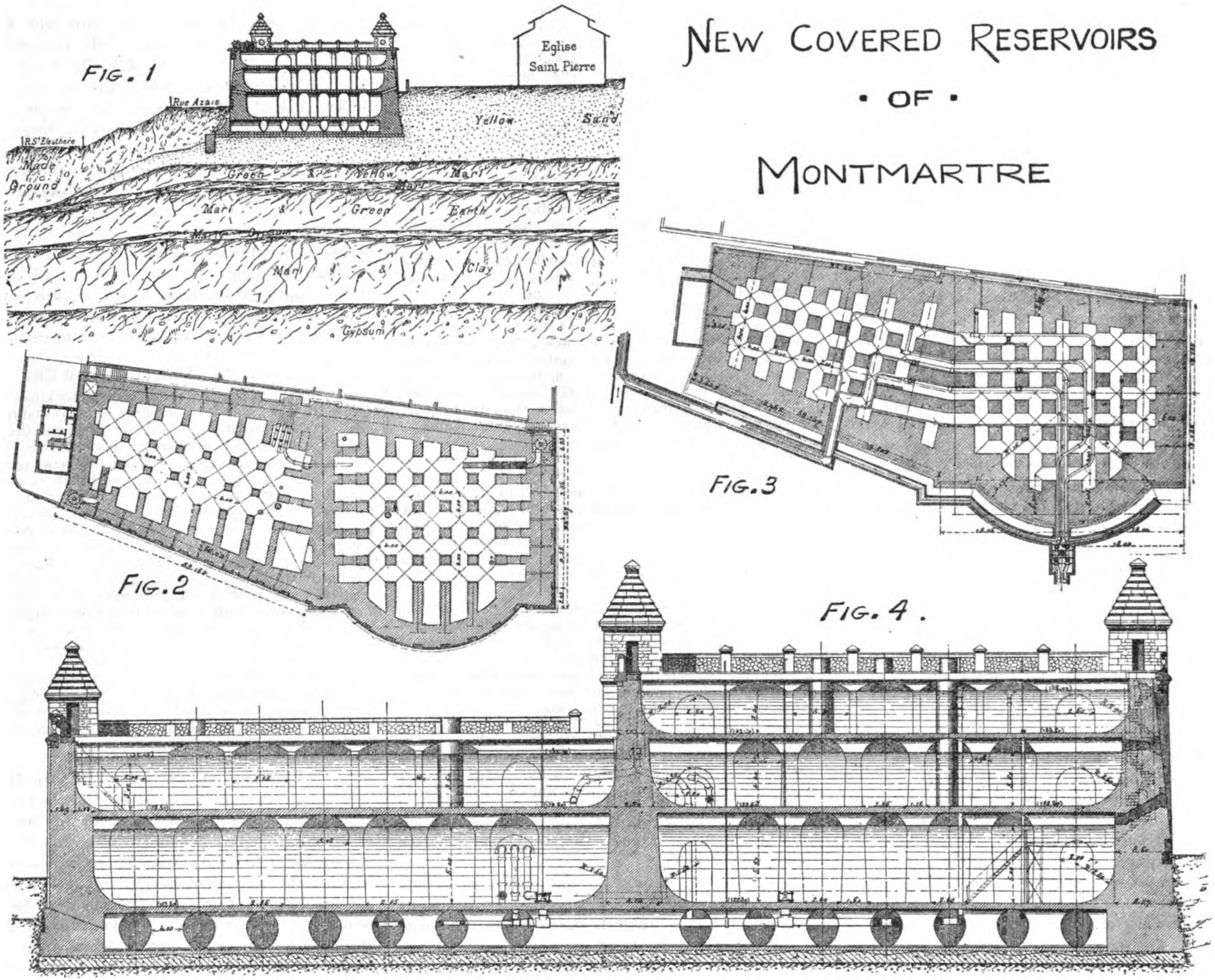


Figure 1 of the illustrations shows the geological formation below the reservoirs; Fig. 2 represents a horizontal section; Fig. 3 represents a horizontal section at the lowest story; Fig. 4 shows a vertical longitudinal section.

The geological formation encountered made the work of construction difficult in many respects and called for special precautions to prevent landslides. It will be seen from Fig. 1 that when once the virgin soil is reached a bank of yellow sand is found preceding the layers of gypsum, which are about 3 m. thick, very fine and easily carried away by water. It was necessary then to avert the considerable change which presents itself here, either from infiltration through the masonry or from the cracks, which are almost infallibly produced in the floors. With this in view, the principal floor has been made with a layer of concrete, covered over the whole extent with impenetrable cement mortar, leveled in such a manner as to form a series of trenches, at the bottom of which are the drainage pipes, all running into a small gallery, which forms a collector beyond the works. A second bed of concrete, the total thickness of which is 0.75 m., is run over the last covering, and finished horizontally to receive the masonry. The infiltrations are thus collected and drained off. This floor itself forms the ceiling of a lower chamber easily accessible, enabling the arch which supports it to be thoroughly inspected. The network of galleries, 2.40 m. in height and 2 m. wide at the springings, forms a series of supporting arches, the pillars of which are the bases of the pillars of the reservoirs. The floor of this lower chamber is cemented over where coming in contact with the arches and pillars, which are rough, in order to permit of the free flow of the water running through from the upper fissures. Finally, in order to prevent the escapes which would take place in the embanked part of the surrounding walls, and the existence of which might be unperceived for some time, one of the outer recesses of these walls has a covering with trenches, and drainage pipes running into the galleries of the under chamber. The lower story of the small reservoir, and the first two stories of the large one, are constructed in the center with supporting arches, and round the circumference with inverted arches, the outer walls being joined to the floor by inverts 2.50 m. in radius. The two upper stories are covered by means of elliptic brick arches, of a total thickness of 0.07 m., and a rise of 0.60 m., for 3.55 m. span; the abutment piers are isolated from the circumference walls, as also from the covering itself, by a space of 0.10 m., simply covered by brick placed flat without mortar. The spandrils of the arches are filled with concrete surmounted with a covering of cement and turfed over.

The following figures are here of interest:

	Meters.
(1) Great reservoir:	
Lower story: Depth of water	5
Depth under key-stone	5.80
Span of the vaults in center	2.70
Thickness of the pillars	(1.60 + 1.30) + 2
Middle story: Depth of water	3.50
Depth under key	4.40
Thickness of pillars	(1.15 + 0.95) + 2
Upper story: Depth of water	2.80
Depth under key	3.40
Thickness of brick pillars	0.45
(2) Small reservoir:	
Lower story: Same as lower story of great reservoir.	
Upper story: Depth of water	3.50
Depth under key	4.30

The surrounding and partition walls are calculated on the most unfavorable hypotheses, probably never realized in practice; all the stories reckoned as full, the isolation of the abutment piers of the arches of each story is assumed, and no account is taken of the support from the embankments, or of the counter thrust of the smaller reservoir for the partition wall.

The vertical pressures, on account of the oval form of the lower galleries, are uniformly divided over the whole surface of the foundation floor. For the small reservoir they are 12.03 k. and 1.70 k. At the base of the south wall there has been added an abutment apron (see Fig. 1) jutting out to prevent the removal of the bed soil there by underground water. The masonry is of millstone, with Portland cement and mortar, 470 kilos. per cubic meter of sand for the lower and middle stories, and of Burgogne bricks for the upper stories.

The decorative parts only are in rough ashlar facings, except the cornices and the covering of the towers, which are chisel dressed. The plasterings are of Vassy cement and sifted sand. The pillars of the upper stories are also uncovered, but they rest on the general coating of the corresponding floors. Lighting and ventilation are secured by lateral rectangular openings made in the outer walls. Light is admitted also through the top of the covering at one part, and through shafts, one meter in diameter, which give access to each story for handling material in case of repairs.

The first stories, as already remarked, are for the storage of river water. The supply pipe, 0.4 m. in diameter, first leads to a large tank from which two branches are carried to these first-story reservoirs. The supply pipe for the spring water also is 0-4 m. in diameter and leads to a supply tank for the second-story reservoirs. A branch with which this pipe is fitted permits of the filling of the upper story by cutting off the flow to the supply tank. Each story is provided with distributing and emptying sluices operated from the earthworks of the reservoirs.

The work was carried out between 1887 and 1889 under the direction of Mr. Bechmann, chief engineer, according to plans by Mr. Journat, supervised by Mr. Dutoit. The cost amounted to about 1,000,000 francs.

HOW CITY WATER MAY BE WASTED.

In the recently issued annual report of the Zanesville, O., water-works, the following table is published, giving, in gallons and hundredths of a gallon, the discharge of water per minute through various sizes of orifices at different heads. The table illustrates in a striking manner some of the points raised in the course of the water waste prevention discussion at the May meeting, at Chicago, of the American Water-Works Association. Rough calculations were there made tending to show the quantities of water which escaped in the small streams sometimes allowed to run from faucets in cold weather to prevent freezing.

In connection with the table it is explained that the wire of which pins are made is $\frac{1}{32}$ of an inch in diameter—No. 21 wire gauge. The finest cambric needle is made of wire $\frac{1}{64}$ of an inch in diameter—No. 27 wire gauge. A stream the size of a pin, running one year with head of 150 (being the average of low pressure in Zanesville) will flow 115,632 gallons, at a loss, counting at the rate of 10 cents per 1,000 gallons, of $11.57. A stream the size of a cambric needle, running at the same pressure for the same time, will waste 26,280 gallons, and, at 10 cents per 1,000 gallons, a loss of $2.63.

Gallons and Hundredths of Gallons that will be Discharged per Minute Through Various Sized Orifices at the Heads Stated.

Head in Feet.	Pressure per Sq. Inch.	DIAMETERS OF ORIFICES IN INCHES AND FRACTIONS OF AN INCH.													
		$\frac{1}{64}$	$\frac{1}{32}$	$\frac{1}{16}$	$\frac{1}{8}$	$\frac{1}{4}$	$\frac{3}{8}$	$\frac{1}{2}$	$\frac{5}{8}$	$\frac{3}{4}$	1	$1\frac{1}{4}$	$1\frac{1}{2}$	$1\frac{3}{4}$	2
20	8.60	0.02	0.07	0.30	1.20	5.10	11.70	20.60	32.20	46.20	82.30	128.40	184.80	252.00	328.80
40	17.32	0.02	0.11	0.45	1.80	7.40	16.30	29.60	45.50	65.50	116.50	182.40	261.60	256.40	465.60
60	25.99	0.03	0.14	0.55	2.20	8.90	20.00	35.60	57.70	80.30	142.80	223.20	320.40	436.80	571.20
80	34.65	0.04	0.16	0.65	2.60	10.30	23.20	41.20	64.30	92.60	164.40	258.00	370.80	505.20	658.80
100	43.31	0.04	0.18	0.75	2.90	11.50	25.90	46.10	72.00	103.70	183.60	288.00	415.20	565.20	738.00
120	51.98	0.05	0.19	0.78	3.10	12.60	28.30	50.40	78.80	113.50	201.60	315.60	453.60	624.40	807.60
140	60.64	0.05	0.21	0.85	3.40	13.60	30.60	54.50	85.20	122.40	217.20	340.80	490.80	668.40	872.40
150	64.97	0.05	0.27	0.88	3.50	14.10	31.70	56.40	88.20	127.20	225.60	352.80	507.60	669.20	902.40

DESIRABILITY OF CIRCULATION OF WATER IN RESERVOIRS.

In the course of a paper on "Algæ Growth in Reservoirs and Ponds," read before the New England Water-Works Association a few months ago, F. F. Forbes, Superintendent of the Brookline, Mass., Water-Works, said :

"In all reservoirs exposed to sunlight which are supplied from ground waters or from rapidly flowing streams, over rocky or sandy beds, circulation is a positive injury. Every gallon of such water contains food for millions of organisms, and each drop pumped into a reservoir increases the amount of organic matter to a corresponding extent.

"In proof of this, you have only to look again at the remarkable growths in the Brookline and Newton reservoirs. If a building was on fire, and to quench the flames a quantity of very combustible material should be thrown on it, it would not be difficult to foretell the result ; and there is no more reason in pumping into a reservoir a quantity of fresh water, with the idea in view of improving the quality of that water in so doing.

"As an additional proof of the statement I have just made, I will relate a little experience we had in the Brookline reservoirs several years ago. Everybody said that circulation was what we needed to keep the water free from algæ, and one time after the reservoir had been carefully cleaned, this view of the case was given a thorough trial. It was in summer, when our daily consumption was about a million gallons. All the water, nearly, was pumped into one end of the reservoir, and made to pass through it. The amount of water in the reservoir during this trial was not much in excess of the daily consumption ; in other words, nearly as much water was pumped into the reservoir each day, and drawn from it, as the reservoir contained, yet the algæ came in about the same length of time, and were fully as abundant. In consequence of this, the consumer received no water which was not laden with algæ ; whereas, if the water had been pumped directly into the distribution, and only the surplus reached the reservoir, the water would have been good as long as pumping continued.

"It is doubtful whether circulation improves water in any case, unless it is in ponds and reservoirs which have deposits of mud or decaying vegetable matter on the sides and bottoms, or water which has been drawn from such sources."

TAXATION OF PIPES IN PUBLIC STREETS.[*]

An interesting question of law, and one upon which the courts are in hopeless disagreement, arises when a tax is levied upon iron pipes laid by private parties in the public streets by permission of the local authorities. Common examples of such pipes are gas and water mains laid by private corporations.

The fundamental inquiry is as to the nature of the interest of the corporation in the mains after they have been laid. Four theories have been held by the courts.

I. In Tennessee it is held that the pipes remain the personal property of the company.[†]

II. In Iowa it is held that they are affixed to the land on which the main works or sources of supply are situated, and are taxable as real estate of the company in the town where that land lies, though they may run into another town.[‡]

III. In Rhode Island it is held that they are affixed to an easement which the company possesses in the soil of the street, and are therefore real estate of the company where they lie.[§] They are taxed, then, not *as an easement* of such value, but as actual tangible real estate owned by the company as appurtenant to its easement.

IV. In England it is held that they are affixed to the soil, and are, therefore, real estate ; but that they are only occupied, not owned, by the company.[‖] This view is apparently held in New York also.[¶]

To consider the less tenable views first, it seems clear that the theory of the Iowa court cannot be sustained ; though it is supported, it is said, by the practice of the assessors in at least one other Western State. It seems to have at least three fatal flaws. First, it is opposed to the facts. The water mains in that case were no more affixed to the water-works than to the street hydrants or to the land of consumers ; as, for instance, a bridge is equally affixed to each bank of the river. Secondly, it is opposed to every other decided case in which the subject is considered. Thirdly, it is opposed to common sense.

The Rhode Island case is based on a phrase of Lord Campbell in his decision in the Chelsea water-works case, so far as it is based on any authority ; and this phrase really lends no aid to the Rhode Island decision. It is a novel idea, that a chattel can be so affixed to an easement as to become the real property of the owner of the easement. If, for instance, the owner of a right of way should affix stone steps to the land, would they not pass to the owner of the land ? Could they be claimed as affixed to the right of way ? There are other objections to the Rhode Island theory, but this seems conclusive.

It remains to consider whether the pipes are personal property. It seems to me that they clearly are not, and that the English and New York theory is preferable to that of Tennessee. The pipes are put in the ground to remain there, or to be removed only when they become worn out and it is necessary to replace them with other pipes. Suppose the license of the company to use the streets were revoked, the company would clearly have no right, after that, to dig up its pipes. This is, to be sure, consistent with continued ownership by the company ; but intention settles the question whether or not they become part of the realty, and the fact that the company can remove its pipes only with the concurrence of the authorities is important, as indicating a probable intention that they shall remain in the soil.

In fact, when a worn out pipe is replaced by a new one, the old iron is carried away by the company. But this is consistent with theory that the pipe is part of the realty. Suppose a tenant chooses to repair a brick walk on the leased premises, putting in new bricks ; would he not be entitled to the old ones ? Could the landlord bring trover if he destroyed them ? Much more should it be so here. The company having a right to do so enters the land and severs certain old iron from the soil ; the iron becomes a new article of property, and may well go to the company.

Suppose, instead of laying pipes through the streets, a gas or water company should dig a tunnel, cementing the sides of it to prevent leakage. There can be no doubt that the cement would become part of the realty. Is there any difference when iron is used in place of cement for the same purpose? As iron pipe is it not *functus officio*, having become the wall of a tunnel, to be removed, if at all, not as iron pipe but as old junk?

This view, which is that of the English courts, seems to me the only one tenable. If it is correct, the remaining question is merely one of interpretation of the statute providing for taxation. It is in the power of the Legislature to tax the company for the pipes. This may be done, as in New York by a special provision making the pipes real estate of the company *for purposes of taxation*,[*] or as in Massachusetts, by taxing the value of the company's franchise, which is, of course, in an indirect way, taxation of the pipes, since the value of the franchise includes the value of the pipes.[†] An expedient holding gas pipes to be part of the machinery of manufacture[‡] is questionable in point of fact ; if in fact they were part of the machinery of the company they might well be taxed to it as such, though the legal ownership were in another.

In the absence, however, of a special provision of the statutes, pipes in the public street should be taxed neither as the real estate nor as the personal property of the company that lays them.

THE FOSTORIA, O., WATER-WORKS.

J. M. Howells, civil engineer, of Chicago, Ill., contributes the following particulars concerning the water-works now under construction at Fostoria, O., under his supervision.

Previous to his engagement the city had made numerous efforts to secure a water supply on the franchise plan. These resulted in letting the first franchise, about six years ago, to some New York people, who, after spending some money in boring wells, abandoned the enterprise. A year and a half ago another franchise was let, but this also was thrown up in little time.

Well water may be had in abundance, but is hard, running, in some instances, as high as 96 grains per gallon of soluble solids, which defy boiler compounds of every description. One of the railroads runs a water train, hauling water to the town daily for use in boilers. The impounding system has been adopted, taking the supply from 17 square miles of water-shed, which discharges floods through a small valley near the town, but furnishes no flow at all most of the season.

The works consist of a canal, taking water from the valley, a mile above the city. The canal discharges into a collecting and settling reservoir of about 15 acres water surface. This reservoir discharges through a brick conduit, three-quarters of a mile long, into a lower main reservoir of 20 acres water surface and 20½ feet deep, holding over a hundred million gallons. From the main reservoir water is conveyed to the center of a circular filter basin, where the daily supply is sprayed into the air by gravity, then sinks through the filter forming the bottom, and is conveyed to the well. The filter basin is six feet deep, underlaid by a filter-bed something after the old English plan. The water supply has been practically cleared of sediment by settling before arriving at the aeration fountain and filter-bed. Little is therefore left for the latter to do.

The water tower stands adjacent to the filter-bed and possesses some novel features. It is based upon the solid rock 25 feet below the surface; its first 16-foot section is the pump well, the next compartment above is the pump-room, the next above is a shop or water office and other storerooms above. At 53 feet above the surface, and 78 feet above solid rock, the masonry leaves off, and a steel water tank, 25 feet diameter by 100 feet high, commences. The pump-room is circular and 31 feet in diameter. Adjacent to the tower is a stone boiler-room 46x34 feet. The tower is being built of Berea and Grafton stone and superior class of masonry laid in Portland cement.

The pumps are two independent sets of duplex, horizontal, direct-acting pumps, to be furnished by the

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[*] Joseph H. Beale, Jr., in the *Harvard Law Review*.

[†] Memphis Gas Light Co. *v.* The State, 6 Coldw. 310.

[‡] Appeal of The Des Moines Water Co., 48 Ia 324.

[§] Providence Gas Co. *v.* Thurber, 2 R. I. 15.

[‖] Compare King *v.* Brighton Gas Light Co., 5 B. & C. 466, with Chelsea Water-Works Co. *v.* Bowley, 17 Q. B. 358. In the former case the company was held to be an *occupier* of land in the parish through which its pipes ran, and, therefore, to be liable to the poor-rate. In the latter case the company was held to have no *interest* (*i. e.*, ownership) in the land through which the pipes ran, and, therefore, not to be liable to the land-tax. In the former case it was distinctly held that the pipes were not personal property, but were affixed to the soil; the contrary having been urged by the company's counsel. The effect of these two cases is, therefore, as stated in the text.

[¶] People *v.* Assessors of Brooklyn, 39 N Y. 81. The decision is, that the pipes were not affixed to any land of the company, and, therefore, not taxable to it as real estate *belonging to it*. The court seems to take it for granted that the pipes were real estate.

[*] Laws of 1881, c. 293.

[†] Dudley *v.* Jamaica Plain Aqueduct Corporation, 100 Mass. 183.

[‡] Com *v.* Lowell Gas Light Co., 12 All. 75; Memphis Gas Light Co. *v.* The State, 6 Coldw. 310.

Gordon Steam Pump Company, of Hamilton, O. The boilers are two of 85 horse-power each, furnished by the Mansfield Machine Works, of Mansfield, O. There are being laid 16 miles of cast-iron mains, from 14 to 4 inches. The pipe is furnished by the Lake Shore Foundry, and laid by J. J. Rumsey. By locating the works in town the force-main was eliminated, thus avoiding the use of 18-inch pipe, otherwise necessary. All the pipe system is productive, there being ten dwellings within a radius of 300 feet from the pumps.

H. J. Karg, of Fremont, O., is the contractor for the stone tower and boiler-house and filter basin, and the conduit, which connects the two large reservoirs. Cook & Heaton, of Junction City, Kan., are contractors for the reservoirs. The valves were purchased from the Rensselaer Manufacturing Company, and the hydrants from R. D. Wood & Co., of Philadelphia. The Porter Boiler Manufacturing Company, of South Chicago, are making the steel tank for the tower. All the work is progressing well, and will probably be finished before winter.

DATA ON BOILER SETTING.

AT the recent New York meeting of the American Boiler Manufacturers' Association, a partial report on boiler setting was submitted by a committee which had been previously appointed to take the subject in hand. The committee, as will be seen by the following synopsis, had prepared a series of questions which were sent to the members, but to which only three replies had been received. The questions cover the subject of boiler setting as far as it could be covered by the committee, and the statements sent to the several members requested that they would not only answer the questions presented to them, but that they would also send in such further questions bearing on the subject as might, in their judgment, seem of importance. The replies herewith presented were received from President James Laffan:

1. What do you consider the proper distance for boiler above the grate surface? and has this distance any fixed relation as to the area of the grate and the quality of fuel used? A. Distance from grate to underside of boiler 20 inches to 24 inches for coal. There is no relation between grate surface and this distance. For wood this distance should be not less than 28 inches to 32 inches.

2. What sized openings should the grate surface contain for different grades of fuel? A. The openings between grate bars should not be less than ⅜ nor more than ½ inch for coal. For wood and peat coal ¼ inch to ⅜ inch is wide enough.

3. What proportion should grate surface bear to heating surface for different grades of fuel? A. The grate surface should not be less than one-fortieth of the heating surface, but the larger the same is the better the result will be. For locomotive boiler the grate surface can be made somewhat smaller, but should not be less than one-sixtieth of the heating surface. Don't think there is any relation between heating surface, grate surface and fuel, the difference in fuel only requiring a difference in the grate openings. Do not think there exists any relation between length of boiler and length of furnace or grate under same. The length of grate should never be over 7 feet, as it is impossible to keep the same clear at the inner end.

4. What is the maximum length of grate that you would recommend for use without center rests? A. Five feet.

5. Have you had any experience with shaking grates? A. Yes, sir. Don't think very much of same, as they are very easily put out of order by pieces of cinders getting between the bars or into the shaking mechanism, thus causing breakage of bars and frequent repairs.

6. Have you had any experience with automatic stoking apparatus? A. No, sir. Think, however, that for some grades of fuel they are indispensable, such as coal, slag, sawdust, tan bark, and some sorts of peat coal, when they give a bright, clear fire, with little or no smoke.

7. Should air be introduced at the bridge wall? If so, state how. A. No. If the fuel is not put on the grate in too thick a layer no necessity for such introduction of air is needed. It is a fault met with everywhere; that whenever more steam is required the fireman fills up the grate with coal till it sometimes reaches the bottom of the boiler, thus frequently causing bagging of fire sheets, besides very heavy smoking of the stack.

8. Do you advise bridge wall to be straight or curved parallel to the boiler? A. Bridge wall to be straight. A curved wall has the tendency to concentrate flame and heat under center of boiler, as the flame will take the shortest way back to stack—*i. e.*, over the lowest part of the fire bridge.

9. What should be the thickness of bridge wall at top and bottom?

10. Should bridge wall be sloped or vertical? A. Bridge wall should not be less than 18 inches at bottom, but may be tapered off toward top to 9 or 13 inches. Do not think it makes any difference whether front of bridge wall is sloped or vertical.

11. Should the space behind the bridge wall be reduced or enlarged? State reason. A. Space behind bridge wall should be enlarged, as it will reduce the velocity of fire gases, and thus have them give up more of their heat to the boiler.

12. Do you think it advisable to take air in at any point back of bridge wall? A. No. The temperature of the gases is too low there to ignite any smoke that may have formed over grate. Hence it can have no other than a cooling effect.

13. In what place should fire brick be used; and in lining furnaces with fire brick should they be tied to the main walls or built independently, or do you prefer that the brick be laid in Flemish Bond? Should the joints be made thick or thin? A. Fire brick should be used in all parts of the setting which are exposed to the hot gases. It is better to have fire brick lining tied in with red brickwork, unless the lining is made 13½ inches thick, when it can be built up separate from outside walls. This arrangement will require very heavy walls. As usual out 9 inches fire brick lining is used in the fireplace and 4½ inches behind the bridge wall. Joints in fire brickwork should be as thin as possible.

14. What should be the depth of the ash-pit? And what rule would you follow in determining said depth? A. Depth of ash-pit is generally determined by local circumstances. Think it does not matter how deep or how shallow an ash pit is, as long as it is kept clean, so as to give the air necessary for combustion free access to the grate. A deep ash-pit has the advantage that it does not need cleaning so often. As a general rule the ash pit is level, or nearly so, with the floor on which the fireman stands, and as for convenient firing, the grate should not be higher than 28 to 30 inches; the depth of ash-pit is thereby determined.

15. Should the ash-pit be level or inclined? And do you approve of water under the grate? A. It makes no difference whatever whether the ash-pit is level or sloping from or towards the bridge wall. Water in the ash-pit may be of use on river steamers to reduce the danger of the woodwork taking fire. An advantage claimed for water in the ash-pit is: By the dropping of hot ashes and cinders from the grate into the water, steam is generated, which, in passing through the hot coal lying on the grate, is there divided into oxygen and hydrogen, thus helping the combustion.

16. Should the grate surface be level or inclined? A. Do not see any advantage in inclining grate bars, unless a so-called cinder grate is used, on which the cinders finally land, and which is so arranged that it can be dropped, thus throwing the accumulated clinkers into the ash-pit. An arrangement like this will reduce the labor of the fireman in cleaning grates considerably, and also prevents the introduction of cold air under the boilers while the fire doors are kept open during the latter process.

17. Should the boiler be set inclined or horizontal? A. Boiler should, as a rule, set horizontally, or nearly so. They may be set a little lower at the rear end, so as to facilitate the draining of the same.

18. What do you consider the best mode of suspending the boiler? (*a.*) Brackets on sides resting on walls? If so, should same be fitted with expansion rollers and plates? How many lugs do you recommend for each side of boiler? Also shape and location for greatest strength? (*b.*) Suspending from cross-beams above boiler by two hook rods on each beam from eyes or lugs on each side? (*c.*) Suspension from a center? (*d.*) Do you consider wooden beams in this connection a source of danger? A. Side brackets resting on masonry may be used for short boilers. If used on long boilers, side plates or expansion rollers should be used at one end of boiler. There ought to be not more than two brackets on one side, so divided that the distance between them is about three-fifths of the total length of the boiler, or the distance from ends of boiler to center of bracket is equal to one-fifth the length of boiler. Long and heavy boilers are best suspended from two beams or girders by two or three bolts at each end. Boilers over 40 feet long should have three or even four sets of hangers, as the case may require. Both hanger bolts being quite long and provided with heavy spiral springs, so as to make allowance for expansion and contraction. Wooden beams or girders used for supporting boilers are not necessarily dangerous if kept far enough away from masonry. In these days of iron and steel, wooden girders should not be recommended, however.

19. How should the tops of boilers be protected? Is there any objection to a plain brick arch? or, should there be an air space? or, should such space be filled with cinders? A. The tops of boilers are best protected by light cast-iron plates laid over the top of same and resting on the side wall. These can easily be removed so as to allow a frequent inspection of this part of the boiler. Brick arches, in case of a leak, have to be torn away and then rebuilt again. Cinders filling in between brickwork and boilers are dangerous unless granulated blast furnace cinder is used. Cinders from boiler or blacksmith's fire are very sulphurous and consequently have a high tendency to form rush, particularly where there is heat and dampness at the same time.

20 Do you approve of outside and inside wall for the boilers with an air space between? If so, state proper thickness of inside wall on side, outside wall on side, inside wall in rear, outside wall in rear, air space between side and rear wall, thickness of wall between two or more boilers, also proper air space for same. A. Where plenty of money and room is on hand boilers may be set with air spaces between the walls. No wall should be less than nine inches thick, with three or four inches air space between them. If boilers are supported by side walls, the outside walls should be 13 inches thick and have pilasters where the boiler is resting.

21. How should the walls be stayed? A. Unless boiler walls are very heavy, they should be stayed by cast or wrought iron buch-stays, held together by rods at tops and bottoms.

22. What is the proper distance from boiler to inside rear wall to admit accessibility to the tubes and proper area for currents of gases? A. The distance between the rear head of boiler and brickwork should not be less than 12 inches.

23. How should the back connection be made? With tee bars or by arching? A. Connections between rear end of boiler and brickwork is best made with cast-iron plates or fire brick, suspended, when boilers are suspended, as the expansion and contraction will destroy an arch in short time. If resting on mud-drum stand, this connection can be arched, as the rear end of boiler will remain stationary in this case.

24. Do you know of any reason why flues touching the boiler above the water space should not be emphatically condemned? A. No.

25. What do you consider the proper area for flue for single boiler? State what rule you would follow in determining this question. A. Do not understand this question.

26. Have you had any experience with automatic damper regulators? A. No.

27. Is it, in your opinion, dangerous to have large spaces in which gases may collect for sudden ignition, producing the so-called "back draught"? A. Yes.

28. In case two or more boilers are directed into the same flue, should any provision be made for diverting the draught for each individual boiler? A. If the draughts from the different boilers come in the same direction, or nearly so, no special provision of this kind is necessary, but if the draught enters from directly opposite directions a center wall should be provided.

29. Do you think it is good practice to use auxiliary pipes in furnaces or flues for heating water? A. No. unless they are so placed that they are easily accessible, as it happens quite frequently that these pipes choke up with scale.

30. State proper height and area of stack, and the method you would follow in determining same. Also state whether you would prefer octagonal or square brick stack, and how should it be lined? A. Area of stack to be not less than three-fifths of the total area of grate openings, and height not less than 40 feet; 100 feet is high enough for any boiler stack, provided the area is large enough for the work that is required of it.

31 What is the proportion of the area of the space over the bridge wall compared to the grate surface?

32. What should be the ratio of grate to tube area for the different grades of fuel for forced and natural draught?

In the discussion following the presentation of this report, Mr. Dunden, of San Francisco, stated that it referred only to one class of boiler—namely, cylinder-tubular boiler, and that this, in the opinion of the speaker, was the poorest boiler made. Mr. Raynal, a member of the committee, explained that the report was only a record of the doings of the committee, and that it was not intended to be final, and that it only partially covered the ground. The questions were sent out with the belief that the answers received would aid the committee in formulating correct rules for setting boilers.

Mr. Rohan stated that the report was supposed to cover externally fired boilers, and was not applicable to locomotive or marine boilers. It was not a report, but only a series of questions to be sent out and to really precede the presentation of a final and thorough report. The report was received and ordered printed.

BOOK NOTICES.

INTRODUCTION TO POOR'S MANUAL OF THE RAILROADS OF THE UNITED STATES FOR 1890; by H. V. & H. W. Poor, New York.

POOR'S Manual is so well known that even an outline of its character is not necessary to our readers. The pamphlet before us forms an introduction to the manual proper for 1890, and contains a series of carefully prepared tables, showing the general condition of the railroads of the United States in 1889, their mileage, equipment, liabilities, assets, etc. A few of the figures may be interesting here. The total number of miles of railroad in the United States at the close of 1889 was 161,397, of which 5,751 miles were built during the year. The cost per mile of all roads making returns, as measured by the amount of their stocks and indebtedness, equalled $60,309. In 1889 the total investment was $9,680,942,249; the gross earnings were $1,003,736,596, equal to 10.4 per cent. on the investment, and the net earnings were $332,284,986, or 3.3 per cent. on the capital.

AN important scheme for the development of the water power of St. Louis River, at Fond du Lac, Wis., is being carried through, all the rights and privileges of the St. Louis Water Power Company having been sold for $1,000,000 to a syndicate headed by the Wilburs, of Boston. Two dams will be built sufficient to command about 64,000 horse-power.

Correspondence.

Communications giving information or opinions on matters of general interest to the engineer, the architect, the contractor, or the municipal officer, will be welcomed in this column. Fairness will suggest that when communications are sent simultaneously to this and other journals we should be informed of it at the time. Anonymous letters will not be noticed.

PARTICULARS ON STREET CLEANING.

DEPARTMENT OF PUBLIC WORKS,
BUREAU OF STREET CLEANING,
PHILADELPHIA, JULY 8, 1890.

To the Editor of THE ENGINEERING AND BUILDING RECORD:

Allow me to suggest that answers to the questions in the accompanying circular from the various towns and cities in this country would make interesting reading to many of your subscribers, as I find the subject of street cleaning is agitating the public mind to a very great extent at present.

I am frequently called upon by visitors from other places for information upon the subject, and as a reader of your paper I think it would be wise to get the information and arrange it so that one city could be heard from through each issue. Yours truly,

SYLVESTER H. MARTIN,
Chief of Bureau.

PHILADELPHIA

1. What is the population? A. 1,050,000.
2. How many houses, stores and dwellings? A. 203,500.
3. How often are ashes removed? A. Once each week.
4. How often is garbage removed? A. Three or four times each week.
5. How many miles of paved streets? A. 749 miles.
    - *a.* Cobble stones, 392.2 miles.
    - *b.* Rubble stones, 117.6 "
    - *c.* Granite block, 98.2 "
    - *d.* Macadam, 96 miles.
    - *e.* Asphalt block, 18.3 miles.
    - *f.* Asphalt sheet, 15.8 "
    - *g.* Brick, 11.2 miles.
6. How many miles of unpaved streets?
7. How often are they cleaned? A. Once, twice, three and six times weekly.
8. What is the average width of main streets? A. 50 feet.
9. Are your streets underdrained? A. Partially.
10. How many sewer catch basins? A. 7,600.
11. How often are they cleaned? Once each week.
12. What provision for removal of dead animals from the streets? A. Removed by street cleaning contractors.
13. Is the above work done by contract or by day's work? A. By contract, renewed each year.
14. What is the annual cost of cleaning the streets? A. Contract price, 1889, $425,042.
15. Does the city own the plant for street cleaning?
16. Does the city own the plant for removing ashes?
17. Does the city own the plant for removing garbage?
18. Does the city own the plant for cleaning catch basins?
19. Does the city own the plant for removal of dead animals?
20. For the supervision of all above work? A $11,920.
21. What is the final disposition of the street dirt? A. Used for filling low lands.
22. What is the final disposition of the ashes? A. Used for filling low lands.
23. What is the final disposition of the garbage? A. Fed to hogs, residuum used as fertilizer.
24. What is the final disposition of the dead animals? A. Buried.
25. Are streets swept by machinery or hand labor? A. Both.
26. What kind of hand-brooms are used? A. Bass, Push-brooms.

[In connection with what we have recently published concerning street-cleaning methods* the above will prove interesting. We have taken measures to collect further information on the subject in the way suggested by Mr. Martin, and will be glad to hear from anyone having data relating to it.]

A SYSTEM OF SIDE HILL STREET GRADES.

NEW YORK CITY, July 2, 1890.

To the Editor of THE ENGINEERING AND BUILDING RECORD:

SIR: I have been much interested in the method of determining the proper elevation of corners in street intersections on steep grades proposed in the report of Messrs. Hering and Rosewater, to which attention was called editorially in your issue of June 28, and which certainly seems to be a very satisfactory solution of a very troublesome problem.

Among the suggested queries in your editorial is one regarding permissible grades on the diagonal at intersections. In the lower left hand corner of Fig. 3, page 53, the extreme difference of elevations between two curb corners is $11.26 - 8.74 = 2.52$ feet, and the distance between them is $42 \times \sqrt{2} = 59.4$ feet, giving a grade of $2.52 + 59.4 = 4.24$ per cent. It would be interesting to know if in Duluth this side grade ever gives any trouble to vehicles rounding the upper corner, or if it has been reduced by crowning, as you suggest.

Supposing the upper side of the same figure to be north, it will be noted that the southeast block corner of the northwest intersection is 0.66 feet lower than the curb immediately north of it, and as the southwest block corner of the northeast intersection would be only 0.3 foot above the curb facing it on the north side, it would follow that if the sidewalk grades at curb and blocks lines were uniform the latter would be lower than the former for more than two thirds of the length of the block, with the effect of running the rain water against the houses for that distance. Of course this is not done, on the contrary, Fig. 2, page 54, shows the lower sidewalk on side hill streets sloping toward the curb; but if any rule could be formulated to determine just how quickly or within what limits of distance or grade this reversal of the side slope of the sidewalks can well be accomplished it would certainly be desirable, and, in connection with what has been already given, would apparently enable the engineer to decide promptly and systematically every question that could arise concerning side hill street intersections.

In this connection I would like to suggest the following arrangement of street grades on a side hill in which, by throwing some of the inclination of the up and down streets into those at right angles with them, which might otherwise be level or nearly so, the maximum grades can be very much reduced and easy access be given to every part of the district.

For instance, in Fig. 1 is shown a set of street grades on a side hill whose average slope is 30 per cent. Here, by putting retaining walls, shown by short cross lines, across every other block of the up and down streets, as recommended in the Hering-Rosewater report, and undulating the grade of the cross streets, the maximum grades are reduced to 15 per cent., which is a practicable limit. By arranging the grades as shown in Fig. 2 the maximum may be reduced to 10 per cent., or a 45 per cent. slope may be traversed on 15 per cent. grades.

SIDE HILL STREET GRADES.

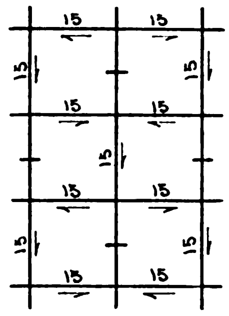

Fig 1.

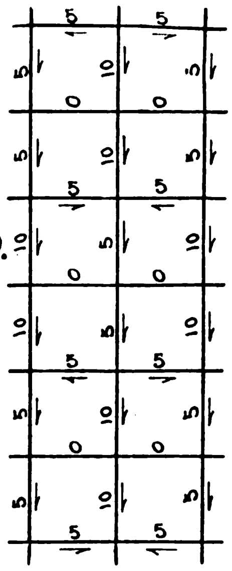

Fig 3.

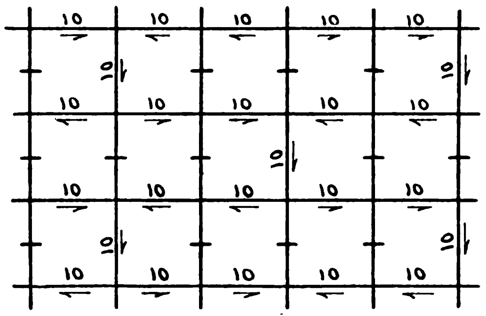

Fig 2.

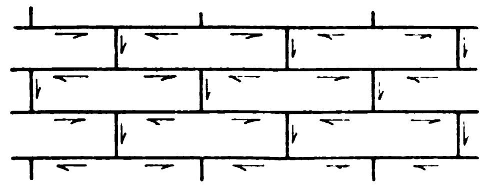

Fig 4.

If the arrangement shown in Fig. 1 is used on a 10 per cent. slope the cross walls might be omitted and the up and down streets would then have alternate grades of 5 and 15 per cent. while the cross streets would undulate 5 per cent. either way. Also, if the arrangement in Fig. 2 is used on a 15 per cent. slope all cross walls might be removed from every other up and down street, which would then have a uniform grade of 15 per cent. The other up and down streets would retain their cross walls on every other block with 5 per cent. grades between while the cross streets would undulate 5 per cent. either way.

For lighter slopes of say 7½ per cent. the arrangement might be modified, as shown in Fig. 3, where any part of the district can be reached within half a block on a 5 per cent. grade, the grade of the up and down streets alternating every two blocks from 5 to 10 per cent., while of the cross streets half of them undulate 5 per cent. either way and the other half are level.

The above typical illustrations are sufficient to show the general principle of the system which can be varied indefinitely to suit circumstances, and while irregularities of ground may seldom permit any single plan to be used for any great distance, the system will furnish a standard to be always approximated as closely as circumstances will permit.

It will be found that the best results are usually obtained by laying out the streets as nearly parallel and perpendicular to the contour lines as possible, except where the slope is light enough to permit uniform grades on an angle of 45 degrees with the contours, which will reduce the cut and fill.

In all the above figures the ground is supposed to rise from the observer and the blocks to be exactly square. The figures show the slope in feet per hundred while the half arrows point down hill. The amount of cuts and fills and hence the cost of the work will be reduced by making the blocks, or better, the distance between the cross streets (as distinguished from the up and down ones) as small as possible. This may in some cases lead to the arrangement shown in Fig. 4, in which no cross walls are used, and long narrow blocks like those in New York are substituted for the square ones with the alley through them that seem to be preferred in most western cities.

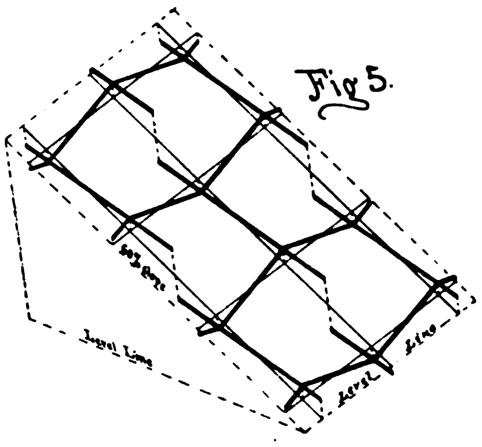

Fig 5.

Figure 5 is an isometric projection of the arrangement of grades shown in Fig. 1. The scale is the same, but in order to show the variations of slope more distinctly that of the side hill has been taken at 60 per cent., and that of the streets at 30 per cent. The centers of the streets are shown in heavy black lines, the breaks indicating the location of the retaining walls. The light lines are the projections on the side hill of the center lines of the streets and the distances between them and the heavy lines show the amount of cut and fill. The construction lines are dotted.

H. W. BRINCKERHOFF.

Notes and Queries

on Domestic Engineering.

Communications relating to the practical details of plumbing, heating, lighting and ventilation will be welcomed in this column. The writer's true name and address must always be given, but an assumed name may be used for publication if preferred.

HOT-WATER RADIATORS ON A LEVEL WITH BOILER.

"ARCHITECT," of Cairo, Ill., writes: "Can a hot-water heater be set up as well on a level with the ground floor—that is, in the first story of a house as in the basement or cellar? Can it work to as good advantage in heating the first and second stories? In this town there are no cellars."

[In our issue of July 12, 1890, we show an arrangement of securing circulation through hot-water radiators placed below the level of the boiler. The flow pipe from the boiler is first carried up some distance, in this case to the top of the first story, and is then brought down to supply the radiators.

The plan has given entire satisfaction. The same method is frequently applied where indirect hot-water heating is employed, and where the indirect radiators are only slightly above the level of the top of the boiler. The working conditions of such radiators corresponds very nearly with those on "Architect's" first floor, the boiler and radiators there being on the same level. If our correspondent, therefore, will apply the principle illustrated in our former issue he will have no trouble in getting proper circulation in his first floor radiators. The second-story radiators call for no special considerations, and ought to work well when connected in the customary manner. We would suggest, however, that independent circuits be used for each story. With this arrangement each set of radiators will have its own main flow and return pipe, and there will be no opportunity for the upper radiators to circulate at the expense of the lower ones.]

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* See Vol. XXI. Pages 154, 186, 201, 212, 217.

Questions and Answers.

All questions relating to building construction, paving, sewerage, water supply, or kindred subjects, will be welcomed in this column provided they relate to matters of general interest and are not such as should properly be referred to a consulting engineer. Answers will be carefully prepared and a proof of both question and answer mailed to the inquirer as early as proper consideration will permit. They will be published for the benefit of other readers as soon as convenient. The full name and address should be given, not necessarily for publication, but as a guarantee of good faith, and to facilitate further correspondence in case the question is not sufficiently explicit.

Inquiries of the Editor, in order to secure prompt attention, should *not be written on the same piece of paper as a communication* to the *Publishing Department.* Letters renewing subscriptions are sent to a clerk in the publishing office, and matter for the Editor, if in the same enclosure, is likely to be overlooked unless it is on a separate piece of paper, so that it may be promptly sent to the Editor.

HOW MANY LEAKS ARE ALLOWED IN AMERICAN WATER MAINS?

W. Perry, Jr., hydraulic engineer, Montreal, P. Q., writes: "Would you, through your columns, ask the water-works engineers and superintendents of the United States if they allow seven leaks per mile in jointing cast-iron water pipe? My reason for asking you this question is, I saw a letter in one of our city papers saying that there was an average of four leaks per mile, and that the best American engineers allowed for seven leaks per mile. If such is the case it is the first time I ever heard of allowing for bad work in jointing water pipe. Water works men generally pride themselves in having as few leaks as possible."

[We quite agree with our correspondent that it would be a peculiar practice to make allowance for bad work in jointing water-pipe. One leak per mile ought to be sufficient to call for repairs.]

The contractors for paving Broadway and Park Row' New York, were notified on the 5th inst. by Public Works Commissioner Gilroy to begin the work on those thoroughfares within five days. The carrying out of these orders will make it necessary for the Broadway Railroad and the Third Avenue Railroad companies to make haste with their cable trenches. Unless the trench work is done before the new pavement is laid the Department of Public Works will oppose it. No permits can be secured for work that will necessitate the tearing up of a newly laid pavement.

In consequence of low water in the city reservoir at Amsterdam, N. Y., well water is being sold on the streets for five cents a pail. Many are afraid to drink the reservoir water because they think it impure. The water continues to recede, and just now there are said to be great fears of a water famine.

THE JOURNEYMEN PLUMBERS AND STEAM FITTERS.

The Journeymen Plumbers' and Steam Fitters' Association concluded its convention at Pittsburg on the 1st inst. The following officers were elected for the ensuing year: President, P. J. Quinlan, of Boston; First Vice-President, George McDonald, Denver, Col.; Second Vice-President, A. A. McLaughlin, Worcester, Mass.; Third Vice-President, M. J. Driscoll, Brooklyn; Fourth Vice-President, Thomas C. Shannahan, Pittsburg; Secretary, Richard A. O'Brien, Washington; Treasurer, P. H. Gleason, Brooklyn; Executive Board, representing Northern States, Edward Carroll, New York; M. J. Coolahan, Pittsburg; representing Western States, James H. Doyle, St. Paul; Charles H. Signor, St. Louis; Eastern States, James J. Doody, Brooklyn; J, Scott, Lowell, Mass.; Southern States, John M. Haupt, Baltimore.

In the matter of a uniformity of wages, it was decided that to form a national scale would be impossible, owing to the difference in prices of living in different localities. It was therefore agreed to elect a vice-president for each State, whose duty it would be to call conventions of delegates from the local unions in his State to regulate wages, apprentice laws, hours of work, and to confer with master plumbers as to the condition of the trade and consult with them as to means for improving it. It would be also the mission of the Board of Conference to arbitrate in the case of disputes and adopt such plans as would obviate, once and for all, all occasion for strikes.

The Vice-Presidents chosen for this work were: For New York State, Edward Carey; Colorado, M. J O'Garra; Massachusetts, A. A. McLaughlin; District of Columbia, N. J. Plast; Maryland, C. E. Zimmisch; Virginia, A. J. Bowman; Minnesota, J. F. Grillow; Nebraska, M. J. Conway; New Jersey, Thomas Hart; Connecticut, J. J. Flinn; Pennsylvania, James Robinson; Washington, D. H. DeClark; Missouri, William F. Coakley. The States not represented will be notified to send a name to the National Association to be appointed. The officers were installed and at 6 o'clock the convention adjourned. The next convention will be held in Denver, Col., on the last Monday in July, 1891.

USE OF LEAD TO PREVENT SLIPPERY PAVEMENTS.

Mr. J. C. Merriweather, of Greenwich, England, proposes a combination of lead with paving materials to prevent slipping. One plan is to place lead plugs or strips at or in the joints of paving blocks; preferably at the intersection of cross and longitudinal joints, and another is to use the same device in coalhole or manhole covers, the theory being that "lead is sluggish and bites."

It is a very difficult material for either a man or horse to slide on, but as heretofore used for wheelways, noticeably on Holborn Hill, London, it proved too soft to stand the traffic, while its value to the junk man proved a strain on the street Arabian under the trials of London life.

In coalhole and other covers in a sidewalk its use would be very grateful to pedestrians, while its employment in granite slabs might save a great deal of channeling now resorted to when they grow too slippery through wear for safety.

DOMESTIC
PLUMBING HEATING LIGHTING & VENTILATION
ENGINEERING

THE BENEFITS OF PLUMBING INSPECTION.

At the recent convention of the National Association of Master Plumbers at Denver, John J. Weaver, of Philadelphia, read a paper on plumbing inspection, in which he said that "one of the benefits is that inspection of plumbing and house drainage secures to the householder good plumbing; for, as the rules must be complied with the plumber must, therefore, be abreast with the times, for if he does not know how to work properly he must learn, or else quit the business.

"The inspection of plumbing and house drainage says to the householder: 'Stand by the department in seeing that the plumbers furnish a certificate of final inspection,' and they will find that the department is the means through which has been avoided the ventilation of the drain into the hot-air pipe of the heater, or the impregnation of the ground from leaky joints in soil pipes. It is presumed that in other places the same proportional beneficial results have followed the establishing of plumbing and house drainage as have been observed in Philadelphia.

"During the years, 1884, 1885 and 1886, the three years immediately preceding the establishment of house plumbing and house drainage in Philadelphia, the number of deaths from the principal zymotic disease was 8,897, and during the years 1887, 1888 and 1889, the three years immediately succeeding, the deaths from the above diseases were 8,401, showing a decrease of 436, a yearly average for the three years' life of the department of 165⅓.

"The householders are fast finding out that the conscientious, competent plumber does not deserve the abuse that so often has been heaped upon him by those who are ignorant of the amount of brains, as well as brawn, which is necessary to properly conduct the plumbing business, that the plumber is as important, if not more so, than the physician, for his work, if well done, prevents the diseases which, when once contracted, the physician cannot always cure.

"Now we must admit that whatever benefits the householder must benefit the plumber, for upon such customers he depends for prosperity in his business.

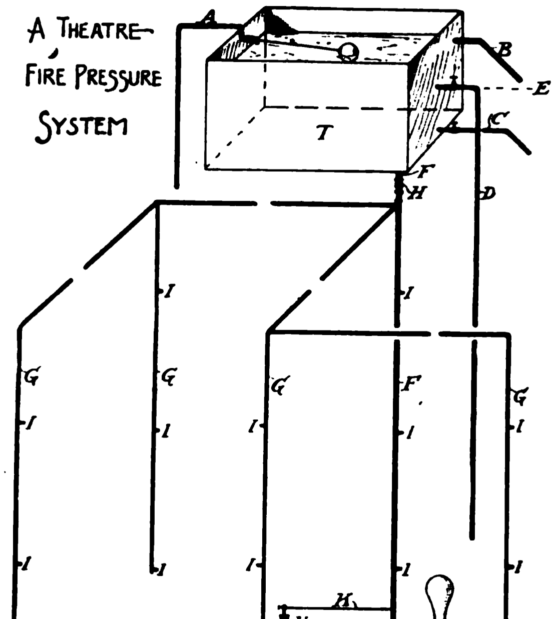
"The inspection of plumbing and drainage has been a powerful lever in raising the plumbing business to a higher standard, by showing the community that those who know how to do work properly were among the number active in establishing the inspection of plumbing and house drainage, having that commendable pride in their business which would not allow the death-rate of the city or town in which they lived to be increased through criminally defective plumbing, if such could be prevented by the inspection of their own work along with that of others who had no further interests in their trade than the amount of money to be made out of each job.

"The establishing of rules and regulations for inspection of plumbing by the Board of Health, or some other competent department, gives such a security to our customers that, where formerly they would have only crude and cheap fixtures, they now desire not only to increase the number of plumbing conveniences but to have them of elaborate and expensive material, all of which, of course, tends to the advantage of the plumber.

"Finally, inspection of plumbing and house drainage is increasing the number of plumbers who do good work, for no plumber can truthfully say that he alone in his city or town, where such inspection exists, is the only plumber who does good work. It increases the number of those who believe that good work pays, and have learned that their customers are willing to allow them a living profit for the same. In short, those who conceived and executed the thought of having plumbing and house drainage inspected by the Board of Health, or some other responsible authority in which the customers of the plumbers may have confidence, builded better than they knew."

A THEATRE FIRE PRESSURE SYSTEM.

The automatic steam and tank pressure arrangement for general and fire purposes in the Broadway Theatre, New York City, is shown in the accompanying diagram, where T is a 6,000-gallon iron roof tank, filled through a pump pipe A. B is an overflow. C is an emptying pipe. The general house supply is through a pipe D, which pierces the tank at E half way up, so that it can draw off the water in the upper half of the tank only, always leaving below the level E 3,000 gallons of water that can be drawn only through the fire line F, which has branches to four other lines, G G, etc. H is a check valve, closing by an upward pressure, I I, etc., are hose cocks. J is a Worthington pump with a patent automatic pressure regulator connected by a pipe K to the pump pipe F. Steam, at a pressure of about 60 pounds, is always kept up, received through the pipe L. A spring at N is regulated so that a pressure of about 70 pounds in the pipe will balance the steam pressure in the pipe L and close a valve at M. If, now, water be drawn from any hose cock I the pressure is diminished, the steam opens the valve M and starts the pump, whose pressure closes the check valve H and allows the pump to work at any pressure on the fire streams until the hose cocks are closed and the pressure in the pipe F becomes great enough to close the valve M. The tank water is thus shut off while the pump is working and so is preserved for use while the pump is starting if the street supply should fail.


A THEATRE FIRE PRESSURE SYSTEM
A
B
E
C
T
F
H
D
I
G
F
H
N
L
M
J
THE ENGINEERING AND BUILDING RECORD

This arrangement is illustrated from a description by W. R. Bracken, of the firm of Moody & Bracken, of New York City, who did this work, with the other plumbing in the building.

HEATING AND VENTILATING SCHOOL-HOUSES.

(Continued from page 139.)

THE solution of the problems in school-house heating and ventilating, pointed out last week by Mr. William E. McClintock, has brought out some ingenious methods of conveying heat in, and foul air out, some of which are described by the author as follows :

SHURTLEFF SCHOOL, CHELSEA.

This is a three-story stone building with 16 rooms and a hall equal to two more rooms, and the coat rooms to correspond. The system in use in this building is what is known as the Smead & Northcott and includes the heating, ventilation and sanitation.

The building is divided into two equal parts, each being treated exactly alike. The fresh air is introduced through windows in the basement into chambers. Thence it passes into brick flues, and by means of a damper can be passed directly into the rooms, or first passed over the heater and then into the rooms, or part of it can go by each channel and be admitted to the room at any desired temperature by working the damper. The heater consists of a long fire-box protected by a corrugated iron lining that allows an air space between it and the casting of the box itself and which prevents the fire-pot being heated to a red heat. The flame and smoke pass out of the rear end of the fire-pot, then back through a series of tubes to the front end of furnace, when it again passes to the back end through a smoke pipe, and thence to the smoke flue. The air to be warmed thus comes in contact with a very large surface at a comparatively low temperature. The damper that allows the warm and cold air to mix is regulated by a crank in the school room and is worked at the will of the teacher alone The warm air is introduced into the rooms through a register in the wall about 8 feet above the floor, except in one or two cases where the construction of the building would not permit.

The foul air extractors are in the side walls at the floor on two or three sides of the room other than the side with the heat register. The extractors are in the aggregate a little larger than the inlet for warm air. These are 3-inch strips, fastened to the floor timbers and at right angles to same, that allow of a free circulation beneath the floors which are nailed to these strips. This last method has, I think, been abandoned at the present time on account of the extra danger of the rapid spread of fire. Vertical wooden flues, tin lined, pass down from each room, connecting with the space under the floors, and ending in a large brick gathering room.

From the gathering room the air passes into and through a tunnel that doubles on itself, and then by a right-angle turn, ends in the side of the bottom of the main stack, which is of brick and ends 4 feet above the roof. The inside dimensions of this stack are 3.55x5.62. A small heater in the stack at the cellar floor will heat the stack to a temperature of 92° Fahr., if desired, creating a current having a velocity of between 10 and 11 feet per second. An arrangement of closets and seats over the tunnel referred to furnishes a sanitary convenience. The fœcal matter is received on a brick floor so laid on iron as to give a 6-inch air space beneath it. On the boys' side the urinals discharge by pipes into the same tunnel. All of the moisture seems to be evaporated from both the fœcal matter and the urine, leaving a dry and almost inodorous substance which can be saturated with oil and be burned if so desired. The draught is at all times down through the seats when the covers are raised, with a velocity of from 6 to 10 feet per second. No smell can be perceived either in the closets or urinals, although some 800 or 900 pupils use them.

Air meter tests give a good flow of air under various conditions and in the direction planned and at rates that show the air in the room to be changed in from 9 to 16.4 minutes. The best results are when the stack is heated thoroughly and the air moves with a mean velocity of 5.5 feet per second. Allowing the school to be full, we have 450 pupils to each stack, and with 20 cubic feet per pupil, we have to discharge 9,000 cubic feet per minute, or at the rate of 5.5 feet per second. In order to get 30 cubic feet per second we must have a velocity in the stack of 8.5 feet per second.

A few tests have been made in this building to ascertain the amount of carbonic gas. These tests were made just before the noon closing, and showed at the breathing line 14.36 parts, and at the outlets 16.53 parts to the 10,000. This showing is rather a disappointment, but goes to prove that in order to get as low as 10 parts in 10,000 we must allow more than 20 cubic feet per minute. These results compare favorably with Prof. W. R. Nichols' examinations of 29 school rooms in Boston in 1880, when he got a mean of 15.6 parts per 10,000.

The cost of introducing the whole of the heating, ventilation, and sanitary appliances was $7.000.

BROADWAY SCHOOL.

This is a two-story wooden building with four rooms, each 28x32 feet, and 14 feet high. The building was originally heated by steam pipes running around three sides of each room, the steam being furnished by a tubular boiler. The ventilation consisted of an outlet flue; but no means were furnished to allow fresh air to come into the rooms.

There are 56 pupils in each room. The intention was to allow 25 cubic feet per minute per pupil when the building was remodeled in the year 1888. The steam pipes were left in their original position in order to act as supplementary heaters during very cold weather, and are intended to be used when the temperature is extremely low.

Steam coils are placed in the cellar, one each for a room, and these are connected directly with the outside air by flues having a clear opening of 30x18 inches, covered by a wire netting of ⅜-inch mesh. The flues allow the air to pass over the steam coil and thence into the school-room, being delivered into the room at a point about eight feet above the floor and on the side with no windows. The amount of air admitted through these flues can be regulated by means of a damper in each flue.

The foul air is removed by ducts built of lath and plaster work up to the attic floor, and from there the four ducts join together into one in the center, and near the roof have an inside measurement of 31 5x40.5 inches, or 8.86 square feet. The section of the ducts from each room is equal to 3.76 square feet. The main ventilating shaft ends just above the ridge of the roof in a cupola having wire netting around the openings to keep out the birds, etc. In the upper part of the main ventilating shaft there are six lines of 1¼-inch steam pipe passing around the four sides and heating the air of shaft. The flue for ventilation in each room has a register in the wall at the floor and one at the top of room. The lower register is the same size as the warm air flue, 30x18 inches, the upper one being slightly smaller, 18x10, for no other reason than that it was built so and not changed with the rest of work. The ventilating outlet is on the same side of room as warm air inlet. The expense of refitting this building as described was $450, which includes the indirect steam heaters, cold air boxes, flues for warm air to rooms, ventilating ducts from attic floor through the roof, and all the registers and fitting.

Several experiments have been made to see the amount of air passing into and through the rooms, and its quality in the rooms. Trials in the main shaft above the points of delivery for the individual flues gave as the rate for the whole building 16 8 cubic feet per minute per pupil.

There are two slight changes that could be made in this building that would probably add to the efficiency—viz.: The steam for the coil in the top of the main flue should come from a separate small heater or from the main boiler with shut offs for the other rooms ; as the rooms are heated too much when the outside temperature is high if more than two pounds are indicated on the gauge, while that amount will give good results in the shaft. The second change is to divide the cold-air shaft just before entering the coil box with a damper to allow the cold air to pass directly into the rooms or through the coil for heating or to be mixed to give any required temperature before entering the rooms. One other evil in this building results from the direct steam pipes in the rooms. These are often used by the janitor to heat the rooms in the morning quickly, but they are not always closed when the session opens. The result is too much heat ; and it is necessary to open the windows for comfort.

CARTER SCHOOL, CHELSEA.

This is a four-story brick building and as remodeled has what is known as the Fuller & Warren system of heating and ventilating. There are 16 rooms, a hall equal to two rooms, and the usual coat room.

The fresh air is introduced through galvanized iron boxes opening through the cellar wall, two at each end of the building, dividing the same into four equal parts. The air passes from the air boxes into the brick chamber where the heater is located, entering the same at the bottom. The heated air passes from the top of the heating chamber into brick flues that lead directly to the different rooms. The hot-air flues pass to the bottom of the furnace, where there are openings that allow the cold air to pass into the same and then into the rooms direct, if desired ; or where it can be mixed with the heated air to any desired temperature by means of a damper that is controlled by either the janitor, by a chain at the furnace, or by the teacher with a crank at the inlet register in the school-room. A double-acting damper closes the cold-air inlet before passing to the heater and at the same time opens the down extracting flue from the rooms, allowing the warmed air from these rooms to be heated over again during those times when school is not in session. This is no doubt a good thing as far as economy of fuel is concerned, but it is leaving a great deal to the honesty of the janitor ; or it affords a great temptation for him to be late about his fires in the morning if he so desires. Of course this damper should never be used when school is in session. The warm air is introduced into the room at a point about eight feet above the floor through the side wall, opposite the windows.

The foul air extractors are located in the floor or side walls at the floor, and are of tin-lined wooden construction and pass down to a brick chamber in the cellar below the concrete floor level from which point they pass into the base of the main stack, which is of brick, and passes up to a point about 4 feet above the roof. A small heater in the base of this stack, fired from the cellar, raises the temperature in the stack so as to give a good flow of air up the shaft and suction down from the rooms. The main stack has an area of 4x7 feet, and one is located at each side of building taking the air from eight rooms. Area of down extracting flues is about 640 square inches. The heater used here is a round furnace with tubes in the top to give an increased heating surface.

The State inspectors have got as high as 30 cubic feet per scholar per minute from all the rooms. At the only time I tried the discharge I found the air flowing through the stack at the rate of 11,620 cubic feet per minute, while 12,000 would allow 30 cubic feet per minute per pupil. Although I found this to be the mean flow I also found that in certain rooms we failed to get so good a result, the amount lessening somewhat as we reached the upper floors. Trials made since show this defect to be remedied mostly, if not wholly ; and it is safe to say that the pupils are getting the full 25 if not 30 cubic feet needed.

A test of the air in this building showed there were but 8.63 parts of carbonic acid gas at the breathing line and 9.08 parts at the outlet per 10,000. This result was obtained in a room on the second floor at 11.30 just as school was let out, but before the doors had been opened. The cost of putting in the heating and ventilating was $6,456.

I think I have said enough to show that there have been cases of badly ventilated buildings in which school children have had to work much to their disadvantage ; and that changes are taking place that are giving good results theoretically, and which will give to our children what is of far greater advantage than an education, and that is good health.

(To be continued)

COST OF ONE-INCH BRANCH TEE COILS.

THE Boynton Furnace Company, of New York, sends us the accompanying table giving the cost of 1-inch branch tee coils of various sizes. To steam and hot water fitters and engineers its convenience is at once apparent, giving as it does at a glance the area of heating surface in any size of coil, the cost of the complete coil, and the cost per square foot of heating surface. The table takes into consideration the cost of the pipe, right and left ells, branch tees, hook and expansion plates, plugs and wood brackets, and putting up, but does not include the cost of supply and return valves, air valves, nor the cost of connecting the coils with a distributing system after they have been made. The largest run of branch tees has been figured on, and the figures in general have been so taken that the prices given in the table may be considered as outside prices. Of course they will vary somewhat, according to locality and the ruling discounts on pipe and fittings, for which allowance must be made.

COST OF ONE-INCH BRANCH TEE COILS.

Discount on pipe from 1½ inches up, 55 per cent.; 1¼-inch pipe, down, 45 per cent. Discount on fittings, 70 per cent. Time, $6 per day for man and helper (10 hours per day).

Number of Hook Plates.	Length of Spring Pieces in ft. (lineal)	Height of Coils in Number of Pipes.	Length of Coils in ft. (lineal)	Time Required. Days.	Lineal Feet of Pipe in Coils.	Square Feet of Heating Surface.	Cost of Coil.	Cost Per Square Foot of Surface.
1	2	4	5	¼	28	9⅓	$5.90	63¼c.
2	2	8	5	½	56	18⅔	10.37	55½
2	2	4	10	½	48	16	6.90	43
2	2	8	10	¾	96	32	12.37	38½
2	2	12	10	1	144	48	17.96	37½
2	2	4	15	½	68	22⅔	7.90	30⅞
2	2	8	15	¾	136	45⅓	14 37	31¾
2	2	12	15	1	204	68	20.96	30¾
2	3	4	20	½	02	30⅔	9.10	29⅝
2	3	8	20	¾	184	61⅓	16 77	27⅜
2	3	12	20	1	276	92	24.56	26⅝
2	3	4	25	½	112	37⅓	11.60	31⅛
2	3	8	25	1	224	74⅔	20.27	27⅛
2	3	12	25	1¼	336	112	29.09	26
3	3	4	30	½	132	44	12.81	29
3	3	8	30	1	264	88	22.50	25½
3	3	12	30	1¼	395	132	32.56	24⅝
3	3½	4	35	¾	154	51⅓	13.93	27⅛
3	3½	8	35	1	308	102⅔	24 70	24⅛
3	3½	12	35	1½	462	154	35 86	23¼
4	3½	4	40	¾	174	58	15.06	26
4	3½	8	40	1	348	116	27.11	23⅜
4	3½	12	40	1½	522	174	39.36	22⅝
5	3½	4	45	1	194	64⅔	15.84	24½
5	3½	8	45	1¼	388	129⅓	30.93	24
5	3½	12	45	1½	582	194	45.36	23⅜
5	4	4	50	1	216	72	18.84	26
5	4	8	50	1¼	432	144	33.13	23
5	4	12	50	1½	648	216	48.66	22½
6	4	4	55	1	236	78⅔	20.20	25⅝
6	4	8	55	1¼	472	157⅓	35.55	22⅝
6	4	12	55	1½	708	236	52.16	22 1/10
6	4	4	60	1	256	85⅓	21.20	24⅞
6	4	8	60	1¼	512	170⅔	37.02	21 7/10
6	4	12	60	1½	768	256	55.16	21½

THE largest cistern in the world is claimed to be under the machine shop at the Charlestown, Mass., Navy Yard. It is 100 feet in diameter, with a depth of 40 feet. It was built in 1858 by Master Laborer Otis Little, and supplied water to the great machine plant. The cistern was fed from a number of wells on the higher land near Chelsea Street by means of underground aqueducts. More than 850,000 bricks were used in its construction. This mammoth well has not been utilized since the introduction of Mystic water into Charlestown in 1865.

NEWARK, N. J., is considering the advisability of having electric wire subways. A short length of subway has been in use for over a year past, but subways are now proposed in a large number of streets.

STEAM-HEATING IN THE MECHANICS' BANK BUILDING, NEW YORK.

PART II.—THERMOSTATS, STEAM VALVES, ELECTRO PNEUMATIC VALVES AND DIRECT RADIATORS.*

ALL the heating in this building is automatically controlled by thermostats placed in each room, and operating pneumatic valves that regulate the admission of steam to the radiators and warm air to the conduits.

Figure 3 shows the details of the thermostat that may be set to work at any temperature, and is claimed to operate satisfactorily within a range of one degree. The figure shows the back of the instrument that is mounted on a brass bed-plate P, to which are fixed the standards A B B that carry the mechanism and have holes Z Z for attaching it to the wall or other convenient support. One end of lever C is connected to A by the pivot D, and the other end by a screw F tapped through lug E.

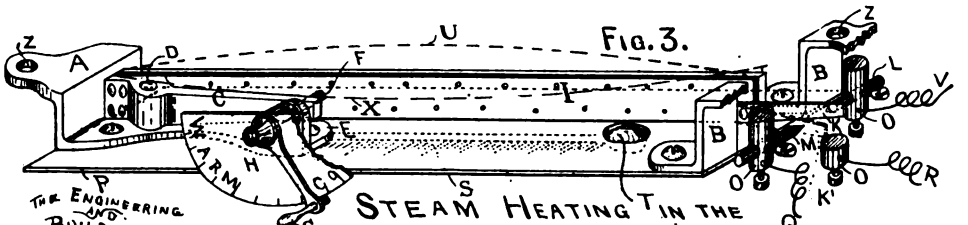
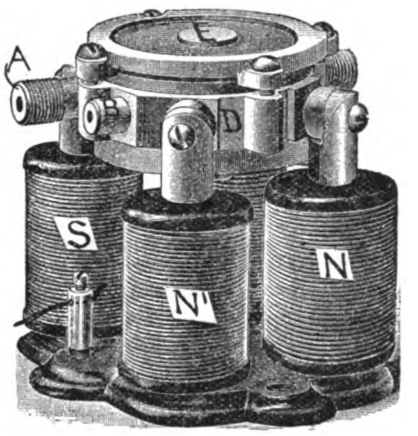


Fig. 3.

Steam Heating in the Mechanics Bank Building N.Y.



Steam Heating in the Mechanics Bank N.Y. Fig. 4.

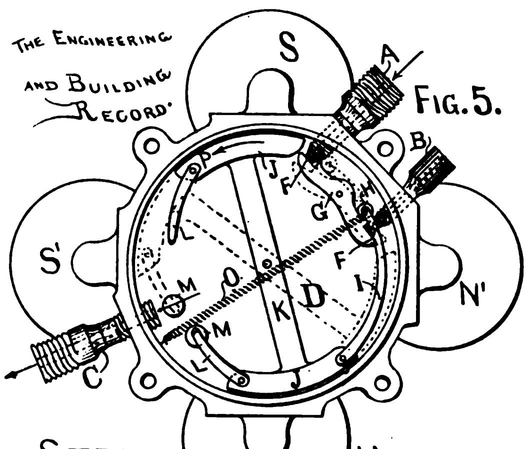


Fig. 5.

Steam Heating in the Mechanics Bank Building

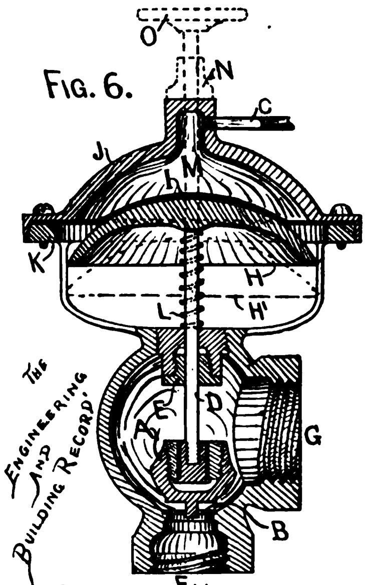
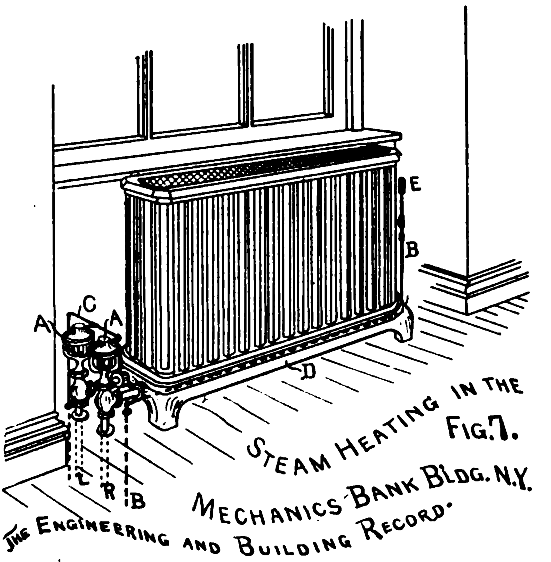


Fig. 6.

Steam Heating in the Mechanics Bank Building



Steam Heating in the Mechanics Bank Bldg. N.Y. Fig. 7.

The expansion bar I is made of a plate of brass and a plate of rubber riveted together and attached to lever C at pivot D.

The other end of the bar is free and carries a platinum contact bar K. O O O are bind posts fixed on plate B, and receiving the circuit wires Q R V, and the adjustable contact points L and M. The rubber and brass in bar I expand and contact differently for the same differences of temperature, so that a rise in temperature will make it bow out to the (exaggerated) position U, and throw K to K' in contact with M, thus completing the electric circuit from R through Q and opening the valve.

A fall in the temperature bows out I in the opposite direction to the (exaggerated) position X and makes contact between K and L, thus completing the circuit from R to V and closing the valve.

By moving lever G along the scale H, screw F is turned and swings lever C on its pivot D so as to set the bar K nearer to either L or M, and make the thermostat operate at any desired temperature within 15 degrees of that originally provided for.

T is a thermometer with scale S on the face of plate P, the thermometer is entirely independent of the thermostat and in no way connected with its operation, but is attached to it simply for convenience.

The current from the thermostat operates the electro pneumatic valve, of which Fig. 4 is a general view and Fig. 5 is a plan with the top E removed.

The chamber D is substantially a three-way valve with its ports opened and closed by a pair of electro magnets. A, C and B are tubes to the compressed air main, to the steam valve, and a free vent, respectively. C is always open into chamber D. A is open when B is closed and vice versa. N S and N' S' are electro magnets. J J are armatures connected by cross piece K that is pivoted in the center.

Lever G, pivoted at the center, has its faces F F covered with rubber into which the sharp edges of tubes A and B sink and make tight joints. The arm I is pivoted to one end of armature J, and carries the contact roller H that has its bearing on G maintained by the spiral spring O. The operation by the thermostat, Fig. 3, is as follows: Air pressure is always maintained in tube A, suppose it to be shut off as shown in Fig. 5, then the vent B is open and the steam valve operated through pipe C is open; if now the temperature rises a little and operates the thermostat it sends a current through V and magnatizes the poles N' S', which then attract the armatures J J that revolve in the direction P, and the movable parts of the mechanism take the positions shown by dotted lines; lever G opens A and closes B, and the pneumatic pressure in C closes the steam valve. When the temperature has fallen sufficiently the thermostat changes the current from V (Fig. 3) to Q, which correspondingly cuts it off from electro magnet N' S' and sends it through electro magnet N S, which then attracts the armatures J J back to the original position, shutting off air pressure through A, opening vent B and allowing the steam valve to open as pressure fails in C. L L are contact springs that switch off the current through conductors M M as soon as the armatures reach their extreme positions, thus cutting off the current and saving the battery.

Figure 6 is a sectional view of the steam valve and shows its operation by compressed air from tube C, Fig. 5. F is the steam inlet, and Q its outlet. B is the valve seat and A the poppet valve, whose stem passes through a stuffing box E and is fastened to a wooden head H.

I is a circular rubber diaphragm, clamped between the hemispherical shell J and the ring K. L is a spiral spring that opens the valve A as shown, when there is no pressure in chamber M; if pressure be admitted through C, the diaphragm and stem head will be forced down towards position H', indicated by dotted lines, and the valve will be closed and steam shut off as long as pressure is maintained in M. This cut shows the valves as used in this job, but in some cases the stem D is continued to pass through another stuffing box N and terminate in a handle O, shown by dotted lines, so as to admit of regulation by hand at the radiator independently of the thermostat system.

Globe valves, gate valves and other forms are also arranged in the same manner.

Figure 7 shows the arrangement of the valves illustrated by Fig. 6, on the Bundy radiators D, which are in most cases placed under the windows. L is the live and R the return steam pipe. A A the valves controlling their delivery, and C' is the air pressure pipe. E is the air valve, and B its vent pipe.

(To be continued.)

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*Part I.—Arrangement of Exhaust Main, Boiler Feed Heater and Warming Fresh Air Blasts was published August 2.

TRADE PUBLICATIONS.

EXHAUST STEAM ECONOMIZER.

THE "Vacuum" exhaust steam economizer, made by Warren Webster & Co., of Philadelphia, Pa., is described and illustrated in detail in a new catalogue just issued, and dated July, 1890. A large number of testimonials from different sources are printed, tending to show that the apparatus is in extended use. As its name implies, the apparatus is designed to use exhaust steam economically in heating feed water for boilers and in acting as a purifier.

TUBULAR WELL SUPPLIES.

THE Cook Well Company, of St. Louis, Mo., have sent out a new catalogue in which they illustrate and describe their tubular well supplies and their system of tube wells. Strainers, pumps, hydraulic jacks and a large number of details are shown, and tables of sizes and prices are given.

STEAM AND WARM AIR HEATERS.

THE new catalogue recently issued by the J. F. Pease Furnace Company, of Syracuse, N. Y., gives detailed descriptions of their warm air furnaces and combination steam and warm air heaters. A large number of engravings are given, and also extensive tables of sizes.

THE MULFORD BOILER.

THE Mulford Heater Company, Galva, Ill., are sending out their new 1890 catalogue, in which their steam and hot-water heating boilers are illustrated and described at length. Interesting chapters also are given on steam and hot-water heating, the difference in cost between the two systems, fuel consumption, etc. The concluding pages contain directions for starting and managing the boiler, tables of prices and sizes, and numerous testimonials.

VALVES AND HYDRANTS.

THE Galvin Brothers' Valve and Hydrant Company, of Detroit, Mich., have issued a neat, new catalogue, devoted to their several water-works and steam specialties. A large number of different forms of gate valves for both water and steam corporation stop cocks and hydrants are illustrated and described, and sizes and prices are given.

The company are sending out also copies of a decree of the Circuit Court for Wayne County, rendered June 30, 1890, according to which their Mr. James Galvin is made sole owner of the contested patent on a swinging wedge gate valve.

CONTRACTING NEWS DEPARTMENT.

A WEEKLY RECORD

OF SPECIAL INTEREST TO CONTRACTORS, BUILDERS AND MANUFACTURERS OF ENGINEERING AND BUILDING SUPPLIES.

ARCHITECTURAL COMPETITION.

KENT, WASH. — Building. — Plans are wanted. no date specified, for erecting a $10,000 school building at this place. Address Clerk Board of Education, as above.

CONTRACTING INTELLIGENCE.

For works for which proposals are requested see also the "Proposal Columns,' pages i-ii-158.

WATER-WORKS WANTED.

CHESTER, N. Y., August 5, 1890.

To the Editor of THE ENGINEERING AND BUILDING RECORD:

DEAR SIR: We have a scattering village here of perhaps from 700 to 1,000 inhabitants, and have been talking water-works for the past year. We have incorporated fire limits, but as yet have not been able to get water put in. Can you recommend me to any parties that would be likely to take hold and help put through a system of water supply if we can show good return for the investment.

GEORGE M. ROE.

IRON MOUNTAIN, MICH., Aug. 4, 1890.

To the Editor of THE ENGINEERING AND BUILDING RECORD:

We have no paved streets, no system for cleaning, etc. We are about to get streets into shape and introduce sewerage and water supply systems.

F. E. WOODBURY,
City Engineer.

BUENA VISTA, VA., Aug. 6, 1890.

To the Editor of THE ENGINEERING AND BUILDING RECORD:

The City of Buena Vista wishes to buy hook and ladder truck, hose wagon, and a number of 2½-inch linen rubber-lined fire hose. Address C. BARGAMIN,
Supt. City Water-Works.

WATER.

For Additional Water Items see Proposal Columns.

MURPHYSBORO, ILL.—M. T. Stookey, manager of the Belleville, Ill., Water-Works, is the contractor for the new Water-Works here and electric light plant. A stand-pipe has been contracted for, to be built by Riter & Conley. of Pittsburg, and a Hyatt filter will also be put in. The new works are almost completed.

ST. ALBANS, ME.—There is a project for a water-works system being discussed by the local officials.

MAMMOTH SPRINGS.—According to reports a stock company has been organized at this place for the purpose of establishing a system of water-works.

CLINTON, TENN.—It is about settled that this place will establish a water-works system.

BASTROP, TEXAS.—It is probable that the work of constructing the proposed water-works system for this place will be commenced before long.

GOLDENDALE, WASH.—The local officials have decided to establish a system of water-works at this place.

TRENTON, TENN.—Reports say that this city has voted $20,000 in bonds for the construction of water-works at once. Mayor M. Oppenheimer may be addressed.

GREENSBORO, ALA.—The people of this place have voted for water-works, and bonds will be issued at once. Mayor W. W. Powers can furnish information.

NORTH BROOKFIELD, MASS.—The people of this place are complaining of a shortage in the water supply, and there is a movement to increase it.

ST. LOUIS, MO.—Bids will soon be opened for the construction of six new settling basins by the Water-Works officials, to cost about $1,000,000.

FULTON, KY.—This city has decided to issue $25,000 for the purpose of providing for the erection of a system of water-works. Address the Mayor for particulars.

CORRECTIONVILLE, IOWA.—Reports say that this place is to have a system of water-works, and that the Town Clerk can furnish particulars,

ST. PAUL, MINN.—The Minnesota Subway Conduit Company has filed articles of incorporation with the Registrar of Deeds. The capital stock is $10,0000, and the project is to operate conduits and lay pipes conveying water from Lake Superior across Minnesota Point and Bay of Superior to the State line between Minnesota and Wisconsin. The following gentlemen are the incorporators: C. A. Severance, C. W. G. Withee, W. C. Hubbell, A. N. Taylor and S. Powers.

HUBBARD CITY, TEXAS.—The people of this place are discussing the water-works question.

DARBY, PA.—The Borough Council has passed a resolution granting permission to the Clifton Heights Water Company to lay pipes through the borough.

PHŒNIX, ARIZ.—The Farmers' Irrigation Co. has been incorporated here, with a capital stock of $100,000. A pumping outfit will be built.

SPOKANE FALLS, WASH.—Reports say that the Water Committee has recommended the construction of a reserve reservoir to guarantee better protection against fire.

MADISON, S. D.—H. Keene, Cashier First National Bank, writes: "The establishment of water-works has not progressed as rapidly as expected, owing to a delay made by the Artesian well contractors in not having their pipe on hand. The well is now down from 175 to 200 feet. No action has been taken by the committee in soliciting proposals for pipe and other material. It depends a good deal as to the result of obtaining a flowing or pumping well."

MONMOUTH, ILL.—There is talk of calling an election to decide the question of extending the water supply system at a cost of $25,000.

EAST PORTLAND, ORE,—A plant is to be established at this place by the East Side Water Company, at an estimated cost of $120,000. Address Isaiah Buckman for particulars.

BROWNSVILLE, TEXAS.—It is probable that a system of water-works will be established at this place. Particulars can be obtained by addressing Frank McMullen as above.

NEW BRITAIN, CONN.—The Committee on Water Supply has concluded that a new water main from Shuttle Meadow is necessary, and it is thought probable that the Water Commissioners will sanction its construction. The commissioners have recommended the building of a pumping station at the foot of Arch Street to serve as a temporary relief. Both matters will be considered at the next meeting of the Common Council.

NEW WESTMINSTER, B. C.—The following proposals for the construction of a system of water-works at this place were recently opened: E. S. Scoullar & Co., New Westminster, for material for main pipe, $41,954.28; for making and laying same, $113,161.40; total, $155,115.68. Wolff & Zwicker, Portland, Ore., for material, and making and laying main pipe, $171,271.60. D. McGillvray, Vancouver, for material for main pipe, $45,589.45; for making and laying same, $104,476 80; total, $150,066.25. Albion Iron Works Company, Victoria, for material for main pipe, $55,522.63; for making and laying same, $107,714.50; total, $163,237.13. The Risdon Iron and Locomotive Works, San Francisco, for making and laying the main pipe, $115,586. Bell-Irving, Patterson & Co., New Westminster, for material for main pipe, $41,954.28. J. J. Robson, London, England, for material for main pipe, $42,929. Contract let to D. McGillvray.

SHELTON, WASH.—W. D. Baldwin, Town Clerk here, writes: "The town of Shelton is about bonding itself for $20,000 for the purpose of erecting and maintaining water-works, electric lights, and for street improvements."

LEBANON, PA.—Press dispatches say that there are serious fears of a water famine at this place, and that steps will probably be taken to increase the supply.

FALL RIVER, MASS.—Reports say that the Board of Aldermen has voted to borrow $25,000, the money to be used for the extension of the water service.

LOWELL, MASS.—Numerous water-main extensions are to be made at this place.

SOUTH BEND, IND.—The question of making extensive improvements to the water-works system at this place is being considered by the city officials.

CHICOPEE, MASS.—Extensions are soon to be made to the plant of the local water company.

ST. PAUL, MINN.—The Board of Public Works will consider plans for a new pump at the McCarron Lake station.

MILES CITY, MONT.—S. Gorden, City Clerk, writes: "The Miles City Water and Electric Light Company, of which E. R. Gilman, President of the North-West-Thomson-Houston Electric Company of St. Paul, is President; and H. F. Batchelor, President of the Stockgrowers' National Bank of Miles City, is Secretary and Treasurer, have just completed a limited water supply for Miles City, Mont. At present only about 1¼ miles of mains have been laid for the protection of the business portion of the city, but the indications are that the system will be rapidly extended. The supply is from drive wells, 20 2-inch wells supplying a large pump and 5 supplying a small pump."

WEBSTER, MASS.—It is probable that the movement for water-works at this place will result in establishing a system at an estimated outlay of $75,000.

SPRINGFIELD, MASS.—The bids received by the Water Commissioners for the work of improving Ludlow reservoir, were not satisfactory, and probably new bids will be called for.

NORTH BROOKFIELD, MASS.—Town Clerk George R. Hamant writes: "Private citizens have made preliminary surveys for water. The town has not taken any action yet. The Board of Trade is to make some investigations relative to obtaining water, then, probably, the subject will be brought before the town."

NEWARK, N. J.—The Executive Committee of the Aqueduct Board has recommended that proposals be advertised for furnishing 12,300 feet of 24-inch pipe and specials; also 1,800 feet of 12-inch pipe and specials, for the purpose of laying a new distributing main from the Clinton Avenue reservoir to Walnut Street, in accordance with plans already submitted to the Board: also, for furnishing the pipe and specials and laying the same.

LANCASTER, PA.—An additional reservoir is proposed for this city at a cost of about $27,000. For particulars, address Robert Clark, Chairman Water Committee, as above.

LEEDS, IOWA.—This place is to have a system of water-works.

PETALUMA, CAL.—Extensive improvements are to be made to the plant of the Petaluma Water Company.

ALEXANDRIA, LA.—It is probable that the projected water-works system for this place will soon be established.

ASTORIA, ORE.—The sum of $150,000 is to be expended on improving the local water-works system.

JANESVILLE, WIS.—The Board of Water-Works Directors of this city has ordered the laying of an additional 4,500 feet of mains.

WATER-WORKS.—See our Proposal Columns for information regarding water-works and water-works furnishings at the following places: Marysville, O.; Pasco, Wash.

SEWERAGE.

For Additional Sewerage Items see Proposal Columns

ST. PAUL, MINN.—The Board of Public Works will recommend the appropriation of nearly double the amount of money for sewers this year that they did last year. The amount of paving done will be somewhat less, and that of other improvements will be about the same.

CENTRAL FALLS, R. I.—Frederick E. Shaw, of this place, has been awarded a contract to construct new sewers, at a cost of $10,000.

OTTAWA, CAN.—It is proposed to drain Stewarton and Rochesterville, at an estimated cost of $200,000. The City Engineer can furnish particulars.

CINCINNATI, O.—A trunk sewer 12 foot connection, 1,000 feet long, will be ready for bidders at the City Engineer's office in ten days.

WILLIAMSPORT, PA.—It is probable that important steps will soon be taken towards making the proposed improvements to the sewerage system of this city.

WEST TORONTO JUNCTION, ONT.—Willis Chipman, C. E., Toronto, Ont., has made a report on a proposed system of sewerage for this town.

HARRISON, N. J. — Considerable sewer work is contemplated at this place. For particulars address the Clerk of the Common Council, as above.

MERIDIAN, MISS.—Reports say that a system of sewerage is to be established at this place.

SEWERS.—See our Proposal Columns for information regarding sewer construction at the following places: Boston, Mass.; Tiffin, O.; Binghamton, N. Y.; Galion, O.; Greensboro, N. C.; Cleveland, O.; Key West, Fla.; Para, Brazil.

BRIDGES AND IRON STRUCTURES.

For Additional Bridge Items see Proposal Columns.

TOPEKA, KAN.—At a recent election in Shawnee County it was voted to appropriate $200,000 for building a bridge across the Kansas River at this place. The bridge will have a 50-foot roadway.

WILLIAMANSETT, MASS. — The County Commissioners are having plans prepared for the masonry and superstructure for a new iron bridge across the Connecticut River between Holyoke and this place.

MINNEAPOLIS, MINN.—The Great Northern road is preparing to build a bridge over its tracks at Fifteenth Avenue S. E., as ordered by the City Council some time ago. Plans have been prepared, and the work will begin soon.

LITTLE ROCK, ARK.—Reports say that a bridge will be probably be built over the Arkansas River from this city to Argenta.

ROCHESTER, N. Y.—Reports say that a new bridge is to be erected at Court Street, at an estimated cost of $150,000.

CINCINNATI, O.—The plans prepared by the City Engineer for the Eight Street viaduct provide for a structure 2,956 feet long, which it is estimated will cost $280,000. It is also proposed to rebuild the McMillan Street bridge at an expense of about $35,000.

LYONS, IOWA.—The contract for the construction of a bridge over the Mississippi River at this place, has been awarded to the Chicago Bridge and Iron Company, at $90,990.

WESTON, W. VA.—The Suars County Commissioners have accepted plans for a new iron bridge at Weston. The Commissioners will soon advertise for proposals.

DODDRIDGE COUNTY, W. VA.—The County Court of this county has ordered its Committee on Roads to advertise for proposals for four steel bridges for this county.

ALEXANDRIA, LA.—A new bridge is to be erected over the Red River near this place.

FALL RIVER, MASS.—It is proposed to erect a bridge over the tracks of the Old Colony Railroad, at South Park.

NEW BRUNSWICK, N. J.—The Board of Freeholders of Middlesex County, at a recent meeting, authorized the erection of a large number of new bridges and culverts. Among them were several culverts over the Commercial Avenue brook in New Brunswick.

BRIDGES.—See our Proposal Columns for information regarding bridge construction at the following places: Trenton, N. J; Whitby, Ont.; Toledo, Wash.; Montgomery, Ala.; Beeville, Tex.; Hamilton County, O.; Brooklyn, N. Y.; Newport, R. I.

STREET-WORK AND PAVING.

ST. PAUL, MINN.—A proposition has been brought before the Board of Public Works to pave Bradley and other streets in the vicinity. It will come up again for consideration on August 16. The estimated cost of the paving is $52,000.

EAST ST. LOUIS, ILL.—The Highway Commissioners of Centerville Station Township have contracted with Caster Stalle, of this city, for the paving of Cahokia, Caseyville, Collinsville and Centerville roads. The contractor has two years to complete the work, and will receive $5,342 per mile for the paving of the Cahokia Road, $5,792 for the Caseyville road, $5,942 for the Collinsville Road, and $5,442 for the Centreville Road.

NEWARK, N. J.—Considerable street paving is to be done at this place.

NEW HAVEN, CONN.—It is proposed to expend the sum of $5,000 on additional street paving.

GAS AND ELECTRIC-LIGHTING.

BELOIT, WIS.—Beloit is to have 30 2,000-candle power electric lights in addition to those already in use.

PELHAM, N. Y.—The Pelham Bay Park Electric Light Power and Storage Company has been incorporated here with $10,000 capital. The trustees are, George W. Cochran, Edward S. Becker and Benj. Franklin.

ONEONTA, N. Y.—The Board of Trustees of this place has renewed a contract for the public lighting of the village with the New York and New Jersey Gas Light Company.

NEWARK, N. J.—The East Newark Gas Light Company will make numerous extentensions to its mains.

OAKLAND, CAL.—The stockholders of the Oakland Gas Light Company are considering the question of making extensive improvements to the plant.

NEW YORK CITY.—An exchange prints the following: "Specifications have been prepared for an electric light plant at the Mare Island Navy Yard. When the work at Mare Island is completed the continuation of the electric work at New York and Norfolk will be considered."

NAPA, CAL.—The following proposals for lighting this city for a period of eight months, from September 1, 1890, moonlight schedule, have been opened: Napa Gas Company, for 50 lamps or more until 1 A. M., per lamp per month, $2.50; same all night, $3.50. Thomson-Houston Company, for 24 arc lights, 1,200 candle-power, until 1 A. M., per lamp per month, $10; same all night, $15; for 40 incandescent lamps, 20 candle-power, per lamp per month, until 1 A. M., $2; same all night, $3.

WHITEHALL, N. Y.—The Trustees of this place are discussing the question of substituting electric lights for the present method of lighting.

ALEXANDRIA, LA.—An electric light plant is proposed for this place.

CLINTON, MO.—The Common Council of this place has decided to light the public streets, etc., with 38 arc lights.

ATLANTIC CITY, N. J.—There is talk of organizing a new gas company at this place.

JERSEY CITY, N. J.—The New Jersey Investment Company has been incorporated here, with a capital stock of $1,200,000, to manufacture and set up electric lights.

NEW YORK CITY.—The Gas Commission has awarded contracts to the East River, Mount Morris, Harlem, United States, and Brush Electric Light Companies for lighting 209 city lamps for which contracts had not been made. The companies agreed to do the lighting for the same prices they were paid last year.

ELECTRIC RAILWAYS.—New electric railways will be established and improvements will be made to those already built at the following places: Macon, Ga.; Seattle, Wash.; Steilacoom, Wash.; Union, Ore.; Little Rock, Ark.; North Yakima, Wash.; Rockville, Md.; Tenneyton, Md.; Los Angeles, Cal.; Dallas, Tex.; Whatcom, Wash.; Westfield, Mass.

BIDS OPENED.

NEW YORK CITY.—Bids for dredging were opened by the Dock Commissioners August 7. The contracts are for dredging for a new pier off West Fifty-second Street, and at Pier (new) No. 57, North River; for a new pier No. 58, and at Pier (new) No. 59, North River. Following are the bids per cubic yard: P. Sandford Ross, 16 cents; Morris & Cumings Dredging Co., 20 cents; Charles Du Bois, 12 cents; Atlantic Dredging Co., 16 cents; North American Dredging and Improvement Co., 19½ cents.

SOUTH BETHLEHEM, PA.—The contract for the new L. V. offices is awarded to J. S. Allan, of South Bethlehem; contract price, $45,000.

ALBANY, N. Y.—The Superintendent of Public Works has awarded to P. J. Brumelkap, of Syracuse, for $16,967, the contract for extending the jetties of the Shinnecock Canal, and dredging the canal.

GOVERNMENT WORK.

WASHINGTON, D. C.—The following proposals for the work specified were opened on the given dates by the Supervising Architect of the Treasury Department:

Williamsport, Pa.—Approaches to the United States Court House, Post Office, etc., opened August 2, advertisement of July 9. Bidders: Owen Patterson, artificial stone for sidewalk, $13,208; Warsaw stone, $20,765. National Paving Co., artificial stone, $14,542.75. W. H. Waltz, artificial stone, $21,683; Warsaw stone, $23,945. George E. Sherry & Co., artificial stone, $15,500. Martin Hendricks, artificial stone, $15,612; Warsaw stone, $19,487.

Lowell, Mass.—Erection and completion of, except heating and approaches to, the United States Post Office. Opened August 6. Bidders: L. D. Wilcott, North Conway granite, $259,490; Concord granite, $262,990; Am. S. S., $267,790; $277,790. D. J. Curtis, brown Crandell, $194,900; Long Meadow, $199,000; Middlesex Port Conn., $201,000; Leic. marble, $244,000; Concord granite, $265,000. Darling Bros., Monsor granite, $227,000; Monsor gray stone, $243,461; Blue Hill, $235,388; Concord gray, $236,729, Concord red, $233,729; Cape Ann granite, $242,224; Melford granite, $236,886; Espir blue marble, $256,000; Leic marble, $250,156. Sweet & Runels, North Conway granite, $228,411; Concord granite, $235,269; Dustable granite, $231,840; Deer Island, Me., granite, $228,411; Norway, Me., granite, $233,343. C. F. Foos & Co., Maine and New Hampshire granite, North Canon, $236,856; Maine and New Hampshire granite, North Fay, $241,657; Norway granite, $241,336; Cape Ann granite, $246,457.

INDUSTRIAL.

BROOKLYN, N. Y.—At a meeting of the Board of Supervisors, held August 5, the question of building a tunnel, under Newtown Creek, from this city to Long Island City was discussed, and a motion to appoint a day on which all interested parties could be heard was carried.

IT is reported that M. H. Keefe, Helena, Mont., has the contract for cutting the Busk-Ivanhoe Tunnel on the Continental Divide of the Rocky Mountains, on the line of the Colorado Midland Railway, which, when completed, will be the third largest tunnel in the United States, and that the work is now likely to be pushed to an early finish. The Ingersoll-Sergeant Rock Drill Company, No. 10 Park Place, New York, will furnish the complete double outfit of tunneling machinery—boilers, air compressors and rock drills.

WHEELING, W. VA.—The following proposals for building a stone bridge over Wheeling Creek were opened by F. L. Hoge, City Engineer, July 21, 1890:

ITEMS.	BIDDERS.						
	Paige, Carey & Co., New York, N. Y.	Hallock Bros., Roetstown, O.	Harrold & Campbell, Beaver Falls, Pa.	B. B. Harris, Greensburgh, Ind.	J. Le Duke, Berea, O.	Jutte, Stratton & Foley, Pittsburg, Pa.	Jolly Bros., Pittsburg, Pa.
For each cubic yard of grading approaches, as specified	$0.75	$0.70	$0.40	$0.40	$.30	$0.60	$1.00
For each cubic yard of excavation in foundation pits for abutments, including the refilling and removal of same, as specified	1.00	1 00	1.25	.60	.75	1.50	1 80
For each cubic yard of excavation in foundation pits of wings, including the refilling and removal of the same, as specified	.40	.42	.60	.60	.90	1.50	1.80
For each cubic yard of excavation in foundation pits of abutments and wings removed over 300 feet, per 100 feet, as specified	.03	.03	.03	.20	.02	.02	.02
For each 1,000 feet of white oak plank used in drainage, per M., B. M., as specified	27 50	28.00	35.00	30.00	30.00	26.00	22.00
For each pound of wrought-iron spikes used in drainage and dowels in coping, tie rods, nuts and washers, used in spandrels, as specified	.05	.05	.05	.02$\frac{8}{10}$	.05	.03½	.06
For each pound of Steel I beams, wall plates and brackets, as specified	.05	.05	.04	.03$\frac{7}{10}$	.04½	.04	.06
For each lineal foot of vitrified clay pipe of 12 inches diameter, used in drainage, as specified	.30	.30	.75	.75	.38	.37½	.40
For each lineal foot of same, of 18 inches diameter, used in drainage, as specified	.35	.37½	1.25	.85	.65	.48	.65
For each lineal foot of same, of 24 inches diameter, used in drainage, as specified	.50	.55	2.00	1.37	1.20	.87	1.25
For each cubic yard of concrete (Portland cement) used as specified	7.50	7.40	9.00	9.00	6.50	7.36	9.50
For each cubic yard of concrete (American cement) used, as specified	5.50	5.50	7.00	6.15	5.00	6.00	8.00
For each cubic yard of masonry laid in the abutments in Portland cement mortar, as specified	12.25	12.25	12.50	12.95	14.00	11.00	11.50
For each cubic yard of masonry laid in abutments in American cement mortar, as specified	10.50	10.25	11.80	12.00	11.00	8.00	11.00
For each cubic yard of masonry used in arch sheeting, including centering and coating back of arch, as specified	16.00	15.00	16.50	*21.40 †16.75	27.00	27.07	33.50
For each cubic yard of masonry used in wings and external spandrels, as specified	8 00	8 00	9.00	12.00	11.50	12.50	11.50
For each cubic yard of masonry laid in arch backing, as specified	8.00	8 00	5.50	7 00	6.00	8.00	6.80
For each cubic yard of masonry used in retaining walls, as specified	8 00	8.00	6.80	9.00	6.00	9.00	11 50
For each cubic yard of masonry used in parapet walls, as specified	21.00	20.00	18 00	‡	30.00	27.07	15.00
For each cubic yard of brick masonry used in interior spandrels, as specified	10.00	10.00	8.50	10.20	8.00	13.60	9.30
For each cubic yard of granite (if used) for ring stones, as specified	50.00	52.00	....	40.00	38.00	55.00	55.00
For each lineal foot of Medina sandstone in curbing set, as specified	1.00	.98	.80	1.00	.65	.75	.75
For each square yard of flagging laid, as specified	2.00	2.05	2.25	2 80	2.00	3.00	1.60
For each square yard of brick paving laid, as specified	1.50	1.55	1.30	.85	1.25	1.50	1.35
For each insulated pole set, as specified	150.00	140.00	25.00	35.00	45.00	45 00	150.00
Estimated cost American cement in abutments	$104,386.00	$102,045.00	$110,106.00	$124,981.00	$123,364.00	$131,031.00	$143,814.00

* Berea, O., stone; † Frefort, O., stone. ‡B. B. Harris, Berea, O., stone, $21.00; Frefort, O., stone, $16.00, for each cubic yard of masonry used in parapet walls. Hallock Bros. bid withdrawn, and contract awarded to Paige, Carey & Co., of New York, who have commenced work.

PROPOSALS.

(Continued from page ii.)

STREET PAVING.

SEALED PROPOSALS WILL BE RECEIVED for furnishing the materials and laying about 4,750 square yards of **GRANITE BLOCK PAVING** at the office of the Board of Road Commissioners of the city of Waterbury, City Hall, until 2 P. M., August, 20, at which time and place they will be publicly opened and read.

All bids must be upon proper blanks and must be accompanied by a bond for $300, with satisfactory sureties, conditioned for the execution of the contract within five days after notice of its award.

Certified checks for $300, payable to the city of Waterbury, to be deposited with the Board of Road Commissioners, will be received in place of the above bond.

Specifications can be seen at the City Engineer's office, at which place blank forms of proposal can be obtained as well as further information.

By order of the Board of Road Commissioners.

F. W. WHITLOCK,
11 Acting City Engineer.

PROPOSALS.

Notice to Sewer Contractors.

SEALED PROPOSALS WILL BE RECEIVED up to TUESDAY, August 26, 2 o'clock P. M., at the office of the Board of Directors of the Street and Sewer Department, of the city of Wilmington, Delaware, for the construction of certain **SEWERS**, as follows: 5,715 feet of brick sewer, from 24 inches diameter to 2' 7" by 3' 10½", and 6,753 feet of terra cotta pipe, from 8 inches diameter to 20 inches diameter.

A certified check for $1,000, made payable to the order of the Board of Directors of the Street and Sewer Department, will be required of each bidder as a guarantee that the party or parties to whom the contract may be awarded will execute the same within five days after notice so to do has been sent to the address furnished by them.

The right to reject any or all bids is reserved.

Proposals must be sealed and addressed, "The Board of Directors of the Street and Sewer Department, Proposals for Building Certain Sewers."

Copies of the proposals, contract and specifications will be sent to those desiring them, or the same, together with the plans, can be seen at the office of

T. CHALKLEY HATTON,
12 Engineer in Charge of Sewers.

PROPOSALS
FOR
Key West Improvements.

OFFICE OF CITY CLERK,
KEY WEST, FLA., June 2, 1890.

SEALED PROPOSALS WILL BE RECEIVED by the City Clerk of KEY WEST, FLA., until 1st of September, 1890, for furnishing the necessary material and putting in an underground system of **SEWERAGE**; also for **GRADING** and **PAVING** the streets of said city and furnishing the material for same; also for furnishing and laying of water mains.

1st. All bids must be made upon the printed forms to be obtained from the City Clerk and inclosed in a sealed envelope, directed to the Board of City Commissioners, and marked on the outside of envelope, "Proposals for Key West Improvements."

2d. Each bid must be accompanied by a cash deposit or certified check of five hundred dollars, to be left in the hands of the City Clerk, subject to the conditions specified, as a guarantee of the good faith of the bidder.

3d. The city reserves the right to reject any and all bids.

4th. Bidders are requested to be present at the opening of the bids.

5th. Bidders are expected to bid separately on sewer system and material, on grading and paving of streets, and on furnishing and laying water mains.

6th. Plans and specifications can be seen at the office of the City Clerk, and at the office of Johnson & Flad, Consulting Engineers, Laclede Building, St. Louis, Mo.

WM. L. DELANEY,
8-10-12 City Clerk.

WHARF, Washington, D. C.—Proposals are wanted until September 2, for rebuilding Broad Street Wharf, at League Island. Address N. H. Farquhar, Chief of Bureau of Yards and Docks, as above.

AQUEDUCT, New York City.—Proposals are wanted until August 27, for building an auxiliary earth and masonry dam with gate house, etc., for reservoir D, near Craft's Station. Address John C. Sheehan, Secretary Aqueduct Commission, as above.

BUILDING, Ukiah, Cal.—Proposals are wanted, no date specified, for the erection of a $50,000 building here. Address Architects Copeland & Banks, 126 Kearney Street, San Francisco, Cal.

BUILDING, Hoquiam, Washington.—Proposals are wanted, no date specified, for the erection of a brick and stone building here, at an estimated cost of $25,000.

STREET WORK, Jersey City, N. J.—Proposals are wanted until August 11, for doing certain street work at this place. Address George T. Bouton, City Clerk, as above.

WATER-WORKS, Marysville, O.—Proposals are wanted until August 15, for the construction of a system of water-works. Address the Light and Water Company, as above.

PROPOSALS.

SEWERS, Binghamton, N. Y.—Proposals are wanted until August 18, for the construction of certain sewers. Address W. J. Flanigan, City Clerk, as above.

BRIDGE, Hamilton County, O.—Proposals are wanted until August 23, for masonry, superstructure, etc., of a bridge near here. Address Fred Raine, Auditor Hamilton County, as above.

BUILDING, Joliet, Ill.—Proposals are wanted until August 19, for the erection of the Joliet Turner Hall. Address H. Boehine, architect, as above.

SEWERS, Cleveland, O.—Proposals are wanted until August 28 and September 4, for the construction of certain sewers. Address C. G. Force, City Civil Engineer, as above.

REMOVAL OF LEDGE, Indianapolis, Ind.—Proposals are wanted until September 1, for the removal of the limestone ledge in the Kankakee River, near Momence, Ill.—Address Buce Cair, Auditor of State, as above.

PUMPING PLANT, Pasco, Wash.—Proposals are wanted until September 3, for the construction, etc., of a pumping plant and necessary fixtures. Address Fred Kurtzman, of the Board of Directors of the Pasco Irrigation District, as above.

BRIDGE, Trenton, N. J.—Proposals are wanted until August 13, for the erection of the iron work of a high truss bridge near here. Address Symmes B. Hutchinson, County Solicitor, as above.

BUILDING, Iowa City, Iowa.—Proposals are wanted until August 19, for the erection of new chemical laboratories of the State University of Iowa. Address William J. Haddock, Secretary, as above.

RAILROAD SHOPS, Baltimore, Md.—Proposals are wanted until August 12, for the erection of roundhouses and shops at Trinidad. Address H. T. Douglass, Chief Engineer, B. & O. R. R., as above.

RAILROAD WORK, West Detroit, Mich.—Proposals are wanted until August 14, for doing about 35 miles of railroad work. Address Milo H. Davis, Chief Engineer Iron Range and Huron Bay R. R. Co., No. 55 Fort Street, as above.

HOSPITAL, Washington, D. C.—Proposals are wanted until August 30, for the construction of a brick hospital at this Post. Address Lieut. Constantine Chase, U. S. A., as above.

HEATING APPARATUS, Des Moines, Iowa.—Proposals are wanted until August 12, for the heating apparatus and erection of a series of buildings for the Iowa Industrial Home for Adult Blind, at Knoxville, Iowa. Address Foster & Liebbe, architects, as above,

COURT HOUSE, Snohomish, Wash.—Proposals are wanted until August 31, for the erection of a county court house at this place. Address Mayor Blackman, as above.

CITY HALL, Danville, Va.—Proposals are wanted until August 13, for the erection of a city hall and market house at this place. Address C. A. Ballou, City Engineer, as above.

COURT HOUSE, Morgantown, W. Va.—Proposals are wanted until September 1, for the erection of a court house at this place. Address R. E. Fast, Secretary of Commissioners, as above.

BRICK, Sherbrooke, N. D.—Proposals are wanted until August 12, for furnishing 26,000 common or slop bricks. Address L. C. Goplerud, Auditor, as above.

COURT HOUSE, Spartanburg, S. C.—Proposals are wanted until August 30, for the erection of a court house at this place. Address Charles A. Barry, Chairman of the Board of County Commissioners, as above.

LIGHTING, ETC., Blairsville, Ind.—Proposals are wanted until August 15, for the construction of a plant for furnishing heat, light and power by electricity. Address D. A. Fenlon, Secretary Citizens' Heat, Light and Power Company, as above.

SCHOOL, Mankato, Minn.—Proposals are wanted until August 15, for the erection of a high school building. Address H. C. Gerlach, architect, as above.

COLLEGE, Searcy, Ark.—Proposals are wanted until August 15, for the erection of a college building. Address J. E. Skillern, Chairman Building Committee, Searcy Male College, as above.

PAVING, York, Pa.—Proposals are wanted until August 19, for paving, etc., numerous streets. Address W. H. Rodenhouse, Chairman Highway Committee, as above.

SCHOOL, Berea, O.—Proposals are wanted until August 18, for the erection of a brick school building. Address W. Humiston, Clerk Board of Education, as above.

BRIDGES, Whitby, Ont.—Proposals are wanted until August 14, for the erection of two bridges over Warren's Creek. Address T. E. Farewell, County Clerk, as above.

HOSPITAL, Ann Arbor, Mich. — Proposals are wanted until August 12, for the erection of two hospital buildings. Address the Board of Regents of the University of Michigan, as above,

POSITIONS VACANT.

TOO LATE FOR CLASSIFICATION.

WANTED.—A COMPETENT DRAUGHTSman to make shop and picture plans, highway bridge work. A permanent position to first-class man. Apply by letter only, giving references. Address DEAN & WESTBROOK, No. 32 Liberty Street, N. Y.

WANTED.—AN ASSISTANT. ONE CAPAble of using Transit and Level, and able to do draughting. Address A. J. COOPER, City Engineer, Easton, Pa. 11

WANTED, IMMEDIATELY.—TWO EXPErienced architectural draughtsmen. Permanent positions and large salaries assured to satisfactory men. Address C. H. JOHNSTON, Architect, 76 Germand American Bank Building, St. Paul, Minn. 11

Building Intelligence.

NEW YORK.

524–28 W 43d st, br and iron factory; cost, $42,500; o, J A Weser; a, J J Smith.

S s 59th st, 225 w 6th av, br, st and terra cotta club house; cost, $75,000; o, C V Fornes, Pres; a, Schickel & Co.

N s 74th st, 225 w 1st av, 2 br flats; cost, $18,000 each; o and m, P Braender; a, W Graul.

S s 93d st, 275 e Columbia av, 2 br and st flats; cost, $45,000 all; o, J Selfridge; a, G A Schellenger.

N s 106th st, 175 w 8th av, 2 br and st flats; cost, $18,000 each; o, A Gallo; a, J Barrett.

N s 121st st, 90 w Manhattan av, 10 stone dwells; cost, $11,000 each; o, A A Feets; a, J A Webster.

S s 133d st, 400 w 7th av, 3 br and st flats; cost, $14,000 each; o and a, John A Webster.

S s 134th st, 330 e 8th av, br and st flat; cost, $16,000; o, G Manson; a, J A Webster.

S s 82d st, 250 w 10th av, 3 br dwells; cost, $45,000 all; o, W E D Vincent; a, W H Boylan.

205-07 East 23d st, 2 br flats; cost, $48,000 all; o, Fish & Miller; a, Schneider & Herter.

N s 85th st, 160 w 4th av, br stable; cost, $15,000; o, Guguenheimer & Wutermuyer; a, Walgrove & Israels.

731-35 East 5th st, 2 br flats; cost, $38,000 all; o, Schneider & Herter; a, Schneider & Co.

N s 101st st, 35 w Columbus av, 2 br flats; cost, $40,000 all; o, H S Cates; a, H Davidson.

S s 117th st, 425 e 8th av, br stable; cost, $10,000; o, J M Pinkney; a, G Robinson, Jr.

526-28 West 35th st, br factory; cost, $30,000, o, E H Johnson; a, J Kastner.

28 Elm st, br store; cost, $8,000; o, J Pettit; a, J M Farnsworth.

E s Washington st, bet Liberty and Cedar, br store; cost, $100,000; o and a, same as above.

N s 128th st, 140 w 4th av, br flats; cost, $28,000; o, H Reilly; a, E Wenz.

N s 105th st, 70 e Madison av, 2 br flats; cost, $40,000 all; o, J Hickey; a, same as above.

ALTERATIONS.—NEW YORK.

N w cor Morris av and Ash st, br shop; cost, $30,000; o, J P Ryan; a, not given.

N s 51st st, 125 w Lexington av, extension; cost, $18,000; o, Mayor, etc.; a, G W Debevoise.

105–09 E Houston st, girders and piers altered; cost, $8,000; o, Corporation of Trinity Church; a, W A Potter.

BROOKLYN.

S w cor Bushwick av and Hancock st, 3 br dwells; cost, $30,000 all; o, R E McCafferty; a, B O'Rouke.

N e cor Butler st and Roger av, br dwell; cost, $11,000; o, J Freeman; a, C F Eisenach.

S e cor Howard av and Madison st, br dwell; cost, $12,000; o and a, Mones & Ouesne.

S s 2d st, 297 w 7th av, 5 br dwells; cost, $40,000 all; o, Julia A Skidmore; a, W O Tait.

N e cor Butler st and 3d av, br dwell; cost, $10,000; o, W I Conway; a, not given.

N s Park st, 78 e 5th av, 3 br dwells; cost, $18,000; o, H B Lyons; a, W M Coots.

S s Sackett st, 92 e Henry st, 4 br dwells; cost, $32,000 all; o, J Murphy; a, same as above.

S w cor Tompkins and Vernon avs, br dwell; cost, $20,000; o, T Walling; a, F B Langston.

Bleecker st, near Central av, 3 fr dwells; cost, $10,500 all; o, J Taylor; a, J Fletcher.

E s Kane Place, 123 n Atlantic av, 3 fr dwells; cost, $7,250 all; o, Catherine Hill; a, J E Dwyer.

N e cor Atlantic av and Dean Place, 6 fr dwells; cost, $15,000 all; o and a, same as above.

S s Halsey st, 25 e Patchen av, 4 br dwells; cost, $21,000 all; o, Jane McDicken; a, E Dennis.

S w cor 6th av and 21st st, fr dwell; cost, $7,000; o, A Smith; a, E Dennis.

BUILDING INTELLIGENCE.

BROOKLYN.—Continued.

N s Windsor Place, 90 e 9th av, 11 br dwells; cost, $33,000 all; o, Assip & Buckley; a, W M Coots.

N e cor Wierfield st and Bushwick av, br church; cost, $12,000; o, Baptist Extension Society of Brooklyn; a, P F Higge.

N s Green av, 270 w Central av, 4 br dwells; cost, $9,200 all; o, O Saenger; a D Acker & Son.

Gates av near Hamburg av, 2 fr dwells; cost, $8,000 all: o, J Tillman; a, J Taappe.

S e cor Halsey st and Patchen av, br flats; cost, $12,000; o, Jane McDicken; o, E Dennis.

W s Cumberland av, 221 s Fulton st, br stable; cost, $8,000; o, S Ross; a, M J Morrell.

S s Atlantic av, 212 w Classon av, 4 br flats; cost, $24,000 all; o, C B Sheldon; a, W M Coots.

Rogers av, n e cor Butler st, br store and dwell; cost, $11,000; o, John Freeman; a, C F Eisenach; b, T Donlon and M Zang.

MISCELLANEOUS.

BOSTON, MASS. — 631 Cambridge st, Brighton, br academy; cost, $60,000; o, Sisters of St. Joseph; a, P W Ford; b, P Grace.

1069–75 Dorchester av, 2 fr dwells; cost, $11,000; o, Sampson Fentler; a, John A Daunt.

Berkeley st, opp St. James av, br boiler house; cost, $20,000; o, O C R R; a, Geo S Morrill.

181 Tremont st, br alteration and addn; cost, $8,500; o, Hurd Estate; a, A H Dodd; b, H McLaughlin.

151–53 Milk st, br fire repair; cost, $7,000; o, G O Carpenter; b, J J Shaw.

Westminster st, cor William st, br apartment; cost, $15,000; o and b, Ira Bradley; a, S S Woodcock.

147 Tremont st, cor West, br mercantile bldg; cost, $72,000; o, Shreve, Crump & Son; a, Winslow & Wetherell; b, Whiddon & Co.

Paris st, nr Meridian st, br engine and ladder house, cost, $33,000; o, City of Boston; a, City Architect; b, S H Stevenson.

Beacham st, cor West st, br bottling house; cost, $30,000; o, W T Van Nostrand; a and b, C S Stone.

Avon st, nr Commonwealth av, br dwell; cost, $9,000; o, S E Lawrence; a, R S Atkinson; b, D Connery.

Hanover and Cross sts, br addn and alteration to police station; cost, $43,000; o, City of Boston; a, City Architect; b, J H Stevenson.

54–56 Cedar st, 2 fr dwells; cost, $7,500; o, H McDonnel; a, R D Ward & Co.

Leicester st, cor Surrey st, fr dwell; cost, $8,000; o, Philip McBryan; a, A M Bowser; b, C A Prouty.

Dudley st, opp Howard av, 2 fr dwells; cost, $8,500; o, Geo E Howe; a, G A Avery; b, Ourish & Rich.

CINCINNATI, O.—Lane st, Walnut Hills, 2 2½-story br dwells; cost, $22,000; o, J Bloch; a, H E Siber.

Kemper Lane, 2½-story dwell; cost, $9,500; o, M A Marks; a, F Wilson.

Storrs st, 3-story store and dwell; cost, $7,500; o, Henry Shultz; a, L P Hazen.

CHICAGO, ILL.—26 St James pl, br and st dwell; cost, $11,000; o, C S Johnson; a, Geo Maher; b, J J Monaghan.

Exchange av and C & N W R R, br addn to packing house; cost, $35,000; o, Fairbank Canning Co; a, R Oesterle.

7000–06 Webster av, br flats; cost, $18,000; o, Ralph S Price; a, J T Long.

Perry av nr 73d, br dwell; cost, $8,000; o, Shields & Cook.

52d and Justin, br church; cost, $9,000; o, Deutche Evang Church; b, R Tierot.

47th and Woodlawn, br dwell; cost, $8,000; o, N C Niblack; a, S S Beman; b, A M McLochlan.

Madison Park nr Woodlawn av, br dwell; cost, $30,000; o, J H Dunham; b, A H Green.

4369 Oakenwald av, br dwell; cost, $8,000; o, M Manasse; a, F W Perkins; b, J C Robinson.

BUILDING INTELLIGENCE.

CHICAGO, ILL.—Woodlawn av nr 50th, br dwell; cost, $8,000; o, J H Dunham.

87–99 43d, br stores and flats; cost, $60,000; o, Miller & Chamberlin; a, Flanders & Zimmermann; b, W M Crilley.

341–43 41st, br dwells; cost, $10,000; o, A C Hayner; a, Edbrooke & Burnham; b, S Ritchie.

413–17 St Lawrence av, br flats; cost, $20,000; o, W P Foster & Son.

Grand Boul and 46th, br dwell; cost, $8,000; o, J J Grafton; a, C M Palmer; b, J Van Gregory.

4617 Ellis av, br dwell; cost, $12,000; o, W H Pruyn; a, H R Wilson; b, J B Edwards.

5100–02 Madison av, br dwell; cost, $17,000; o, W J Lewis; a, Cole & Dahlgren.

Greenwood and 45th, br dwell; cost, $14,000; o, W J Fitch.

314–48 43d, br flats; cost, $22,000; o, Wm Jones; a, J E Pridmore; b, W D O'Brien.

4609 Vincennes av, br dwell; cost, $10,000; o, J Fleming.

66 Lake Shore Drive, br dwell; cost, $65,000; o, C C Heisen; a, F B Abbott.

83–87 5th av, addn to store bldg; cost, $30,000; o, Eugene S Pike.

3801–03 Wabash av, br and s church; cost, $12,000; o, Wabash av Baptist Mission; a, W W Miers; b, B G Robinson.

2340–42 Portland av, br flats; cost, $12,000; o, F W Etten; a, Jos Frank; b, Guetrich Bros.

35–39 State, br store and flats; cost, $11,000; o, Jno Wheeler; a, Flanders & Zimmermann.

266–68 Noble, br flats; cost, $17,000; o, Chas Liesenhahl; a, Bettinghofer & Harman; b, A Biewolt.

842 Austin av, ink factory; cost, $11,000; o, National Ink Co; a, L G Hollberg.

176–78 Indiana, br shop; cost, $10,000; o, Wm Erbey; a, Furst & Rudolph, b, L Weick.

2129 Dearborn, br dwell; cost, $9,000; o, C E Robinson; a, E R Krause; b, J T Halls.

784–94 W Jackson, br dwell; cost, $22,000; o, Wm R Newman; a, Lamson & Newman; b, H Grosser.

Michigan av nr Madison, 10-story fireproof bldg; o, Chicago Athletic Association; a, Hy Ives Cobb.

Clark, Jackson and La Salle, 2 addn stores; o, Grand Pacific Hotel Co; a, W W Boyington.

Madison and Hayne, br store and flats; cost, $15,000; o, B Mercel; a, W T Lesher.

Van Buren nr Laflin, livery stable; cost, $18,000; o, E Morse; a, same as above.

Washington boul nr Francisco, br and s dwell; cost, $13,000; o, S H Warner; a, Hetherington & Warner.

Forestville av nr 48th, s dwell; cost, $13,000; o, O F Lindman; a, F R Schock.

Belmont av nr Lake Shore, s dwell; cost, $16,000; o, Edw Gray; a, G W Maher.

154 bldgs costing less than $7,000 each.

DORR, MICH.—A $7,000 building will be erected here. Address A W Rush & Son, architects, as above.

DUQUOIN, ILL.—The Presbyterians will erect a church here.

GRAND RAPIDS, MICH.—Brick furniture factory building, also engine and boiler room, dry kilns, etc; cost, $20,000; o, Gunn Folding Bed Co; a, W G Robinson; b, not awarded.

College av nr Fountain st, fr residence; cost, $7,500; o, C C Philbrick; a, as above; b, not awarded.

MILWAUKEE, WIS.—Cor Astor and Brady sts, saloon and bowling alley; cost, $9,000; o, Pabst Brewing Co; a, Otto Strack; b, J Langenberger.

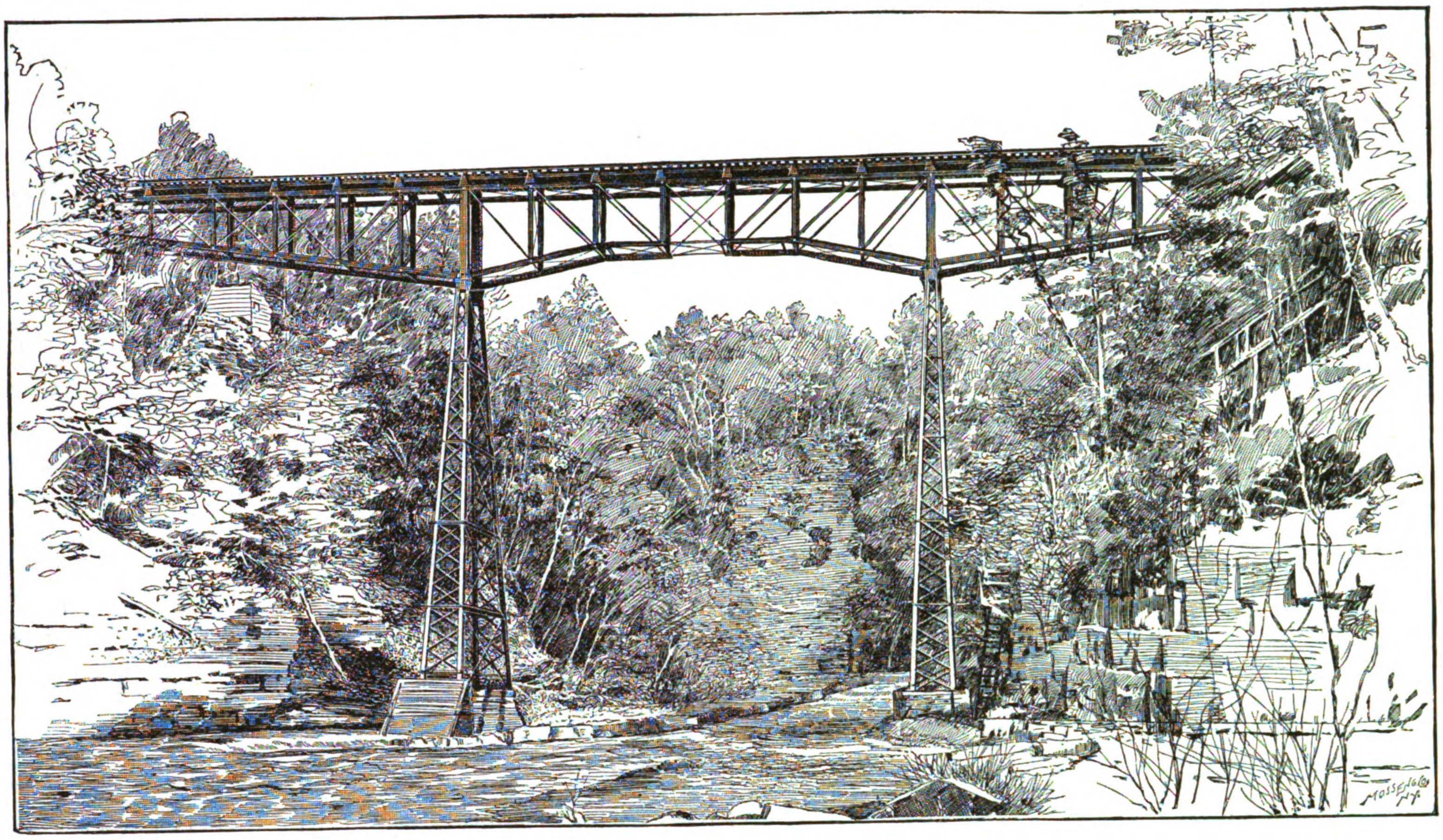
PHILADELPHIA, PA.—Cor 31st and Jefferson sts, brewery; o, Estate of J Mueller.

22d and Dickinson st, 30 fr dwells; o, John Devlin.

247 S 13th st, fr dwells; o, Charles P Nesbit.

43d st, n w cor Ogden, 25 fr dwells; o, J R Jordan.

THE BERLIN IRON BRIDGE CO., EAST BERLIN, CONN.



CANTILEVER BRIDGE,
DESIGNED AND BUILT
FOR THE K. & A. C. R. R. CO., AT KEESEVILLE, N. Y.

BUILDING INTELLIGENCE.

PLYMOUTH, MASS.—A brick block is to be erected at this place.

POTTSVILLE, PA.—Market st, 4-story br brewery; cost, $50.000; o, Chas Rettig; a, H C Wagner; b, S Auman.

PUEBLO, COL.—Plans have been prepared for the erection of a $16,000 business block. Address Architect G W Roe, 303 Central Block, as above.

SALT LAKE CITY, UTAH.—N Commercial st, 4-story br warehouse; cost, $25,000; o, B Roberts; a, Carrol & Rem.

SANTA ANA, CAL.—The C P Leonardt Portland Cement Company will erect a factory building here, at estimated cost of $125,000.

SHORT HILLS, N. J.—A casino is to be erected at this place, at an estimated cost of $20,000.

SIOUX FALLS, DAK.—2-story fr res; cost, $7,000; o, A P Abbott; a, G W Myers, Detroit, Mich; b, not let.

ST. LOUIS, MO.—Geyer and Jefferson avs, br power house; cost, $10,000; o, N D Ry Co; b, Ittner & Spore,

Delmar and Boyle avs, br dwell; cost, $7,000; o, P Y Tupper; b, W Silliman.

Washington and Sarah st, dwell; cost, $7,000; o, Mrs A L Beeding; b, T H Busey & Co.

S w cor Lindell and Vanderventer avs, br church; cost, $20,000; o, West End Chr Church; b sub let.

S e cor 6th and Locust sts, br office bldg; cost $80,000; o, St Louis R E and Inv Co; b, sub let.

Manchester rd and Rapin st, br store and dwell; cost, $7,700; o, E R Martin; b, J Ferguson.

28th and Chestnut sts, br church; cost, $33,000; o, African M E Church; b, Dan Evans.

The Heckel Hardware Co will erect a $50,000 store bldg.

BUILDING INTELLIGENCE.

SHREWSBURY, N. J.—A new town hall is to be erected at this place.

SIOUX CITY, IOWA.—Cor Pierce and 6th sts, corn palace; cost, $20,000; o, Corn Palace Co; a, J P Brown; b, Iverson & Johnson.

Second st, bet Court and Virginia, br and s warehouse; cost, $30,000; o, H H Wilkins; a, E Leak; b, not let.

SOUTH BETHLEHEM, PA.—Cor Seneca and Freytag, br and shingle res; cost, $9,000; o, W E Cox; a, A W Leh; b, no contract let.

ST. PAUL, MINN.—Farrar & Howes have filed with Building Inspector Johnson their plans for a 3-story brick and stone tenement row of 5 dwellings to be constructed on Summit av near Dale st, and cost $45,000.

The plans of the Merchants' National Bank building, to be put up at the corner of Fifth and Jackson sts, at an expense of $100,000, are also in the hands of Mr Johnson. The permit for this will be issued very soon.

The Young Men's Christian Association has applied for a permit for the new building on 10th st near Minnesota. It is to be 4-story stone and brick, to cost $90,000. The contracts have not been let yet.

Iglehart near St Albans, 2-story fr dwell; cost, $12,000; o, J E Williams.

5th, 4th and Wabasha, 3-story arcade bldg; cost, $250,000; o, Thomas Lowry.

Hill st, electric plant, power house; cost, $15,000; o, City Railway Co.

Jackson cor 5th, 3-story st and br bank building; cost, $100,000; o, Mercantile Nat Bank.

Summit nr Dale, 3-story br and st block; cost, $45,000; o, Farrer & Holmes.

Robert cor 5th, 7-story st and br building; cost, $250,000; o, Manhattan Co.

TUSKEGEE, ALA.—A $10,000 building will be erected here. Address Professor Fonville, as above.

BUILDING INTELLIGENCE.

URBANA, O.—A school building will be erected here, at a cost of about $16,000. Address Architects Williams & Otter, Dayton, O.

VALPARAISO, IND.—A $10,000 church will be erected here. For details address Claus Specht, as above.

WEST SUPERIOR, WIS.—A $10,000 dwelling will be erected here. Address E E Basten, as above.

WORCESTER, MASS.—Pleasant, br block; cost, $30,000; o, R C Taylor; a, Cutting & Forbush.

WASHINGTON, D. C.—201 3d st, 3-story br bldg; cost, $7,500; o, G P Zushost; a, A P Clark; b, C Gessford.

3313 O st, 3-story br bldg; cost, $8,500; o, F T Brookes: a, same as above.

Cor 19th and F sts, 2-story br bldg; cost, $18,000; o, A L Phillips; a, R T Fleming.

12th st, extended 3-story br bldg; cost, $7,500; o, Farnham & Chappel.

3d st bet L and N Y avs, 2-story br bldg; cost, $16,000; o, J L Locket; a, C T S Brent.

1215 F st, 4-story br bldg; cost, $30,000-o, M W Beveridge; a, J G Hill; b, Emmerst & Moody.

400–10 12th st, 6 2-story br bldgs; cost, $7,000; o, C Gessford; a, same as above.

301-9 Spruce st, 12 2-story br bldgs; cost, $36,000; o and b, W Y Lewis; a, N T Haller.

614 S st, 3-story br bldg; cost, $10,000; o, G T Wade; a, A P Clark; b, P Hepburn.

636 E Capitol st, 3-story br bldg; cost, $10,000; o, P N Dwyer; a, same as above.

2019 O st, 1406 Hopkins st, 2 3-story br bldgs; cost, $8,,000; o, L Dolliline; a, same as above.

Florida av, 5 2-story br bldgs; cost, $7,000; o, L M Saunders; a, C Federline.

1500 11th st, 3-story br bldg; cost, $8,000; o, R L Warring; a, same as above.

BUILDING INTELLIGENCE.

WASHINGTON, D. C.—1765 G st, 3-story br bldg; cost, $17,000; o, R H Gunnel; a, T F Schneider; b, Emmerst & Co.

Bunker Hill Road, 3-story br bldg; cost, $8,000; o, A Margot; a, P N Dwyer; b, T Smithson.

145–51 Carroll st, 4 2-story br bldg; cost, $11,000; o, W H Campbell; a, Y C Johnson; b, S Prescott.

100–22 E st, 100–4 Moss av, 509–15 1st st, 19 2-story br bldgs; cost, $48,000; o, Simmons & King; a, same as above.

109–34 Col st, 13 2-story br bldgs; cost, $23,400; o and a, same as above.

210–20 C st, 3 2-story br bldgs; cost, $12,000; o, J J Clark; a, Isaac Beers.

1611 K st, 3 story br bldg; cost, $14,000; o, Rev J McKim; a, Harvy L Page; b, Addison & Larcombe.

1609 K st, 3-story br bldg; cost, $15,000; o and b, Addison & Larcomb; a, Harvey L Page.

319–23 5th st, 3 2-story br bldgs; cost, $10,000; o, T Y Shannon; a, W F Kirby & Bro.

1321–23 32d st, 2 3-story br bldgs; cost, $15,000; o, G W King; a, A R Grimm; b, R W Darby.

241 permits less than $7,000 in value.

BUILDINGS.—There is nothing over $7,000 in value to report at the following places: Ogdensburg, N. Y.; Montclair, N. J.; Charleston, S. C.; San Antonio, Tex.; Harrisburg, Pa.; Geneva, N. Y.; Galveston, Tex.; Wilkesbarre, Pa.; Dayton, O.; Binghamton, N. Y.; Poughkeepsie, N. Y.; Wheeling, W. Va.; Canton, O.; Youngstown, O.; Topeka, Kan.; Clinton, Iowa; Springfield, O.

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NEWARK'S WATER-WORKS *VERSUS* PASSAIC'S SEWERS.

THE very full abstract given on another page of the points at issue in the controversy between the cities of Newark and Passaic regarding the discharge of the latter's sewage into the Passaic River will be read with much interest by all who have to do with the problems of water supply or sewage disposal as related to fresh water navigable tidal streams.

The reasons for the legal distinction, as laid down by the Chancellor, between the rights of riparian owners on navigable tidal and navigable non-tidal streams are not very obvious to the lay mind. In the former case the riparian owner is said to have no special right in the stream except the contingent one of accretion, while his riparian neighbor further up the river where the tide has ceased to flow, but where vessels still can come, owns the land under water to the middle of the stream, and can make any use of the water that will not interfere with its use by others or the right of navigation. The most probable explanation that presents itself is that the lawmakers may have assumed that tidal water must be salt, and, therefore, unfit for use, and that the fall of the tidal portion of a river was necessarily too slight to afford any power, and, therefore, did not confer upon riparian owners on tidal streams a right that seemed to have no value. Salt water is, however, often used for street sprinkling, for which purpose it is better than fresh, and tide mills are not uncommon. If any distinction is to be made between the rights of riparian owners on the banks of the same stream, it would certainly seem to be more reasonable to let that distinction be determined by the character of the adjacent water rather than by its tidal change of level. Such a rule applied to the present case would give the city of Newark a standing in court, for the lack of which she seems just now to be suffering a serious injustice.

As to the effect of tidal action in delaying the downward flow of sewage, Mr. Wurtz would seem to be seriously astray in his conclusions, since, as the effect of the natural current of the river is to make the ebb flow longer than the flood, and the effect of the ebb is to accelerate the natural flow of the river, it would follow that the effect of the tide is to bring down the greater portion of the daily discharge of sewage at a rate more rapid than that of the natural current, instead of obliging the greater part of it to traverse a much greater distance before reaching a given point below, as Mr. Wurtz believes will be the case. It must be noted, too, that greater distance does not necessarily imply greater time, which is the essential thing in the aerial oxidation of which Mr. Wurtz speaks.

Some instructive figures as to the effect of the use of the Passaic River water on public health are to be found in an editorial in our issue of June 18, 1887, by which it appears that for the seven years ending in 1881, in which Jersey City and Hoboken were both supplied with Passaic River water, the total death rate of Hoboken exceeded that of Jersey City by 7 per cent., and the death rate from zymotic diseases (for 1880 and 1881) exceeded that of Jersey City by 22 per cent., while from 1882 to 1886 inclusive, after Hoboken had changed her source of water supply to the Hackensack River, the conditions were reversed, and the total death rate of Hoboken was about 1⅓ per cent. less than that of Jersey City, while that for zymotic diseases was 9 per cent. less. It is easy from these figures to conclude that the sooner Newark can avail herself of the proposed new water supply the less sickness and death she will have.

If Passaic were wise she would think twice before inflicting her sewage on her down-stream neighbor, even if the courts allow her to do so, since just above her is the large city of Paterson, and when all of her sewage comes to be poured into the river Passaic can make no remonstrance, and her beautiful stream will in course of time become practically an open sewer, to be perhaps purified at last, as has had to be done in similar cases in England, by the enforced construction of disposal works, whose cost will be much greater than if they had been planned for in the first place.

It pays to be neighborly even for cities.

THE RIVER AND HARBOR BILL AND THE ATTITUDE OF THE NEW YORK NEWSPAPERS.

THE New York daily papers are doing the business interests of the city and those of the whole country an injury by their protests against appropriations for the improvement and development of internal watercourses. This has been going on for years, and, as Senator Miller remarked, while the New York papers protest New York harbor is unimproved. The appropriations for the rest of the country have continued, however, although on two occasions the force of demagoguery was great enough to procure vetoes, in consequence of which a great many works necessary to the development of the country had to be suspended.

This steady opposition to all improvements not immediately adjacent to New York leads the editors of other localities to ask if the opposition is not due to the influence of railroads, or in favor of Canadian canal projects. Under the influence of this feeling a western paper writes: "There is no longer any immovable reason why we should permit the intensely selfish aggrandizement of New York City to stand between the West and Liverpool." The effect of this feeling, which is possibly more general than is imagined, is shown by the action of the Senate Committee in cutting out of the appropriations the one for continuing the cut between the Harlem and the Spuyten Duyvil, an improvement of great value to New York City. One of the New York papers protesting against such action says, "Where so much money is virtually thrown away by the River and Harbor bill," etc.; but though its editor has been challenged to mention any work of magnitude on which the money has been expended to better advantage, he has not responded.

Though not even the entrance to Duluth Harbor, which was cut through a ridge 6 or 7 feet above the surface of the lake, had less depth of water than the cut through Dykeman's Meadow, between the Harlem River and Spuyten Duyvil Creek, these papers are continually inveighing against appropriations for creeks and waterways on which they assert there is no traffic, when they know there can be no traffic on any route until facilities are offered for it. They know that, without a lock, commerce through the Sault Ste. Marie would still be impossible, while the tonnage passing through that canal in seven-twelfths of a year is equal to seven-elevenths of the tonnage entering New York in the whole year. They also know that 10,000,000 more tons pass Detroit during the same seven months than enter and clear at all the seacoast ports of the United States, and that most of this is due to River and Harbor Bills.

Can any one wonder that there is a general prejudice against a city, which, judging from the nearly unanimous tone of its press, has been steadily opposed to the appropriations which has set this mighty stream of commerce in motion, a stream which by raising the price of agricultural products to the producer and decreasing their cost to the consumer enlarges the purchasing power of the money of every one in this country? Nor is the poverty of the West conducive to the wealth of New York and the seaboard generally.

BETTER COUNTRY ROADS.

AT a meeting at Pittsburg last week, of the Pennsylvania State Road Commission, Mr. James B. Powell, referring to the poor system of roads in Pennsylvania, said:

> "Poor roads are compelling farmers to give up agriculture and go to the large cities and towns. One-third of every year a farmer in Pennsylvania is bound up at his home with mud. If your commission commends any radical change the farmers will be scared by the prospect of increased taxation. Do not think of too costly roads. Ohio has five pikes costing only from $3,000 to $12,000. It has been said your commission thinks of having stone roads made. With your 70,000 miles of road in Pennsylvania I consider that an impracticable scheme. Erie County, with its fine gravel and sand—what need has she for stone? You should study the demands of localities. Some roads that are much traveled, like those in the neighborhood of a town, should be improved at a cost of about $3,000 per mile. Other roads ought not to be at more than $250 per mile.
>
> "Every road in the county ought to be named or numbered so that a stranger may know where he is. As soon as practicable all road taxes should be paid in cash. Educate the people up to this. Show them poor roads depress the value of their farms, and that as long as men work out their taxes it is impossible to have good roads.
>
> "I favor State aid for road improvements because towns are increasing in population, and they would pay much of the tax."

Another member of the commission said:

> "I would like to see all road taxes paid in money. State aid is needed to make roads good. The State is great and can afford it. Each county should appoint commissioners, and money should be distributed according to road mileage. I think convict labor on roads would be a good thing. To see criminals with a ball and chain attached, working on the public roads, would be a very wholesome lesson to young people, which would be an impression for good that no other mode of punishment would convey."

Among the practical suggestions made at the meeting was that of Col. J. J. Carter. He favored the establishment of a bureau of State roads, to be connected with the executive department of the State Government, and presided over by a State Engineer or Surveyor General, to be appointed by the Governor. He also favors a road supervisor for each county, to be elected by the people at the same time and for the same period as members of the Assembly are elected—no one to be eligible unless an educated and professional engineer; also a board of road overseers for each township, borough or city, not less than three nor more than five, to be elected by popular vote on the plan of minority representation in each district; the supervisors to appoint a roadmaster, who shall be an engineer by practice, for each district.

A GREYTOWN correspondent of the New York *Tribune*, writing on the Nicaragua Canal, says that the estimated length is 180 miles, and by means of lakes and rivers there are 120 miles clear. There are, consequently, only 60 miles of cut to be made, 13 miles on the Pacific side and 47 miles on the Atlantic side. There are to be six locks, and the depth of the water is to be 30 feet the entire length of the canal. It will take 28 hours for a vessel to pass through, and the rate is to be $2.50 per ton. The canal company now expects to complete the work in seven years.

THE prevailing scarcity of water at Jersey City, N. J., is ascribed to the lack of conduit capacity between the Belleville and distributing reservoirs.

BOOKS ON HOSPITAL DESIGN AND CONSTRUCTION.

IN response to an inquiry from Messrs. Maury & Dodd architects, Louisville, Ky., for information, in book form, concerning hospital design and construction, we repeat that the literature on this subject is voluminous, so that there is much room for selection. Volumes VII., VIII., IX., X., XI., XII., XIII. and XV. of THE ENGINEERING AND BUILDING RECORD contain interesting plans and valuable data concerning the planning and designing of hospitals, upwards of twenty notable hospitals being illustrated and described.

The following are well known books on the subject of hospital construction:

Johns Hopkins Hospital; Hospital Plans; Five Essays by Drs. Billings, Folsom, Jones, Morris and Smith, 8vo; New York; William Wood & Co.; 1875.

Das Städtische Allgemeine Krankenhaus, in Friedrichshain zu Berlin; von Gropins & Schmeiden; Berlin; 1876.

Galton, D.; Report Descriptive of Herbert Hospital at Woolwich; 4to; London; 1865.

Nightingale, F.; Notes on Hospitals; 3d edition; 4to; London; 1863.

Husson, A.; Étude sur les hopitaux; 4to; Paris; 1862.

Monat & Snell; Hospital Construction and Management; 4to; London; 1883–84.

Billings; Ventilation and Heating; New York; 8vo; published by THE ENGINEERING AND BUILDING RECORD; 1884.

Esse, C. H.; Die Krankenhäuser; Ihre Einrichtung und Verwaltung; Berlin; 1868.

D. Galton; An address on the general principles which should be observed in the construction of hospitals, with the discussion which took place thereon; London; 1869.

Oppert, F.; Hospitals, Infirmaries and Dispensaries; Their construction, interior arrangement and management, with descriptions of existing institutions and 74 illustrations; London; 1883.

WATER METERS AT DETROIT.

ACCORDING to the Detroit, Mich., *Free Press*, the saving in the consumption of water which has been effected by the introduction of the meter system at that city has enabled the Water Board to postpone the installation of an additional pumping engine. For this there would have been an imperative demand by this time if the waste of water had not been checked.

A committee was appointed at the last meeting in July, of the Water Board, to look into the matter of reducing the meter rates on water. They reported, at a meeting last week, in favor of keeping the rate on the first 5,000 cubic feet consumed each month as it has been in the past, one cent per 100 gallons. After the first 5,000 cubic feet they recommended that the rate be reduced from three-quarters to one-half cent. This reduction is made possible by the great saving that has resulted from the first year's use of the meters. The report of the committee was adopted, the reduction to take effect on the first of the present month. The report of the secretary showed over 700 meters now in use, and more being added continually.

THE CHESAPEAKE AND OHIO CANAL.

THE fourth report of Henry G. Winship and Victor Cushwa, receivers of the District of Columbia portion of the Chesapeake and Ohio Canal, has been filed with the Supreme Court of the District. The receivers state that a civil engineer familiar with canal business has been employed to go over the entire length of the canal and make measurements and estimates. He reports that the cost of repairs will be $165,955, which, when added to $39,095, required for certain lock gates, etc., needed for the effective operation of the canal, will make about $200,000, which will be the total cost of putting the canal in full navigable order from the Potomac at Cumberland to Rock Creek at Georgetown. They advise that in case this work is undertaken and completed the canal shall be apportioned into nine sections, each section to be under the control of a section boss at $900 per annum, with carpenters, lock keepers, inspectors, harbor masters, collectors, clerks, trimmers, laborers, etc., in all 180 employees, at salaries from $200 to $900 per annum, all under a general superintendent at $3,000 per annum, the whole salaries being $58,740.90. To this is to be added the cost of material needed to keep the canal in running order, extra work in annual repairs and contingencies, making the total annual cost of operating the canal $80,000. The receivers exclude from their estimate of the cost of running the canal the cost of operating the Cumberland coal wharf and the outlet lock of the Potomac Lock and Dock Company above Georgetown. They do not think the canal should pay the charges for telephone service. On the basis of repairing the canal for $200,000 and operating it for $80,000 per annum, they claim that the canal would be profitable, for the presidents of the coal companies have assured the Maryland receivers that 450,000 tons of coal will be sent over the canal each year. The receivers think that with this output of coal and other certain business an annual income of $200,000 can be realized by the canal.

"With the surplus earnings of $120,000 per annum over the operating expenses," continues the report, "your receivers believe that with wise and proper business management the Chesapeake and Ohio Canal can be relieved of its present floating indebtedness, its bonded indebtedness of 1878, together with the interest and the indebtedness to be incurred in the repair of the canal for business operations and other known indebtedness subsequent to the bonded indebtedness of 1844, in about ten years, and that then the claims of the other bondholders could be liquidated."

COMING MEETINGS.

THE American Association for the Advancement of Science will hold its 39th meeting at Indianapolis, Ind., beginning with the council meeting on August 19. At the opening general session of the association on August 20, in the Capitol, President Mendenhall, Superintendent of the U. S. Coast Survey, will resign the chair to his successor, Professor Goodale, of Harvard College, and in the evening will deliver his annual address, to be followed by a reception.

Besides the regular sessions, which will continue until the evening of August 26, the Local Committee has arranged excursions to Terre Haute, Lafayette, the Mammoth Cave, the Shades of Death, and the Natural Gas Region around Kokomo.

Special rates have been secured for transportation and at the hotels. The Permanent Secretary, Prof. F. W. Putnam, can be addressed at the Denison Hotel, Indianapolis, Ind. The officers of the Local Committee are Dr. George W. Sloan, Chairman; Noble C. Butler, Treasurer, and Alfred F. Potts, Secretary.

AMERICAN MACHINERY ABROAD.

THE Ingersoll-Sergeant Rock Drill Company, of New York, has just received an order, from the contractors engaged in removing the iron gates of the Danube, for a large plant of submarine drilling apparatus. Mr. Bessier, a German engineer, recently visited this country in the interests of the work on the Danube. He investigated American methods thoroughly, with the result mentioned. The work extends for 20 miles along the Danube River, and will cost about $5,000,000. The removal of these obstructions has been attempted many times; the earliest attempt dating back to the times of the Roman emperors.

PERSONAL.

COL. B. S. CHURCH, of New York, was recently engaged in going over the project of the Ocmulgee Canal Co., of Macon, Ga., for bringing water to that city from the Ocmulgee river through a 10-mile canal.

W. H. EDWARDS, architect, recently located in Harriman, Tenn., would like to receive some building trade circulars, catalogues, and office samples of building specialties.

K. E. HILGARD, M. Am. Soc. C. E., formerly Principal Assistant Engineer in charge of Fourth Street extension C. & O. R. R., of Cincinnati, sailed for Europe on Wednesday, August 13, on steamer "Nordland," to be absent for several months.

HENRY C. MEYER, Editor and Proprietor of THE ENGINEERING AND BUILDING RECORD, returned from Europe on the steamer "Etruria" August 10, and is now in the Adirondack Mountains.

OUR ARCHITECTURAL ILLUSTRATIONS.

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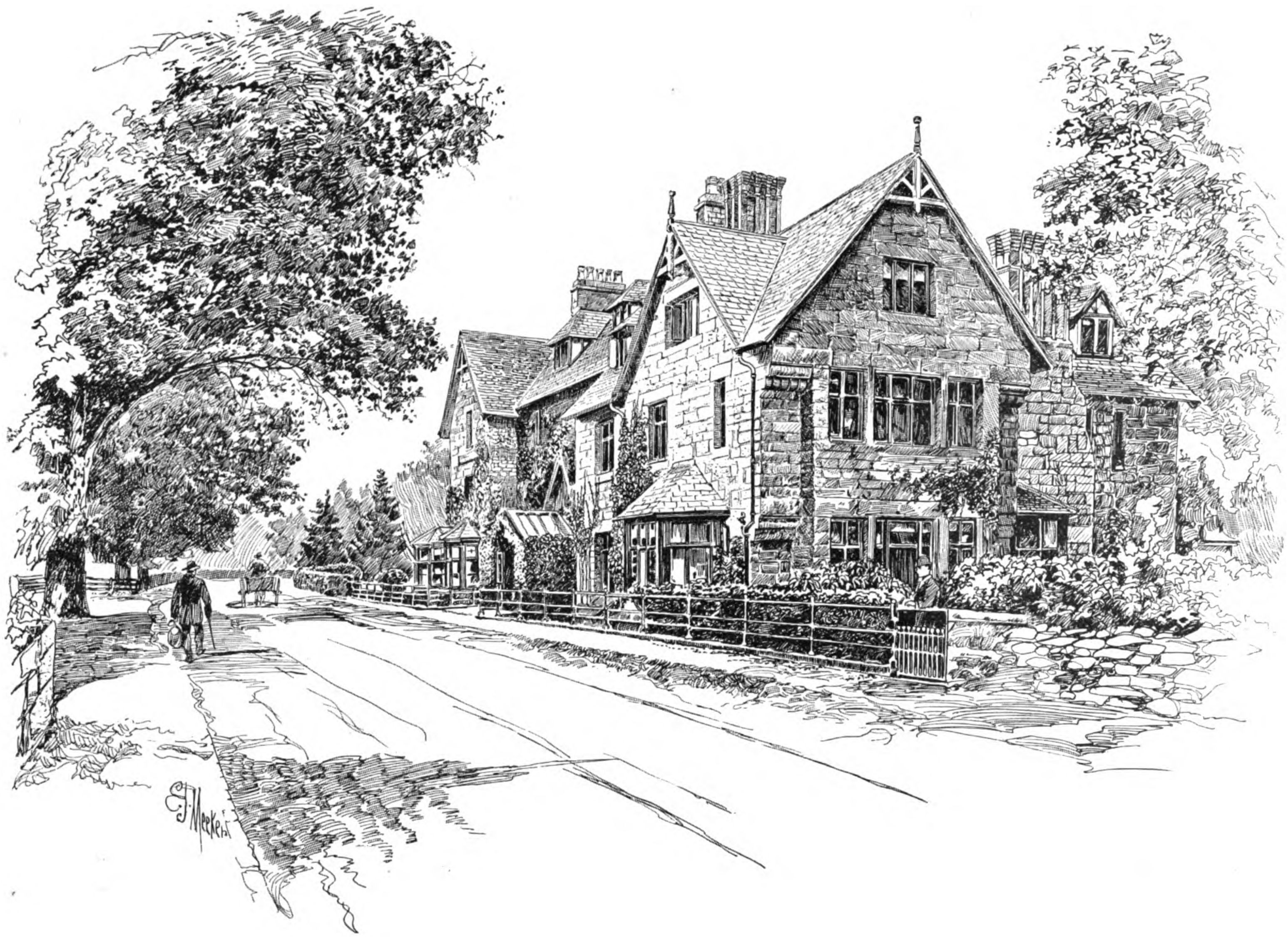

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LETTER FROM ENGLAND.

(Regular Correspondence.)

LONDON, August 1, 1890.

THE question of acquiring the rights of the water companies is being extensively agitated both by the London County Council and the various vestries, and a meeting composed of delegates from the various vestries has recently been held with this view. No apparent result has been arrived at, the chief thing blocking the way apparently being the fact that the London County Council are taking steps to try and get legislation on the point, and the vestries are, of course, anxious to take advantage of the Council's experience in pressing through such action. The resolution was, however, come to that a standing committee should be appointed to prepare notices of a draft bill and to take such other steps as might be necessary for promoting the bill in Parliament for the purchase of water companies' undertakings.

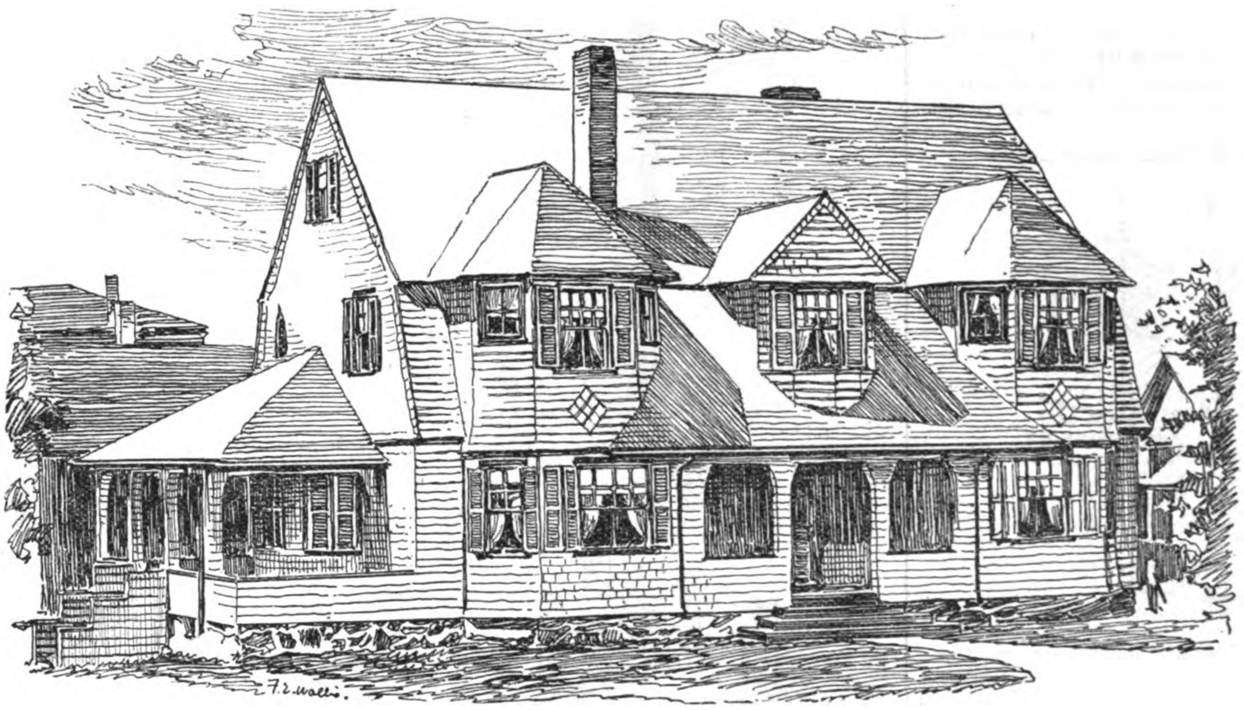
Referring to the special Water Committee promoted by the London County Council, and now being held in the Guildhall in connection with the proposed legislation for acquiring water service, it is interesting to note that the water companies, who were all invited to send delegates, have replied with unanimity, refusing to take advantage of the offer.

The St. Pancras Vestry has decided to provide electric light for public service and for private supply on its own responsibility, and the Electricity Committee of the vestry has recommended the acceptance of tenders amounting to £50,946 ($244,540 80) to carry out the work. The installation apparently will provide 10,000 incandescent lights and 90 arc lamps. Professor Robinson is the engineer for the vestry, and Dr. Hopkinson, of the Institute of Electric Engineers, and Mr. Preece, of the Post Office, having been consulted on the undertaking, express their concurrence and belief that it should be profitable to the ratepayers generally.

A system of dredging which has found great favor at Tilbury Docks, the invention of Mr. Tideman, the Engineer of the East and West India Docks, is now undergoing trial at Southsea. The principle is that of using water jets delivered through twelve nozzles in a frame lowered to the bed of the channel. The application of this principle is in connection simply with the silt deposited by incoming tides. It is stated that whereas the dredging necessary at Tilbury, consequent upon the deposit by the incoming tide in the various basins alongside the ships' hulks, had been £1,200 ($5,760) per week, with this system of water jet it had been reduced to £273 ($1,310.40) per week.

The question of height of buildings in the city is under discussion before the Lords' Committee, who are considering a bill relating to the powers of the London County Council. The proposal is that no building shall be erected to a greater height than 70 feet without the consent of the Council under penalty for contravention. Mr. Balfour, Surveyor to the Duke of Westminster, supported the clause generally so far as stopping monstrosities was concerned, but at the same time would like to see the limit fixed at 100 feet, pointing out specially that it was of advantage that workingmen's dwellings should be allowed to go to a considerable height with a view to obtaining as much room as possible. Captain Shaw, Chief of the Fire Brigade, also attended before the committee, and was of opinion that having regard to the condition of the city, the narrowness of the streets and the crowding of warehouses, the proposed extended powers to the London County Council to increase the cubical contents of warehouses would be fraught with considerable danger unless there was a protecting clause that such enlargement should only be consented to subject to the report of the Superintending Architect and of himself (Captain Shaw). The captain's view was that 60 feet should be the limit. It was of course not for him to advocate the increase of height, inasmuch as his point of view is purely the "fire" point. The committee finally decided that 70 feet was insufficient and that 90 feet was to be recommended.

ACCORDING to a Racine, Wis., account the Wind Lake Canal, one of the most gigantic drainage enterprises ever undertaken in the Northwest and the largest ever attempted in the State, is now completed. Less than two years have been necessary to do the work whereby fifteen miles of canal has been dug and a vast tract of country drained. The land reclaimed, which has hitherto been valueless, is now worth in the neighborhood of $500,000.



RESIDENCE OF DR. F. D. STACKPOLE, YORK HARBOR.—WHEELWRIGHT & HAVEN, ARCHITECTS, BOSTON, MASS.

THE NEW CROTON AQUEDUCT.

THE recent formal opening of the New Croton Aqueduct was somewhat hastened to relieve the urgent demand for additional water supply in this city, and to test certain portions of the construction by subjecting it to actual working conditions before final approval.

It was decided to make a preliminary trial which should inaugurate and test its operation, fill the city storage reservoir in Central Park, and flush out the conduits.

After accomplishing this the aqueduct was to be again emptied, and final inspection and work done before regular service was commenced. Accordingly, after the required satisfactory service, the head gates at Croton Dam were shut at 9 A. M., August 6, so that no more water could enter the aqueduct except by seepage, &c.

The upper portions of the conduit were duly emptied by the gravity flow down to the hydraulic grade line, and at 10 P. M., Aug. 7, the "blow offs" at shafts 25 and 26 were opened and emptied all the submerged part (that below the hydraulic grade), except the section between shafts 24 and 25, which comprises the tunnel under the Harlem River.

The engine at shaft 25 was started at 9 A. M. August 9, and at 7.30 A. M. August 11 had emptied the tunnel.

The final preparations for executing the remaining repairs were commenced on August 11, in the aqueduct between shafts 18 and 19.

The original defects of construction of the aqueduct have been described in these columns, and consisted largely in the omission of backing that was specified to fill all spaces between the masonry and the irregular surface of the tunnel and shaft excavations. Most of these defects have been remedied by piercing the walls and filling the cavities with grout under pressure or by cutting out and replacing sections of the masonry and building the required backing in the cavities. Between shafts 18 and 19 there still remain open spaces over the top only of the aqueduct (which is here a horse-shoe shaped tunnel 10'6"x10'6" inside with arched brick walls about 15 inches thick).

As there can be no hydraulic upward pressure on this part of the aqueduct, it was decided to allow its preliminary use without waiting to put in the overhead filling necessary to protect the brickwork from falling stone, etc. While the aqueduct is emptied the scaffold shown, Figs. 1

and 2, will be erected and afterwards a stream of water 2 or 3 feet deep in the bottom of the aqueduct will deliver a daily supply of 25 to 40 million gallons for city use without in any way obstructing the repairs. Figure 1 is a cross section of the aqueduct, and Fig. 2 is a section at Z Z, Fig. 1, and shows several bents of the scaffold that is 3,000 feet long.

Near shaft 18 an opening has been made through the top of the aqueduct into an open cut through which materials are delivered to the car C that runs on track T and distributes them to holes A A, etc., through which the cavities are filled, each cross beam is firmly secured by the wedges D D driven tight against the side walls of the aqueduct.

A little more grout will be forced through the walls from this platform and some finishing touches will be given to the shafts from adjustable circular platforms suspended from the top, but it is expected that the work will be completed in six weeks, and it is interesting from its simplicity and the arrangements for conducting it while the aqueduct is in operation.

Figure 12 shows a general diagram of the tunnel which is pumped out through shaft 25. The tunnel was originally intended to be driven from C but was depressed, as shown, to avoid the rock seam D.

Figure 3 is a vertical section through the shaft at W W, Fig. 7. Figure 7 is a section at Z Z, Figs. 3, 4 and 5. Figures 4, 5 and 6 are vertical sections at Y Y, X X, and V V, respectively, Fig. 7.

A is the aqueduct and B the pump shaft, both lined with brick walls, backed up with solid rubble masonry to the surface of the rock excavation. The pump shaft has a cast-iron lining, *i*, Fig. 9. O is the aqueduct to New York and Q is the tunnel aqueduct under the river. Communication between shafts A and B is controlled by a gate S, operated by shaft N. As the hydraulic grade line is above the tops of these shafts the arches I I, etc., are built to resist the upward pressure; they have manholes closed by iron covers H H, etc. F is a 36-inch supply pipe; G is a 12-inch drain; J is a 20-inch drain; K and L are 48-inch blow-off pipes emptying into the river.

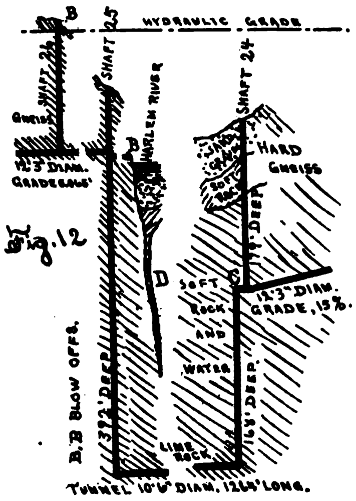


Fig. 12

As the tunnel is likely to be rarely emptied the usual form of pump would be unsuitable and subject to deterioration from disuse and the buckets E E were provided instead for dipping the water out. Each bucket has a capacity of 1,350 gallons and is attached to a steel wire cable passing over sheave C and wound on drum D, that is driven by a reversing engine. The buckets E counterbalance each other, one ascending full while the other descends empty. When the ascending bucket reaches the proper height it is announced by an indicator and the ringing of a bell, an attendant reverses the engine and the other bucket is drawn up, and so on.

While the buckets always rise to a standard height, they have continually to be given a little more descent until the water level is lowered to the bottom of the shaft. This is effected by having one of the drums fixed upon the shaft, while the other is loose and bolted to the first. By releasing these bolts, while holding the loose drum with the brake, the engine is driven in one or the other direction until the proper amount of rope has been fed out, when the bolts are refastened. This whole operation takes about three minutes.

An average of three bucketfuls per minute was dipped out of the shaft, and the contents of shafts and tunnel, amounting to about 3,000,000 gallons, was dipped out in 46½ hours.

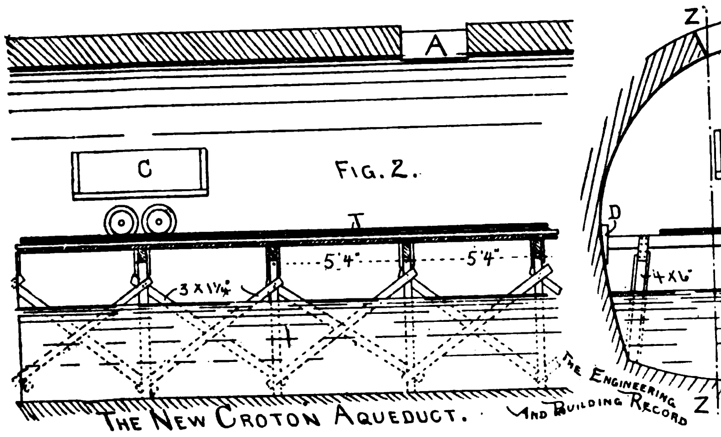


Fig. 1. Fig. 2.

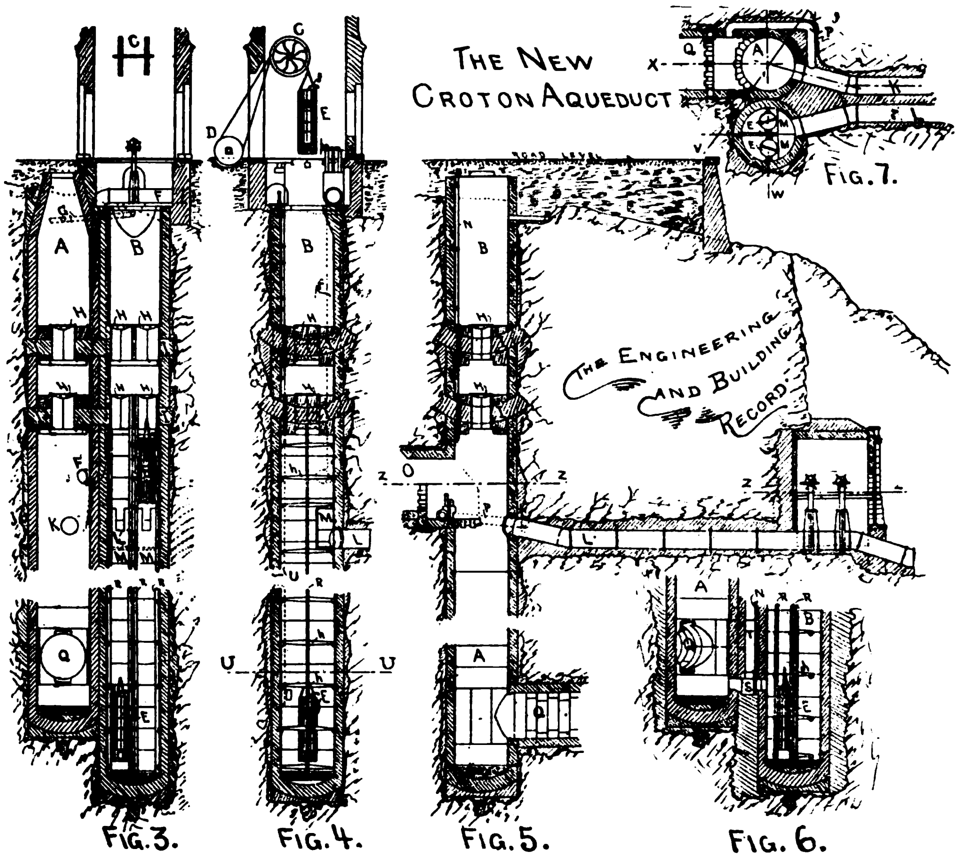


Fig. 3. Fig. 4. Fig. 5. Fig. 6. Fig. 7.

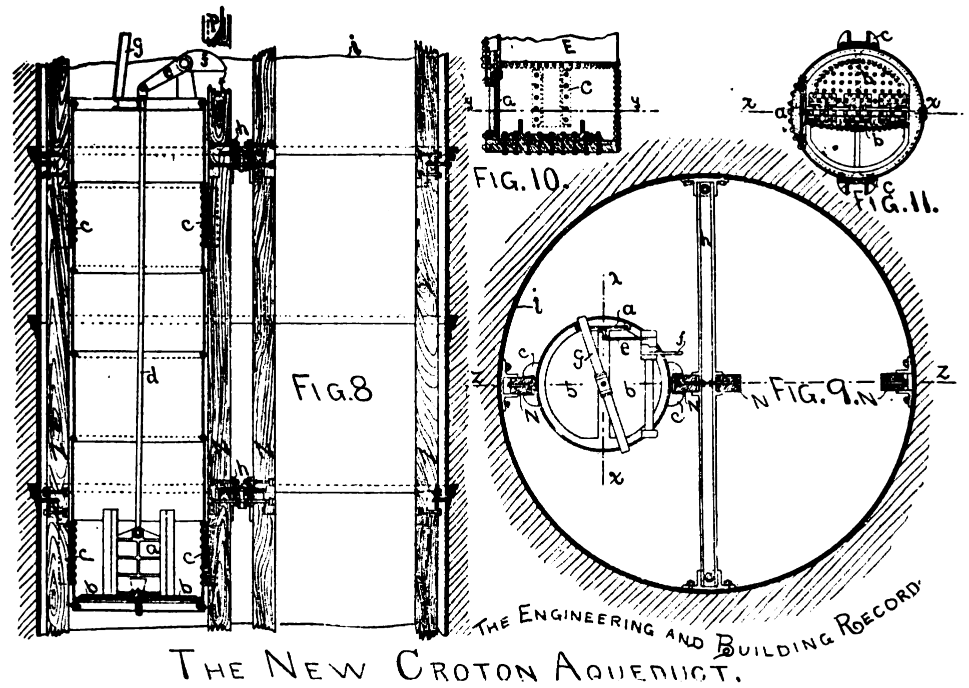


Fig. 8. Fig. 9. Fig. 10. Fig. 11.

THE NEW CROTON AQUEDUCT.

Figure 9 is an enlarged cross section of the shaft at U U, Fig. 4.

Figure 8 is a section at *x x*, Fig. 9.

Figure 10 is a section at *z z*, Fig. 9, of part of the bucket.

Figure 11 is a section at *y y*, Fig. 10, and shows one of the valves *b* open instead of closed, as elsewhere represented.

The reference letters in these figures have the same significance as in Figs. 3, 4, 5, 6 and 7, except that the same pieces are designated here by N N, etc., and there by R R, etc.

When the descending bucket strikes the surface of the water the butterfly valves *b b* open upwards and the bucket fills; when the bucket rises these valves close and retain its contents. N N, etc. (R R, etc., Figs. 3, 4 and 6), are yellow pine guides engaged by the lugs *c c*. When the bucket reaches the required height the latch *f* is tripped by the fixed cam *p*, and, operating the lever *e* and rod *d*, raises gate *a* and allows the water to be discharged into catch basin M (Figs. 3, 4 and 7), and thence through blow-off L.

After the tunnel had been emptied it was inspected by the engineers and found satisfactory. Some mud, sand and loose cement was found in the bottom, where it had been deposited by drainage from other portions of the aqueduct. After this is cleaned out the water will be re-admitted.

THE ROCHESTER, N. Y., WATER-WORKS.

THE potable water supply for the city of Rochester, N. Y., is taken from Hemlock Lake, a natural mountain lake in Livingston County, about 30 miles south of Rochester, 900 feet above sea level and about 380 feet above the level of the city. The area of the water-shed is about 43 square miles.

The city is supplied by a gravity system, the water flowing first into an impounding reservoir at Rush, eight miles south of Rochester, and from there into the Mt. Hope reservoir within the city limits. From this the water is distributed through the city. The capacity of the two reservoirs is 88,091,908 gallons, and the daily available supply is about 9,000,000 gallons, the estimated population of Rochester being 135,000. The total length of conduit is about 30 miles.

For fire purposes in the business center of the city water is supplied by a Holly direct pressure pumping plant, the water being taken from the Genesee River. Power for this plant is furnished by turbine water-wheels, though auxiliary steam power is provided for. The daily capacity of the plant is 7,000,000 gallons. The highest point supplied in the city is 625 feet above sea level and the lowest 137 feet. The pressure in the mains for domestic or potable supply is 40 pounds per square inch, and in the mains of the Holly system 100 pounds per square inch. On December 31, 1889, the figures for mileage of mains, number of hydrants, etc., were:

Miles of mains (potable)	201.281
Miles of mains (Holly)	13.83
Total	215.111
Hydrants	2,043
Watering troughs	43
Fountains	2
Water meters	2,060
Taps	23,146

The water-works are city property. The care and maintenance of the water supply, as well as of the highways and the problem of fire protection, are in the hands of an Executive Board composed of three members, one of whom is elected at each annual spring charter election for a term of three years. This Board has sole power to let all contracts to be made by the city in pursuance of ordinances passed by the city's Common Council, except such as are directed by law to be made otherwise, and has the supervision and control of all work ordered by the Common Council. The bonds for the construction of the water-works were issued under Act Chapter 387, Laws of 1872, and the original fourteen wards of the city, with an aggregate acreage of 4,840 acres were jointly liable. In 1874 two new wards, the Fifteenth and Sixteenth, were annexed to the corporation. Together they have an area of 5,809 acres, making the total area within city limits 10,649. A law was passed which provided that whenever a majority of the taxpayers on a street within the annexed territory shall petition for the extension of water mains or of lamps upon such street, for their benefit, the taxable property and residents upon said street shall become jointly liable to assessment. This petition is presented to the Common Council by the alderman of the ward in which the street is situated. This is true for any ward in the city, but a majority of the owners' names is insisted on in the case of the before-mentioned annexed territory.

If the petition is reported on favorably it is sent to the Executive Board who submits it to the City Assessors for official action as to its being a majority petition, and on its return it is filed for consideration. The various streets mentioned in the petition are personally examined and notes made of their conditions and surroundings, size of distribution mains determined on; estimates of cost of construction are prepared by the Engineer's Department, and a list is made which is considered by a Water-Works Committee of the Common Council, the Executive Board and the Chief Engineer of Water-Works. This committee determine upon what portions presented are in most pressing need of water, and fix upon the amount that will be required to be raised by tax levy for water pipe extension and report to Common Council.

The quantity of pipe and specials required for extensions and current repairs is made up. Notices of letting are published, and pipe contracts let in the usual manner. Public bids are also invited for unloading and distributing water-works materials for the season. The streets under consideration are then surveyed, levels run, grades established, and maps and profiles made (always in duplicate) of the work to be done. The different streets are then grouped in the most advantageous manner as to location, etc.; a letting sheet is prepared, and the groups are published in the official paper for a period of ten days prior to letting. During the three days immediately prior to letting an exhibit is made in the construction office of the water-works of the maps, profiles, if any, where extra cover is required over pipe in view of future reduction in grade, together with said letting sheet, setting forth the items of work embraced in the several groups. Proposal sheets are furnished each contractor. Sealed proposals are handed in to the Clerk of the Board, and the contract is generally let to the lowest bidder. The Board, however, reserves the right to reject any or all bids, etc.

The awards being made, the contracts drawn up, the work is carefully staked out by map; the work of trenching commenced, and an inspector appointed who sees that the proper depths are made to allow for 4½ foot cover; that the pipes are laid in true grades and alignment; that blocks and wedges are properly placed, and the specification amount of lead obtained. When the work of laying pipe has been completed, and joints are made up, hydrants and stop-gates set, etc., notice is given to the engineering department. Measurements of the pipe are then made with a steel tape, two men handling the tape and a third keeping a record, noting, among other things, the condition of the soil, depth of rock, gas pipes, etc., etc. About 59 miles of distribution mains were laid under contract at the time of the building of the works from the lake, and the work was completed October 1, 1876. Since that time the remainder has been put down; the yearly mileage varying according to requirements.

When the year's work is ended the amount and character of mains, etc., laid are noted alphabetically as to streets and embodied in a table. The amount of pipe removed is arranged in another table. Similar tables are arranged for recording the hydrants and stop-gates. The field notes are copied from the small field book into a large record book, in which everything is noted exactly as it occurred in making the measurements. These record books are kept on file.

The record maps are made on sheets of Whatman's cold pressed paper—double elephant, 3'2"x2'1½" outside; inside border, 3'x1'10½"; heavily backed by cloth with leather-bound edges. A scale of 40 feet to the inch is used, the sizes of the different pipes being represented by the following uniform signs.

Emerald green	4"	cast-iron	(light)	24"	cast-iron	(heavy)
French blue	6"	"	"	12"	"	"
Scarlet lake	8"	"	"	16"	"	"
Chrome yellow	10"	"	"	20"	"	"

Wrought iron pipes are shown in burnt sienna, with sizes marked on.

In these maps, the Domestic system is in full lines and the Holly system in broken lines. All Domestic stop-gates and hydrants are designated by blue circles and all Holly stop-gates by red circles.

Every special fitting is shown; streets are colored on respective sides, madder brown and sienna; lettering, uniform; main streets, heavy; side streets, scrip.

A pipe yard, connected with the water-works system, is located on the Erie Canal. Different sizes of pipe are there kept, together with a full line of specials, hydrants, stop-gates, lead, and all material entering into repairs of an extensive system. The various articles are charged to the pipe yard in a book kept for the purpose. Orders are made on the yard and the official in charge endorses the weight on the back and returns it to the engineer's office where it is credited to the pipe yard in a ledger. The lead used in calking pipe joints is obtained from the city and the amount is deducted in the monthly and final estimates. At the end of the season a general inventory is taken, a balance is struck, all material received is accounted for, and what scrap remains is sold.

The city employs a full force of men, calkers, tappers, plumbers, etc., known as the Repair Force. It is in charge of a superintendent of repairs who has a separate building connected by telephone with the office of the Executive Board. The Repair Force is constantly employed in the various duties common to all large distribution systems. They frequently lay large mains where immediate necessity requires it, and make all cut-outs for automatic service, large services, supply of factories, tenement houses, etc.

A brief reference to the Holly system pump-house and machinery will here prove interesting. The lot on which the pump-house is located is known as the south part of lot No. 5, of the Griffith Tract, located on Brown's Race. It has a frontage of 50 feet on the Race and extends back to the Genesee River. There are five water rights connected with the property, embracing about five-eightieths or one-sixth of the water of the Race. The location is eminently judicious, as it is situated but a short distance from the head of the Race, so that in time of low water and in case of emergency, such as a large conflagration, a free draught upon the whole body of water in the Race can be made.

The flume which conveys the water to the rear of the building is located on the south side of the building, its entrance at the Race being guarded by an iron rack or grating, whose bars are about four inches apart, which serves to exclude the larger floating bodies. At the wall separating the engine and boiler rooms, another rack with the bars only one inch apart is placed, by which the water is thoroughly screened and all bodies, of a size sufficient to cause injury to the wheels removed. Behind this second rack is a bulkhead having three large cast-iron vertical gates, each three feet wide and four feet high, by the operation of which the water may be admitted into or excluded from the remainder of the building. Between the flume wall and the boiler foundation is an arched culvert, 3½ feet wide and 6 feet high, the end at the Race being closed up with a solid wall 5 feet thick, beneath which and wholly below the bottom of the Race a large wrought-iron pipe 2 feet in diameter passes. The other end of the culvert is open towards the several suction pits. An opening 2 feet in diameter into this culvert near the bottom of the flume and regulated by a slide gate, allows the water in the flume ahead of the stop-gates to enter into this culvert and thence into the suction pits for the pumps, as well as into the above-mentioned wrought-iron pipe, which is then, however, closed off by a valve across the race. Behind the large wrought-iron tube in the rear of the building, which conveys the water from the flume above to the turbines below, is another bulkhead, with a large sliding gate, and behind this and the north flume wall all the pumps take suction.

A 24-inch wrought-iron pipe runs from the most southern race to the reservoir under the pump-house. This will furnish water to the pumps when Brown's Race is drawn off for any purpose, and may even be used to drive one turbine if required. In case the water should be drawn from both races at the same time, provision is made by which water from the 20 inch Hemlock Lake main may be forced into the 24-inch supply main and furnished to the pump-house for pumping back into the Holly mains, so that three distinct sources of supply of water for the Holly works are accessible.

The machinery consists of three distinct parts. The first embraces four combined steam piston engines, with cylinders 16 inches in diameter and 27 inches stroke, having variable expansion gear, and arranged so as to permit working either condensing or non-condensing. To these four engines four double-acting pumps, 10 inches in diameter and 20 inches stroke, are attached direct. The pumps and engines may, however, be readily uncoupled. Any one of the engines with its corresponding pump may also be quickly detached from the remainder of the set. The four engines with their pumps are arranged on two sides of a substantial arched frame of cast iron, supporting at its top the crank shaft, which carries a large fly-wheel, a gear wheel and the eccentrics. The two cranks at the ends of this shaft are at right angles to each other; and as two engines are coupled to one crank pin, one piston of this pair will be at the middle and the other at the beginning or end of its stroke, and hence it follows that in one revolution of the fly-wheel there will be eight successive discharges of four double-acting pumps, imparting a practically steady pressure and uniform flow of water in the pipes.

The second part of the machinery consists of a rotary steam engine placed in front of the above set, operating two rotary pumps for fire streams. The piston engines may also be made to operate one or both of the rotary pumps, by means of gear wheels, without the aid of the rotary engines.

The third part is the water set, which consists of eight double-acting pumps, arranged in two sets, each having four cylinders 9 inches in diameter and 24 inches stroke, mounted upon heavy cast-iron arched frames similar to the steam set; and, as in the latter, a pair of pumps are coupled together upon one crank pin on each side of the two frames. These two frames are isolated, but the machinery of the one may be connected to that of the other by means of a movable section of shafting, so that the power applied to the one will drive the other. The crank rod of each pump may be uncoupled so that any one cylinder may be isolated, and as in the case of the steam set, the four pumps of each of the two water sets are so connected to the cranks that there will be eight successive discharges of the water during one revolution of the crank shaft. The power used is derived from two turbines working under a head of about 90 feet. The shafts of these turbines extend continuously from the wheels to the frames, where they terminate each with a small bevel gear wheel, working into another of much greater diameter. The shaft supporting this latter wheel also carries a small toothed wheel, which, in turn, plays into the teeth of another large and heavy gear wheel fixed to the crank shaft, that imparts the motion and power to the pumps. These several transformations are rendered necessary in order to reduce the great speed of the turbines.

Steam is furnished by three tubular boilers, any one of which may be used separately, or all of them together. These boilers are each 5 feet in diameter, 16 feet long. Holly's hydrostatic pressure gauges or regulators, of which there are two, one for the steam and one for the water set, regulate the amount of steam to be supplied to the engines or the amount of water for driving the turbines, for a given pressure upon the mains, by means of an automatic mechanism, cutting off or increasing the supply independently of the engineer in charge, besides giving a signal upon a gong when an extra demand for water occurs, as in case of a large fire. There is, besides, a water safety valve in the building to prevent any rise of water pressure in the mains above a certain point.

It is estimated that the four combined steam engines will develop 300 horse-power and the rotary engine 150. The pumping capacity is guaranteed to be no less than 3,000,000 gallons in twenty-four hours, while that of the water set is to be no less than 4,000,000 gallons in twenty-four hours. The power of the turbines is estimated at 250 horse-power. The wheels are of the tangential class, 26 inches in diameter, and were built by Messrs. Stout, Mills & Temple, of Dayton, O. The flume or penstock is a wrought-iron tube 4½ feet in diameter, made of ¼-inch plates. Its lower end rests on a solid pier of masonry and has a 4-inch outlet valve through which it can be emptied.

The cost of the pump-house, land and water rights, cost of pipe and laying, and cost of hydrants and gates was about $350,000. For this sum a 7,000,000-gallon daily supply was obtained. It is thought that from no other source and in no other way could the city be furnished with so much water for anything like that sum. As a result of this construction the daily supply of the city is practically double what it would have been without it, and that, as already stated, for a smaller sum than it could otherwise have been obtained. For the purposes for which it was designed to be used, the river water is as efficient as water from any other source would be.

The present Executive Board of Rochester consists of Julius Armbruster, Chairman, term expires in 1891; William W. Barnard, term expires in 1893; George W. Aldridge, term expires in 1892; Thos. H. Neville, Clerk. George W. Rafter, is Assistant Engineer in charge of additional water supply and Acting Chief Engineer. The Construction Department consists of W. N. Radenhurst, Assistant Engineer in Charge; George A. Hotchkin, Assistant Engineer; Thomas H. Rogers, Draughtsman; F. M. Hills, Leveler; D. H. Westbury, Jr., Rodman. There are during the season three pipe inspectors, one pipe distributor and one man in charge of pipe yard. Daniel O'Neil is Superintendent of Repairs.

There is telephone communication between Hemlock Lake and the various points along the line of conduit—viz.: Richmond Mills, Honeoye Falls, Rush Reservoir and Mount Hope Reservoir. The telephone line was completed in the fall of 1877 and was one of the earliest put up.

ARIZONA WATER STORAGE.

PLANS for irrigating the arid lands of Arizona are, at present, attracting considerable attention.

The smaller streams of Arizona, says the Phœnix, Ariz. *Republican*, are all of one class, running fullest in the spring and almost failing in the summer. Those that run into the plains sink in the sands, and are lost for the major portion of the year. The question naturally arises, Why not store the winter water in suitable reservoirs, to be spread on the thirsty lands at the time of the drought?

This proposition has been appreciated, as is shown by the location of dam sites for water storage purposes in many parts of the territory. The Florence Canal Company has just finished an extensive reservoir in Pinal County to assist in the irrigation of the lands adjacent to the Casa Grande.

Among the projected reservoirs that have been located for the improvement of the lands lying below one of the most important is that upon New River, about thirty miles northwest of Phœnix. It is situated where New River debouches on the plain. The projectors are John King and W. C. Collier, who have been quietly working on the enterprise for years.

The dam will need to be nearly half a mile in length, 320 feet in thickness on the bedrock, 90 feet broad on top and 75 feet high. Hydraulic lime for the manufacture of cement, limestone and other rock for the construction of the dam are at hand in abundance, and can be cheaply quarried. Estimates from civil engineers of repute fix the cost of the work at less than $300,000. With the height of dam proposed the water would cover an area of eight by four miles, there being but little slope to the valley above. The supply of water from the spring freshets of the river is deemed ample, but as a precaution levels have been run to Hudson Creek, Castle Creek and the Agua Fria, and it has been demonstrated that it is practicable to divert at low cost the waters of those streams into the reservoir.

The Agua Fria, at the point tapped, flows the year round. All danger of overflow can be avoided, as a natural spillway exists at the proper height two miles back from the dam, conducting the water over a low bridge into the valley of the Agua Fria.

The land sought to be irrigated is really a continuation of this valley, and embraces over 75,000 acres of excellent soil. Many claims have already been filed in expectation of the benefits of the dam.

About eight miles farther to the west of this dam site and over a ridge is the location of a similar enterprise of fully equal magnitude. It is the property of the Agua Fria Water and Land Company, composed of L. H. Orme, J. P. Orme, J. D. Monihon, N. O. Murphy and William Hancock, all of Phœnix. The dam is to be situated at the narrow gorge of the Agua Fria, 300 yards above the Frog Tanks Hotel. The walls of the canyon at this point are but 300 feet apart to the height of seventy-five feet, and above this gradually retreat from the stream. The proposed dam is to be 175 feet high, with an ample width and a length on top of about 1,000 feet. It will not be difficult of construction. All rock and lime needed can be obtained right at hand.

A dam of the dimensions stated will back the water up stream a distance of ten miles with a depth at the mouth of Castle Creek of 125 feet. At a point two miles above the dam the reservoir will be three and one-half miles in width, besides extending for some distance up Castle and Humbug Creeks. The capacity of the reservoir is estimated at 40,000,000,000 cubic feet of water. This amount will supply for twelve months a canal carrying 40,000 miner's inches of water, and allow for an evaporation of 25 per cent. The natural flow of the Agua Fria will more than supply this amount every year.

The main canal will be taken from the river on the east side, about one and one-half miles below the Frog Tanks Station. It will run along the slope of the river bottom for a distance, emerging on the plain three miles below the Tanks. The land to be irrigated comprises about 75,000 acres. It is of excellent quality, especially adapted to the growth of citrus fruits.

THE entire cost of the Washington Bridge, New York, up to this time, exclusive of office expenses, has been $2,673,601.67, to which is to be added the office expenses, legal costs paid, more land purchased, and the work of grading and terracing completed.

THE patent suit of the Eclipse Radiator Company, of Chicago, Ill., against the makers of the Elite radiator, for infringement on its patent for an ornamental radiator, which has been in the courts for the past two years, has just been decided in favor of the plaintiff.

GARBAGE DESTRUCTION AT ST. LOUIS.

THE promoters of the measure authorizing the Mayor and Health Commissioner to enter into a contract for the disposal of the slop, offal, garbage and animal matter of the city by the Merz process, will begin the erection of two plants immediately upon the approval of their contract. According to the St. Louis *Republic*, the contract must be let before the 1st of September, and the contractors will be required to commence destroying the garbage within four months from that date. The recent three-years' contract for the removal of the garbage was so framed that the contractor can be required to deliver the slop and garbage at the works where they are to be destroyed. The contract for the disposal of the garbage will be entered into for a period of not less than ten years. At the expiration of that time the city has the privilege of purchasing the entire plant at a valuation to be fixed by arbitrators. It is now claimed that the works will cost $113,000. The exact location of the two houses will be determined by the contractors. The ordinance specifies that one shall be in the northern and the other in the southern part of the city.

The cost of the introduction of this system for the destruction of the garbage cannot be estimated beforehand. It is understood that the owners of the Merz patent-right for St. Louis will not bid above $2 a ton for the destruction of the slop and garbage. The amount of garbage collected has been variously estimated. Thirty tons a day is given as a fair figure. At that rate it will cost the city about $22,000 a year to dispose of the garbage and about an equal amount to collect it. The collection, removal and destruction of garbage and slop will cost about $42,000 a year. Then the ordinance provides for the appointment by the Mayor of a garbage inspector, whose duty it shall be to inspect the city for the purpose of determining whether all the slops and garbage are properly collected. Then the inspector is authorized to appoint a competent weigher, whose duty it shall be to see that the garbage is weighed correctly.

The report was sent out from Detroit recently that the Board of Health of that city had condemned their Merz works as a nuisance and ordered them removed. The works to be put up in St. Louis, however, will, it is said, be an improvement on the Detroit plant.

HARLEM RIVER IMPROVEMENT.

THE fact that the item of $350,000 for the improvement of the Harlem River has been stricken from the River and Harbor bill by the Senate Committee has induced Comptroller Myers, of N.Y., to write a long letter to Senator William P. Frye, Chairman of the Senate Committee on Commerce. The Comptroller describes the relations of the United States and the State and city of New York in the matter as follows:

"*First.*—Relying on the good faith of the Government of the United States to carry out this work, the Legislature of the State of New York authorized proceedings to take forcibly from private owners the necessary lands for it, and to compel riparian owners to pay for these lands and the expenses of acquiring them. Such proceedings have been taken, the riparian owners have been assessed the sum of $225,639.91, and the title to the lands so acquired by the city has been transferred to the United States. This assessment has been chiefly paid, and the amount unpaid by owners has been advanced by the Treasury of the city of New York.

"*Second.*—The city of New York has for this improvement ceded to the United States $109\frac{225}{1000}$ acres of land of great value.

"*Third.*—The United States Government has entered upon this work, and has already expended or contracted for the expenditure of $400,000 toward it; it is already well advanced, and the riparian ownership has for several years been adapting itself to the lines of the improvement, the plans of which have been approved by the United States Engineers.

"From the above it will be observed that the faith of the United States, of the State of New York, and that of the city of New York are pledged to the execution of this work, and that the property owners who have been heavily assessed and otherwise burdened by expenses and losses are entitled to have this work completed. For more than 20 years the subject of the improvement of the Harlem River has been before the public. It has been thoroughly discussed in all its bearings, and the work has received the sanction of the ablest engineers and approval of the whole community. The careful examination by the United States Government Engineers has resulted in the expenditure of a large amount of money for comprehensive plans, soundings, etc., the work has been undertaken and is well under way, then it is now suddenly assailed in its last stage of progress by unfriendly influences, and the most deeply regrettable delay ensues.

"I will not enlarge upon the great value of this work to the commerce of this city and of the Western and Eastern States further than to remind you that it will provide a necessary basin at the seaboard terminal of the only water channel of communication between the Atlantic Ocean and the great area bordering upon the lakes. When completed there will be a saving of over 20 miles of intricate, slow, and dangerous navigation down the North River, around the Battery, and up the East River for vessels coming through the Erie Canal and down the North River bound for the Eastern States, and for a considerable portion of the city of Brooklyn.

"The faith of the United States is pledged to the completion of the work, and the necessities of the railroad travel and traffic crossing the river already provided for by the United States Engineers may, with entire propriety and safety, be left to the municipal and State authorities. In my best judgment the speedy completion of the work should be at once assured by an adequate appropriation, and appreciating thoroughly the great interest you have always shown in the commerce of New York, I beg to respectfully bespeak your most valuable influence and efforts to procure the same."

COST OF ELECTRIC STREET LIGHTS.

IN discussing the matter of electric street lighting at Milwaukee, Wis., President Wall, of the Badger Illuminating Company, furnished the following statement of the prices paid for electric street lights, of nominal 2,000 candle-power, by 32 cities, the contracts being the latest ones awarded, and calling for all-night service:

NOMINAL 2,000 CANDLE POWER.

Place.	Term of Contract.	No. of Lamps.	Price per Lamp per Year.
Rochester, N. Y.	5 years	1,200	$105.00
Buffalo, N. Y.	3 years	1,246	146.00
Syracuse, N. Y.	3 years	300	146.00
Albany, N. Y.	6 years	480	182.50
Troy, N. Y	5 years	280	144.00
Brooklyn, N. Y.	2 years	1,100	182 50
Binghamton, N. Y	3 years	123	132.00
New York City, N. Y.	1 year	1,300	127.75
Poughkeepsie, N. Y	1 year	210	123.00
Baltimore, Md.	5 years	607	128.00
Pittsburg, Pa.	3 years	500	105.00
Lancaster, Pa	3 years	138	124.00
Philadelphia	....	1,045	174.00
Cleveland	.. ....	120	130.00
Dayton, O.	10 years	146	150.00
Toledo, O.	5 years	400	100.00
Springfield, O.	1 year	54	130.00
Paterson, N. J.	5 years	200	128 50
Trenton, N. J.	1 year	106	182.50
Camden, N. J	5 years	119	146.00
New Haven, Conn.	3 years	225	131.40
Worcester, Mass.	3 years	170	164 00
Lowell, Mass.	... .	182	182.50
Fall River, Mass.	....	40	180.00
Salem, Mass.	3 years	170	163.50
Springfield, Ill.	....	110	119.00
Sioux City, Iowa	. . ....	75	103.00
Duluth, Minn.	....	200	128.00
Omaha, Neb.	5 years	118	175.00
Kansas City, Mo	....	114	200.75
Detroit, Mich.	1 year	600	140.00
Providence, R. I.	....	500	160.00

The low contract of Rochester, N. Y., at $105 per year, is due to the use of water-power.

THE CINCINNATI WATER-WORKS REPORT FOR 1889.

THE Board of Public Improvements of Cincinnati is taken to task by the local papers for the non-publication of the Cincinnati Water-Works report for 1889, which is said to have passed into its hands formally and regularly. The interesting question is now asked: "What did the Board do with the report? The burning of the court house is said to have covered a multitude of sins. What did Moore's unfinished report contain that it should have been suppressed or spirited away by his successor? It contained, at all events, a correct and reliable record of the pumping capacity and water supply daily for the year up to and including December 31, 1889. The reservoirs were then full of water and the machinery doing satisfactory duty."

THOMAS DOWD, Superintendent of the Orange, N. J., Water-Works, says that the trouble with the city water, which, at present, has a disagreeable smell and is thought unfit for drinking and domestic use, is caused by the presence of vegetable matter in the bed of the reservoir. Every freshet has brought more or less dead leaves, weeds and other debris of a vegetable nature which has settled in the reservoir, and the recent hot weather acting on this has caused fermentation enough to result in the present condition of the water.

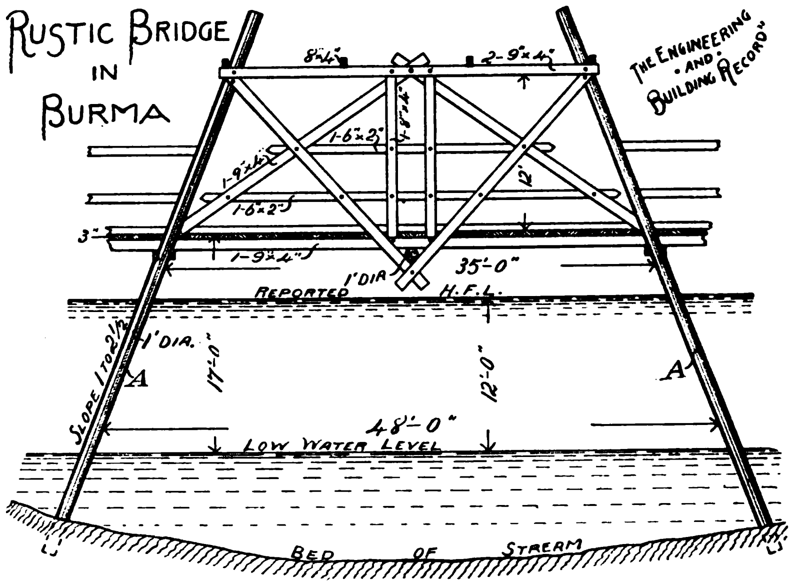
A SCHEME for a grand avenue along the Delaware River front, at Philadelphia, provides for a street 200 feet in width. It is thought that such a street would meet all the requirements of commerce.

THE HATTERAS LIGHTHOUSE.

THE Lighthouse Board has awarded the contract for the construction of the proposed lighthouse* on the Outer Diamond Shoal of Cape Hatteras, North Carolina, to Anderson & Barr, of Jersey City, at their bid of $485,000. The general outlines of the plan for the lighthouse were laid down by the Board, leaving each bidder to furnish his own plans and specifications for doing the work. Anderson and Barr built the lighthouse on the Fourteen Foot Bank in Delaware Bay, and they will follow the same method employed there in building the Outer Diamond Shoal light.

This shoal is the most dangerous point on the entire Atlantic coast, and the difficulties in the way of erecting a lighthouse there are greater than at any point where a similar structure has ever been placed. The contractors will build an immense iron caisson, surmounted with a hollow iron cylinder, and will tow this structure out to the shoal, either from Norfolk or from Hatteras Inlet. It will be sunk on the shoal, in about 24 feet of water, by weighting it down with blocks of stone. When it rests evenly on the sands, the work of excavating will be begun by a force of men inside the caisson, the excavated material being carried up through the cylinder.

The shoal is composed of shifting sands, and it is not known how far down the caisson may have to be sunk. As soon as the base of the caisson rests on a good foundation its interior will be filled up solid with concrete. The cylinder on top will also be filled with concrete to the height of 35 feet above the water level. This base will be surrounded by rip-rap work of stones weighing not less than two tons each, extending to a distance of 400 feet on all sides of the tower.



The lighthouse itself will be nine stories in height, each story containing one room. The first floor is to be a storage room for coal, wood, fresh water, and three lifeboats. On the second floor will be the fog signal apparatus. The third floor will contain the fire-proof vaults for the storage of oil and large tanks for salt water, with storage room for a year's provisions for four men. The next five floors are to be living rooms. Above these are to be the watch room and lanterns. The superstructure is to be of iron lined with brick. Work on the lighthouse is to be commenced within a month, and it is to be completed within two years. The contractors are to maintain the light for one year before its acceptance by the Government.

A RUSTIC BRIDGE IN BURMAH.

AS AN example of native construction without any engineering aid, the accompanying illustration of a bridge in Burmah is prepared from a recent issue of *Indian Engineering*. The bridge consists of 18 spans, the details of one of which are clearly enough shown in the longitudinal section given. In some of the spans the posts A A are vertical. Lateral stiffness is said to be sought, but ineffectually, by bracing the bridge to a couple of side piers.

The bridge was erected by local subscription, and cost about Rs. 6,000.

NEWARK'S WATER WORKS *VERSUS* PASSAIC'S SEWERS.

THE Newark Water Works supply a population of about 200,000 persons with water taken from the tidal portion of the Passaic River, and the City of Passaic, with a population of about 12,000, situated 4 or 5 miles above the water works intake, is constructing a system of sewers to empty into the same stream.

The Newark Aqueduct Board having in vain protested against the undertaking of this work, applied to the Chancellor for an injunction to restrain the City of Passaic from discharging its sewage into the river, alleging that such discharge would materially pollute the water to the injury of its business and the health of those whom it supplied. This application was denied, and an appeal was taken by the Aqueduct board to the New Jersey Court of Errors and Appeals, where the decision of the lower tribunal was affirmed.

This case, involving as it does, the right of municipalities to use navigable streams for sewage disposal and water supply, is of great interest to all who are either officially or professionally concerned in such matters, and the following extracts from the decision of the Chancellor, and the argument of the counsel of the Board on the appeal, will enable them to form a clear idea of the points in dispute.

In denying the application for an injunction the Chancellor held:

1. That the water of the Passaic River, where the tide ebbs and flows, belongs to the State, for uses common to all its citizens.

2. That the city of Newark has no special rights in that water, either by reason of its riparian ownership on the river, or by grant from the State, which may be injured by the apprehended nuisance, and enable the complainant, by showing an apprehended injury, distinct from that which will be suffered by the other inhabitants of this State, to maintain its individual suit to restrain the nuisance.

3. That, at best, such special rights have not been established by adjudication in this State.

4. That the complainant is not in position to ask for a preliminary injunction when the right on which it founds its claim is, as a matter of law, unsettled.

5. That the proceeding in equity to restrain a public nuisance is by information by the Attorney-General.

6. That the statutory authority to the complainant to maintain a suit in equity for nuisance to water courses connected with its works, did not constitute it a public agent to sue to restrain a public nuisance, but merely clothed it with power to sue, as an individual might, for the protection of private property.

7. That an injunction to restrain a nuisance will issue only in cases where the fact of nuisance is made out upon determinate and satisfactory evidence, and that, if the evidence be conflicting, and the injury be doubtful, that will constitute a ground for withholding the injunction. And if the nuisance be merely apprehended, it must appear that apprehension of material and irreparable injury is well grounded upon a state of facts which show the danger to be real and immediate.

8. That such conditions of fact do not appear in this case.

In giving his reasons for this decision, the Chancellor notes that the sewers at present contemplated aggregate 3,650 feet in length, and will receive the sewage of 1,639 people, amounting, with factory waste, to 60,000 gallons a day, rain water being excluded. It is also noted that last year 20 per cent. of the deaths in Passaic were from typhoid and scarlet fevers, diphtheria, cholera infantum and dysentery, as it is from the excreta of persons suffering from such diseases that dangerous pollution of the water is principally feared.

The contentions of the respective parties are thus set forth:

"The complainant takes the position in the first place, that the proposed sewage will pollute the waters that it supplies to Newark and other municipalities, and will thereby create a nuisance especially injurious to the complainant; and, in the second place, if it should be determined that the complainant will not sustain a special and distinct injury, it is, nevertheless, empowered by special statutory authority, to maintain this suit if injury will result to it at all, though it be merely in common with the remainder of the public. To this the defendants reply: First, that the complainant has no right in the waters of the Passaic River which is not common to all citizens of this State, and that an injury to such a right cannot result in such a special and peculiar injury that will enable the complainant to maintain this suit in its own name; second, that in absence of such special injury it has no authority to maintain this suit; third, that if, under the legislation from which it derives its powers, the complainant has obtained a distinct right to the water of the Passaic, such right does not clearly appear, and should be established at law before the issuance of the injunction sought; and, fourth, that, in point of fact, the proposed discharge of the sewage will not pollute or otherwise injuriously affect the waters of the Passaic at the Newark intake."

In commenting on this the Chancellor says that riparian owners on navigable tidal streams have no special rights therein, except the contingent one of accretion, and merely gain by their position a greater convenience in the use of rights common to all. In a navigable but non-tidal stream, however, the title of the riparian owner extends to the land under water to the middle of the stream and to such use of the water as will not interfere with navigation or the rights of others. He, therefore, concludes that as the Newark intake is on tidal water, that city has no special right in the water by virtue of its riparian ownership, and, further, that no such right has been given by any special legislation. It follows from this that if Newark has no special right in the water she can suffer no special wrong by its pollution, and is, therefore, not in a position to complain of such pollution as a private injury, the difference in her case being one of degree merely and not of kind.

In regard to the claim that the consequences of the proposed sewerage will be so disastrous and irreparable that the application should not be dismissed without consideration of its merits, he states it to be a well settled rule of equity procedure that an injunction to restrain a nuisance will issue only on determinate and satisfactory evidence, and that if the evidence be conflicting and the injury doubtful that will constitute a ground for withholding the injunction.

He then proceeds to consider the evidence, adduced by the complainant, of Prof. P. T. Austin, of Rutgers College, who, as chemist for the Aqueduct Board for three years past, has made many analyses of the Passaic water. This gentleman, according to the Chancellor, assumes that the sewage of Passaic will reach the Newark intake in a few hours, and proceeds to show the danger to the health of the inhabitants of Newark that will result from the disease germs thus transported. The fact is also mentioned that Charles Jacobson, the civil engineer of the Board, placed four floats in the Passaic River at or near the mouth of the proposed sewer, one of which reached the Newark intake in four hours.

As opposed to this, the evidence of Henry Wurtz, formerly State Chemist of New Jersey, is adduced by the defendant, which goes to show that, according to analyses made by him in 1881–2, almost the whole effect of the sewage of Paterson (then having at least 50,000 inhabitants) had disappeared in a flow of 4½ miles. Mr. Wurtz gives it as his opinion that the nitrogenous and putrescible constituents of the sewage of the City of Passaic will substantially vanish during the downflow of 4½ miles from the sewer outlet to the Newark intake, and states that $\frac{17}{18}$ of the present pollution of the water at the Newark intake is due to the Newark sewage, which is carried up by the tide. He also says that the alternation of the tidal currents will cause the greater part of the Passaic sewage to travel a much greater distance than 4½ miles before reaching the Newark intake, for which reason it must more certainly vanish.

In considering this evidence two circumstances appear to the Chancellor's mind to be important; first, that practically all traces of Paterson's sewage had disappeared in flowing 4½ miles with no tidal currents, and second, that the Newark sewage, though carried by the tide to the Newark intake, had not produced the injury apprehended from the much smaller quantity of Passaic sewage to be emptied into the river much further away.

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*See Vol. XXI., page 166.

"This experience," he says, "seems to be a complete negation of the danger theory advanced in support of this application, or is sufficient, at least, to render it doubtful whether the danger apprehended is more than chimerical I deem it of sufficient weight to justify me in withholding a preliminary injunction."

He concludes, however, by the admission that it is not a sufficient ground for the refusal of the injunction asked to say that the Newark sewage is a greater and more dangerous nuisance than the sewage of the city of Passaic will be, and that the defendant would have no right to add to existing pollution even in a small proportion.

Incidentally a curious contribution is made to etymological science by either the Chancellor or Professor Austin, it is not clear which, in the statement that "microbes derive their name from the powerful glass by the aid of which it is claimed they may be detected." The word does not yet seem to have found its way into the dictionaries, but is undoubtedly derived from the Greek words *mikros* and *bios*, and means "a little life"

In making his appeal from the decision of the Chancellor, Thomas N. McCarter, counsel for the Aqueduct Board used, among others, the following arguments:

After quoting the substance of the Chancellor's decision he claims first, that "the complainant has such a right in the waters of the Passaic River which flow into its works as will enable it to maintain an action to restrain the nuisance complained of, even if the nuisance be a public nuisance of which the Attorney-General might also complain."

Second, that "assuming the injury apprehended by the complainant and sought to be enjoined to be a public nuisance, complainant had ample legal authority to bring suit to restrain it."

The third claim could not be found in Mr. McCarter's argument as printed, but his fourth claim is that "In the nature of things such use of the water of the Passaic River as complainant or any other riparian owner enjoys is incapable of public or common enjoyment. Every citizen of the State or of the United States may navigate the public waters of the State no matter where he resides, but how can a citizen of Cape May exercise the right of drawing water from the Passaic River? Even an express grant from the State of the right to draw such water would not avail, because the banks of the river are private property on which the grantee would acquire no right but by the consent of the riparian proprietor."

Under the fifth head it is said, "The Chancellor's opinion shows, not that there is any doubt as to the fact that the sewerage of Passaic is about to be emptied into the river in such quantities and of such character as is alleged in the bill, and as near to the complainant's intake (four miles) as is alleged, but the Chancellor is not convinced that, admitting all this, any harm will be done to the water furnished by complainant to its customers."

In considering this point as well as the other claims, Mr. McCarter quotes extensively from various legal authorities and decisions, and goes over many of the admitted facts already discussed by the Chancellor. He also quotes at some length the expert evidence already referred to, and reviews that of Mr. Wurtz, who, according to Mr. McCarter, has arrived "at the conclusion that the impurities now communicated to the Passaic River by the present drainage of that city [presumably Passaic—Ed.] are only about one thirty-fourth part of the pollution which the sewage of Newark inflicts on the river, and that as the soil of the Passaic Valley is light and porous, the objectionable constituents of the drainage now so easily and speedily percolate the soil that the installation of a sewer system could make no important difference in the drainage percolation of this drainage into the river." Referring to Mr. Wurtz's statement that the Paterson sewage had all disappeared from the river in a flow of 4½ miles, Mr. McCarter intimates that there is no evidence that any of it ever got into the river by percolation, sewer or otherwise, and that even if Mr. Wurtz's theory of "the rapid depositing action of aerial oxidation" were correct for the summer time, it would be entirely inapplicable for that large portion of the year when the river is covered with ice.

In answer to the Chancellor's inquiry as to "why, if imperceptible germs of disease, fraught with danger to health and life, continue in water after all traces of the sewage in water from which they come, so far as they can be detected by a chemist, are lost, have not these dangerous qualities become manifested in Newark long before this?" Mr. McCarter quotes from the answer of the defendant and the affidavit of Mr. Wurtz to show that the river water at the Newark intake "is very materially injured and polluted," so "that it was useless and dangerous to attempt to supply the inhabitants of Newark with pure and wholesome water from this source," and that in fact "very recently the authorities of the city of Newark, moved and influenced by the bad quality of the present water supply, entered into a contract for a new and adequate supply from an entirely different source." He alludes to the proposed addition of the Passaic sewage as "the last straw that will break the camel's back," and asks, "if the water is now so bad that complainant was obliged to abandon it for a new supply, must we submit to this additional contamination while such new supply is being acquired?" and then quotes the Chancellor's concluding remark that existing pollution gives the defendant no right to add to it even in a small degree.

Under his sixth head Mr. McCarter calls attention to the fact that it "nowhere appears that the city of Passaic has any authority from the State to use the waters of the river as an outlet for its sewage," and seventh, that even if it shall ultimately prove that all danger from Passaic sewage has disappeared before it reaches the Newark intake, nevertheless the contrary view is so generally entertained that if the proposed plan is allowed to be carried out such a panic will ensue among the citizens of Newark as will cause them to discontinue the use of the water for all culinary, drinking and domestic purposes, causing great public and private inconvenience and great loss of revenue to the complainant, adding, "Language can hardly describe the consternation experienced by the people of Newark when the Chancellor's decision in this case was made public."

The argument concludes with an appendix "containing extracts from encyclopedias, published reports of official boards of health, medical journals and other sources of general information and common knowledge, as to the consequences of water pollution."

ICE FACTORIES AT NEW YORK.

Before the end of August the New York Steam Company expects to be actively engaged in manufacturing ice. Three buildings are now being put into readiness for the purpose.

Factory No. 1 is being erected in the rear of No. 177 Washington Street, near the steam station B. It is a five-story brick and iron building, 25 by 100 feet. This is the smallest of the three, but the daily capacity will be 60 tons. It will have three elevators, and on the first floor will be the storage room, with a capacity of 120 tons. Upon the two top floors there will be cold storage rooms for meats and poultry, Factory No. 2 is being built at No. 525 East Eighteenth Street, in the large yards of the company's machine shops. It will have a frontage of 100 feet and a depth of 100 feet. The producing capacity of this factory will be 120 tons per day, with a daily storage capacity of 240 tons. The plant for Factory No. 3 is being put in on One Hundred and Sixteenth Street, near the East River, among the gas houses. It will be 100 by 100 feet The capacity will be 120 tons daily, with a storage capacity of 240 tons. The builders are at work night and day and the machinery is being put down as rapidly as possible.

The machinery for the Washington Street plant, which will have a daily capacity of 60 tons, will cost $60,000, while the machinery of the other two will cost each $120,000. The ammonia compression system will be used.

Referring to the description of the cast-iron fresh-air inlet described in our issue of August 2, 1890, the Durham House Drainage Company, 158–160 West Twenty-seventh Street, New York, writes that it has manufactured and sold to plumbers such a box since 1884.

The employees at the pumping station of the Troy, N. Y., water-works, sent in a communication to the Board, asking that their salaries be paid weekly instead of monthly, as is now the case. There seemed to be no objection to granting the petition, and the men employed will hereafter be the recipients of weekly payments.

STREET CLEANING PARTICULARS.

In accordance with the suggestion offered in our last issue by Mr. Sylvester H. Martin, Chief of the Philadelphia Street Cleaning Bureau, we have collected data on street cleaning in a number of different cities, retaining, in a measure, the tabulated form of statement used by Mr. Martin.

The following particulars were furnished by Mr. H. S. Beattie, Commissioner of the Department of Street Cleaning and Stevenson Towle, C. E., Eng. of Paving of

NEW YORK

1. What is the population? A. 1,632,798. (Estimate of Health Department.)

2. How often are ashes removed? A. Daily, Sundays excepted.

3. How often is garbage removed? A. Daily, Sundays excepted.

4. How many miles of paved streets? A. 355.83 miles.

Kind of Pavement.	Sq. Yards.	Lineal Feet.	Miles.
Specification Granite........	2,098,044.96	496,601.11	94.06
Block Granite............ ...	673,402.00	136,717 00	25.89
Specification Trap....	1,248,528.82	355,821 90	67 39
Belgian Blocks..	3,110,104.16	712.944.45	135.02
Cobble.........	101,642.76	27,174.60	5.14
Asphalt...	59,984.13	14.400.30	2.73
Wood....	516.00	158.00	.03
Russ.........	2,964.00	621 00	12
Macadam	911,146.00	134,375.00	25.45
Total	8,206,332.83	1,878,813.30	355.83

Total area of new pavements laid during the year 1889, 212,341 square yards, as follows:

Granite Block	170,911	square	yards.
Trap Block...	15,845	"	"
Asphalt........	25,585	"	"

Amount appropriated for maintenance of boulevards, roads and avenues, 1889, $100,000.

5. How many miles of unpaved streets? A. 41; 2½ miles country roads.

6. How often are the streets cleaned? A. About one-third of the streets daily; another third tri-weekly, and the remaining third bi-weekly.

7. What is the average width of main streets? A. 60 feet; avenues 100 feet.

8. Are your streets underdrained? A. Yes.

9. How many sewer catch basins? A. 5,209.

10. How often are they cleaned? A. A force of 17 foremen and timekeepers, 5 mechanics, 55 laborers, and 23 horses and carts have been employed to clean pipe sewers and receiving basins, and to do all small repairs. Total length of sewerage, 433.73 miles.

11. Is the above work done by contract or by day's work? A. In so far as it refers to the Department of Street Cleaning, the work is done by day's work.

12 What is the annual cost of cleaning the streets? A. The appropriation for the work of the Department for the present year is $1,255,835.

13. What is the annual cost of removing ashes and garbage? A. $880,000 of the foregoing amount was appropriated for sweeping, and for the collection of ashes and garbage.

14. What is the annual cost of cleaning catch basins? A. $175,000.

15. What is the annual cost of removal of dead animals, night soil and offal? A. $36,000.

16. For the supervision of all above work? A. So far as it refers to the Department of Street Cleaning, $180,000 of the appropriation was set aside for the purposes of Administration.

17. What is the final disposition of the street dirt, ashes and garbage? A. Principally dumped at sea, to which it is taken in scows. During certain seasons of the year a portion of the collections is disposed of for "filling in" along the water front of, or near to, the city, but at an expense, so far, to the Department which varies very little from the cost of "final disposition" at sea. Ashes, garbage and sweepings are collected by carts, from which they are dumped on scows, located at convenient points, for accessibility, along the water front. The cost of this service has averaged 35 cents per load of 40 cubic feet. The cost of towing these scows to sea, or of final disposition, has, until within the past five weeks, averaged 16 cents per load. It is now at least one-fourth less.

18. What is the final disposition of dead animals? A. Taken to Barren Island.

19 Does the city own the plant for street cleaning? A. The Department owns about one-fourth and hires about three-fourths of the plant now used in the performance of its work.

20. Are streets swept by machinery or hand labor? A. Partly by machine and partly by hand labor.

21. What kind of hand-brooms are used? A. Bass and rattan.

Several of the large breweries at Rochester, N. Y., have equipped themselves with special pumping plant to supply them with water taken from the Genesee River at greatly reduced cost. In consequence of this there has been a daily decrease of 400,000 gallons in the consumption of Hemlock water. The breweries use the Genesee water principally for their ice machines, for which it is of good enough quality.

The new customs administrative law, which recently went into effect, at once raised the prices of imported Portland cements.

EARLY CHURCH STRUCTURES.

There are 15 Congregational churches in Connecticut which were erected prior to the current century. Eight of the number were constructed before the Revolutionary War. The oldest church edifice of the Congregationalists in the State is at Abington. It was built in 1751. Three years afterward the Congregational Church at Hampton was erected. The old brick church at Wethersfield was erected in 1761. There is a legend that its solid walls were paid for from the profits realized in the onion trade a century and a quarter ago. The building is the same outwardly that it was when Washington visited Webb in the historic mansion which is still standing within a stone's throw of the church.

The churches at Farmington and Kensington were constructed in 1771. Legislative interference was required in order to settle the differences that prevailed concerning the location of the Kensington church. The structure is of wood, and the wrought-iron nails used in fastening the clapboards to the framework present a strange appearance to the modern eye.

The oldest soldiers' monument in the State is erected on the grounds adjoining this ancient edifice. The Farmington church has been a prominent factor in the history of the denomination. Among the most noted men who have been connected with it is ex-President Porter of Yale University. The two churches at South Britain and Westminster were built in 1770, and the church at East Haven was erected in 1774.

One of the most notable of the later series of church buildings constructed during the last century is at Windsor. It was the place of worship attended by Chief Justice Oliver Ellsworth of the United States Supreme Court, and the old pew that the distinguished legalist used to occupy is still preserved. The church was constructed in 1794. The old church at Centerbrook, in Essex, was built in 1789, and the church at Newington, near Hartford, was erected in 1795.

THE UTILIZATION OF SEWAGE.

In a paper read by Sir Robert Rawlinson before the London Society of Arts on "London Sewerage and Sewage," it is stated that the entire volume of London sewage is now valued at $8,750,000. According to the same authority land is not corrupted by sewage irrigation, but is improved, as the solids out of 100 tons spread over one acre of land would not give a surface deposit of $\frac{1}{100}$ of an inch in thickness. In the discussion which followed the paper, Dr. Charles Drysdale said that all the European nations were looking to England for a solution of the question and many of them had sent engineers over there to study what has been done. Paris has now a very successful sewage farm of 1,300 acres, which produced most magnificent crops, and the effluent was so pure that any one could drink it, as he had done himself. In Berlin, also, where the authorities had sent engineers to study sewage farming, they had about 1,000 acres on the north and south and not a particle of sewage was sent into the river. So far as the disposal of sewage went every possible plan had been tried, and it was well known now, said Dr. Drysdale, that the only possible way of purifying sewage is by passing it through filtering soils.

The New York elevated roads are at present experimenting with various kinds of brake shoes in the effort to find a shoe that will serve without emitting the disagreeable, grinding noises now produced whenever a train is stopped. Thus far gun metal shoes are said to have given good results, and it is thought likely that they will be finally adopted.

ANNUAL REPORTS.

Annual Report of M. J. McCabe, City Engineer of St. Joseph, Mo., for the fiscal year ending April 15, 1890.

The report opens with a table showing the amount and kind of street paving done, and giving the mileage of improved and unimproved streets. Paragraphs are devoted also to grading and macadamizing, and tables are annexed showing the amount of this work done and the cost. Curbs and sidewalks are similarly treated. Sewers and bridges are next considered, and tabulated statements bearing upon them are given. Short sections are devoted to various other subjects such as public buildings, street repairs and street cleaning and lighting, public parks, etc.

Correspondence.

Communications giving information or opinions on matters of general interest to the engineer, the architect, the contractor, or the municipal officer, will be welcomed in this column. Fairness will suggest that when communications are sent simultaneously to this and other journals we should be informed of it at the time. Anonymous letters will not be noticed.

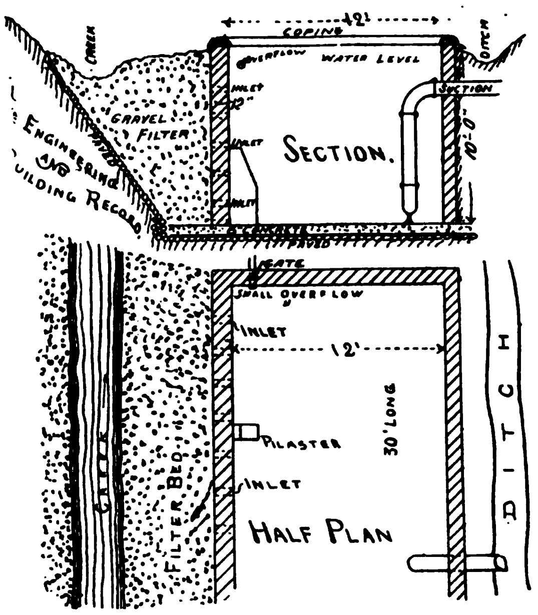
FILTER CHAMBER AT THE GAINESVILLE, GA. WATER-WORKS.

Atlanta, Ga., July 26, 1890.

To the Editor of the Engineering and Building Record:

Sir: I have just finished drawing up plans and specifications for water-works at Gainesville, Ga., and send inclosed a sketch of the filter chamber.

The town will obtain its supply from Castlebury Creek and pump through 8,970 feet of 10-inch main into a standpipe 80 feet high and 16 feet in diameter, and set with its top 162 feet above the central portion of the town.



The flow of the creek is very copious and the supply is greatly in excess of the present demand or need of the town, and the creek is a perfectly clear, pure mountain stream formed by large springs that burst out of the large gravel veins of the mountain, and it becomes a bold branch within a few hundred yards of its source, the entire water-shed is clothed with forest and there is no need for a storage reservoir or settling basin.

I designed a supply well as shown in the cut, 30 feet long, 12 feet wide, and 10 feet deep, lined with a 9-inch wall on the sides where the excavation is made in stiff clay, and a 12-inch perforated wall braced by small pilasters on the side next to the creek. These walls are built of brick laid in hydraulic cement mortar.

The entire area to be occupied by the well and filter is to be excavated beyond the bed of the creek to a depth of 10 feet and the bottom closely paved with the large pebbles and flint rock which are at hand in abundance, and on this paving 6 inches of concrete is to be laid and neatly leveled to form a foundation for the well and filter.

Between the well and creek a filter of clean sand and gravel will be formed leaving a considerable depression along the line of the creek to contract the flow and insure as much as possible the carrying off of leaves, sticks and mud during heavy rains, which, if deposited on the filter would encourage vegetable growth and otherwise impair the efficiency of the filter. The overflow is small and intended only to keep the water fresh, and by constantly skimming off the surface water to prevent the accumulation of animalculæ. It is provided with a gate to be shut during heavy rains to prevent the back water from entering the well except it pass through the filter and the openings prepared for the purpose.

The well is set with its top 18 inches above the highest water mark and so that the creek can be turned through a ditch on the upper side if any repairs are to be made or the filter to be cleaned.

The well is not covered.

The ordinary flow of the stream is in excess of the capacity of the pumps, this fact insures the service of the filter for its entire length. Yours truly,

N. W. Davis, C. E.

DANGEROUS TRUSSES.

To the Editor of The Engineering and Building Record:

Brooklyn, N. Y., August 11, 1890.

Sir: As you are interested in encouraging good building construction, I would like to call your attention to something that seems to me very far from it which I have just observed in Hermann's new theatre building now being erected in Brooklyn. The front, on Fulton Street, is about 35 feet, and the first floor above and next to the street is supported on the side walls and two trusses, if such they can be called, which are shown in the accompanying sketch, and which require no further description, except that the double top chord has two-inch backing pieces between its members, and that the struts are shouldered down to that width and extend up between them. The pieces composing the top chord are not continuous, and are, in one case at least, very roughly butted together at the joints.

The most obvious defect of the whole arrangement is that the two middle struts are absolutely useless, giving no support whatever to the top chord; but in addition to this the end struts have not the proper inclination, which should bisect the angle of the tie rod, and the end plates are so light that they would curl up long before the tie rod had been strained to its full capacity. The top chord also is not properly constructed to resist either transverse or longitudinal stresses.

The floor beams run parallel to the face of the building, and these trusses are at right angles to them and so spaced that one of them supports about 270 and the other about 360 square feet of floor. I believe the New York building law requires an allowance of 100 pounds per square foot for tenement houses and 180 pounds per square foot for public assemblies, for which latter purpose I presume this room is likely to be used. These would give distributed loads of 36,000 or 65,000 pounds on the most heavily loaded truss, which no engineer who will look at it will believe that it could sustain for a moment.

The trusses are weak in so many directions that it is difficult to estimate just what they might carry, but as the central portion of the top chord is practically unsupported for a distance of 18 feet, on which the distributed load might, if figured as above, be 39,000 pounds, it may be worth while to note that yellow pine beams of the same size and span would not be safe for a distributed load of over 11,600 pounds, or less than one-third of that amount.

Even if the full strength of the 1¼-inch tie rod were utilized the whole truss would only be safe for a distributed load of 5 tons instead of the 18 tons that it ought at least be able to carry. For with an area of 1.23 square inches a stress of 12,000 pounds per square inch and an effective depth of 2.6 feet the truss could, as far as the rod is concerned, resist a bending moment of $1.23 \times 2.6 \times 12{,}000 = 38{,}376$ foot pounds, while as the distributed load $= 8 \times$ bending moment $+$ span it is in this case $8 \times 38{,}376 + 30 = 10{,}233$ pounds only.

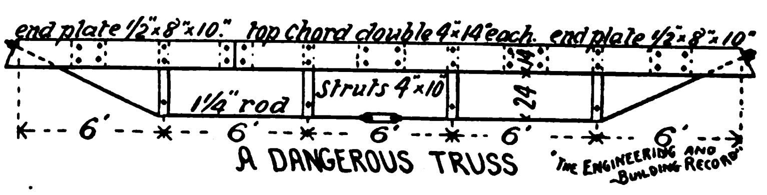
A little further back a pair of heavy iron beams, apparently 20-inch, extend nearly across the building, but for some unaccountable reason stop short of the side walls and rest, one end of them at least, on what seems to be a very inadequate cast-iron column.

All this is difficult to explain on any theory of competent building inspection, and yet the Department of Buildings is not much over a quarter of a mile away, and all I have described is in plain sight from the sidewalk. The construction of a theatre building ought above all things to be most carefully designed and superintended.

Dimensions and distances were carefully estimated, but could not be conveniently measured.

Civil Engineer.

[This communication comes to us from what we have every reason to believe is a perfectly reliable source, and we commend it to the careful attention of those who have charge of such matters in Brooklyn. A theatre building above all others should be above any suspicion of weakness.—Ed. E. & B. Record.]



A DANGEROUS TRUSS

The old Pennsylvania Railroad station at Jersey City was abandoned early this week, and is being demolished to make room for the new structure that is to be erected. The trains are running into a temporary station.

Brooklyn Bridge traffic feels the effect of the outing season and shows it in the returns; but as compared with previous years the traffic for July was larger than in any year, and fully maintains the average annual increase. The total receipts for the month were $85,511.35, an increase of $8,453.81 over July, 1889, and a decrease of $5,924.30 from the June (1890) receipts. The daily average of passengers by promenade and railroad was 99,268 as against 110,701 for June.

DOMESTIC
PLUMBING HEATING LIGHTING & VENTILATION
ENGINEERING

LIME INCRUSTATION IN KITCHEN BOILERS.

An article on lime incrustation in kitchen hot-water boilers, published in the London *Builder*, has interest in America, although trouble of the sort is relatively unimportant here. It may appear, however, when water abounds with lime, and account for stoppages or other difficulties. From the article we reproduce the following:

"Our supply of hard water may be considered to be limited to that which proceeds either through or from chalk strata, and as this water is usually of a crystal-like clearness, it naturally becomes difficult for the uninformed to make it accountable for the hard, stony deposit (limestone, in fact) that incrusts the inner surfaces of these and of steam boilers.

"The supply of this hard water is confined to districts where chalk abounds in the soil, and the degree of hardness naturally varies with the nature of the ground. In the south of England, including London and many counties south of London, nearly all the water is more or less hard, but in the north of England the water is of quite a different character, and hard water is, to a great extent, unknown—so much so that vast quantities of boilers (for kitchen ranges) are made without manlids or any means of removing any incrusted deposit.

"When a new boiler is first charged with this hard water and sufficient heat is applied, the result is to drive off the proportion of acid gas, which goes to make the carbonate into bicarbonate of lime, and the latter is transformed into the former again, and, being insoluble, it is precipitated, forming a thin film or coating upon the inner surface of the boiler; this precipitation does not wholly take place immediately heat is applied, but proceeds slowly until boiling takes place and steam is formed, when the chief precipitation is effected. It is almost needless to add that the greatest quantity of deposit is found at that part of the boiler where the greatest heat is felt, but this may be more fully entered into when describing boilers.

"The deposit which is effected when using a boiler but once is a very minute quantity, but when we remember that the same water does not stay in the boiler (when the apparatus is at work) more than a few moments, and fresh water is being continually brought to the heated surface by reason of the circulation, we can then understand why the deposit seems to accumulate so rapidly, especially as the heated and (wholly or partially) softened water is being continually drawn off for domestic uses, and entirely fresh takes its place.

"The average hardness of London water is about 16 per cent., and a range boiler in regular daily use will have a ½-inch deposit of 'fur' within it after six months' use. No rule, however, can be laid down to ascertain at what rate the deposit accumulates, as, although it is easy to find out the degree of hardness of the water, the result is chiefly governed by the efficiency or non-efficiency of the boiler in its heating capabilities, whether the water is nearly always boiling, or whether it seldom reaches this temperature; and again greatly by the quantity of water used, as every drop of fresh water introduced (to replace that drawn from the taps) has its portion of lime to deposit.

"In the counties south of London, particulatly Sussex, the water is very strongly impregnated with lime, so much so that an ordinary-sized boiler will commonly become sufficiently incrusted in from 12 to 18 months to bring about its fracture.

"The deposit partakes of a variable degree of hardness or solidity, that which is the most dense causing the boiler to fail the earliest, and that which is most porous permitting the boiler to render the longest service. With the different London waters the deposit is of a fairly similar character, being very dense, and, in many instances, closely resembling ordinary limestone; and when this has become of about two inches in thickness (about two years' use usually) it is sufficient to prevent the water having any contact with the boiler plate, with the result that the iron is destroyed by the action of the fire, the same as if the boiler were empty. In instances where the deposit is of a more porous or of a scaly character, it naturally requires a thicker deposit to bring about this result.

"The failure of the boiler always shows itself in the form of a small crack or fissure, not a hole in the common sense of the word; and this fissure is rarely larger than one inch in length by one-sixteenth in breadth, for the simple reason that so soon as the fracture takes place water proceeds from it in a greater or less quantity, and this prevents the fire being ignited, and without the fire, of course, no further damage can be done.

"There are two remedies for this trouble, one being to soften the water by removing (*i. e.*, precipitating by chemical action) the lime in solution; or, secondly, by having the 'fur' removed at regular periods.

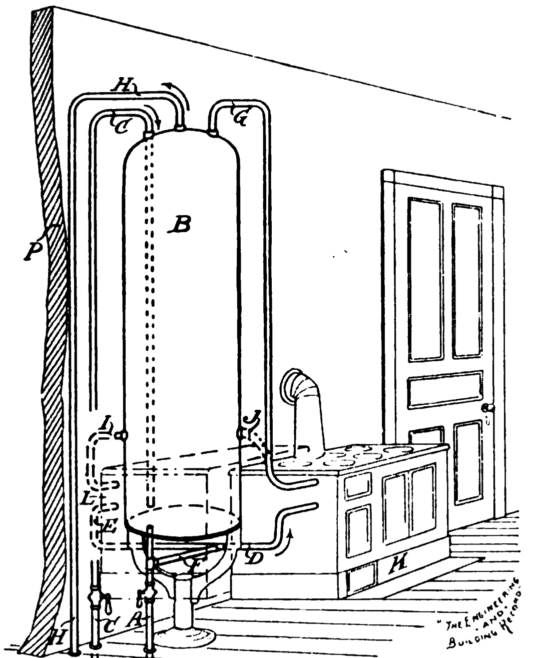
"The first hardly comes within the province of these papers, yet it might be mentioned that whatever process is adopted the softening must be done in a separate cistern, as it would not do to have the precipitated lime carried into the service pipes which run from the house cistern, and each supply of fresh water must be operated upon; and it must be borne in mind that softened water is not agreeable for every purpose, although it may be beneficial to boilers.

"The best remedy and the least expensive is to employ a workman to clean out the incrusted deposit at regular periods. This remedy is, perhaps, sometimes a source of inconvenience, owing to the fact that when this cleaning takes place the kitchen range cannot be used, and, under the most favorable circumstances, this work cannot be done in less than two hours; with some ranges it takes more than a day. The time occupied is to a great extent governed by the amount of trouble experienced in removing the manlid of the boiler. Special means should be provided to make the lid easy of access and removal; but more than three-fourths of the kitchen ranges in the market have no provision of the kind, and the range has to be dismantled and partly unset for the purpose of exposing the boiler manlid.

"In 'cleaning a boiler,' as it is called, the workman has first to get at the lid of the boiler, then to unfasten and remove it; the 'fur' is then loosened with a chisel or other suitable instrument—workmen often have some fancy tool of their own for this work—after which it is removed by the hands and the lid repacked and fastened, and whatever parts of the range have been removed, replaced. Of course, the quantity of 'fur' that has to be removed will govern the time the work occupies to some extent, but the most troublesome cases seldom take more than two hours after the lid of the boiler is removed."

HEATING A BOILER FROM TWO WATER BACKS.*

In a summer cottage at Far Rockaway, L. I., it was desired to have one boiler supply both kitchen and laundry and be heated at will from either range. K is the kitchen and L is the laundry range set back to back against a partition P. B is a 50-gallon boiler receiving cold water through a pipe C and supplying hot water through a pipe H. The sediment pipe A has branches D and E to both water-backs. When the kitchen range is used the circulation is through the pipes F, D and G, but when the laundry range is used it is through the pipes F, E and I. The pipe G was first connected to the boiler at K, as shown by the dotted line, but did not give good circulation. The present arrangement is satisfactory. The diagram is made from data furnished by John Renehan, New York City, who designed and executed the work.



HEATING A KITCHEN BOILER FROM TWO WATER BACKS.

Referring to the article entitled, "How City Water May Be Wasted," published in our issue of August 9th, the National Meter Company, of New York, write that the table giving the discharge of water per minute through various sizes of orifices at different heads, which we credited to the annual report of the Zanesville, Ohio, Water Works, first appeared in their book on "Statistics, Water Rates, &c."

HEATING AND VENTILATING SCHOOL HOUSES.

(Continued from page 155)

In discussing Mr. McClintock's paper the question of how to readily determine the amount of carbonic acid in the air was brought up. Mr. E. P. Adams thought that the ordinary way of discovering the approximate percentage of carbonic acid gas in the air, might be modified so as to make it easy for a teacher to tell when the air has become too impure to be healthful. The proposed method was to have several bottles, one containing, say, 100 cubic centimeters, another 200, and another 300, and a saturated lime-water solution. The bottles being filled with water, commence with the smallest bottle and carefully empty the water, introduce the standard quantity of lime water, say 15 cubic centimeters, and shake the bottle. The purpose of pouring the water out is to bring into the bottle some of the air which is in the room. If the water becomes turbid the quantity of carbonic acid gas is easily determinable from the relative proportion of the lime water and the air in the bottle.* If it is not indicated by the first bottle, the next larger quantity may be used, and so on until you find what quantity of air does render the lime-water turbid. After the standard of the room has been determined a bottle of that size should be kept on hand, filled with water, and if the teacher thought that the air was becoming impure, he could simply pour out the water, introduce the lime-water, and shake it, to test the degree of impurity relative to the standard.

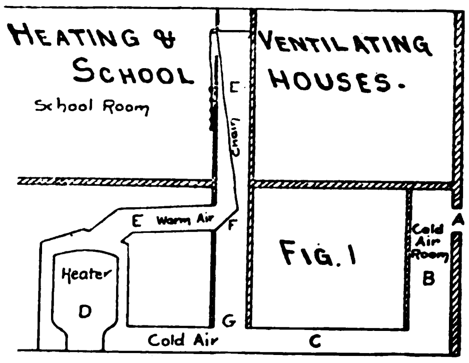


FIG. 1

Prof. S. H. Woodbridge said that there had been an instrument lately devised by Professor Wolpert for the indication of atmospheric vitiation, or rather, for indicating the proportion of carbonic acid in the air, which may take a place, for that purpose, with the thermometer for the indication of temperature, and the barometer for the measurement of atmospheric pressure.

It is essentially this: A shallow glass vessel about 6 inches in diameter and 2 inches deep is partly filled with a standard solution of carbonate of soda, colored a bright carmine by phenol-phalin in solution. On the surface of this liquid floats an air-tight metallic box, which may be contracted or enlarged within narrow limits by a conveniently placed thumb-screw. To the edge of this is attached a glass syphon tube, one leg of which is immersed in the liquid, and the other end drawn down to a much smaller calibre, overhangs the edge of the glass vessel. The rate of flow through this syphon is regulated by the distance by which its outside end is below the level of the liquid in the vessel, and this is in turn regulated by the buoyancy of the float. The liquid drops from the syphon into an angular trough, inclined and open at its lower end, and having suspended from its tip a small sized cotton string of some 15 inches length, in such fashion that the liquid will follow down the cord, coloring the string a bright carmine. The string is weighted at the lower end by a glass ball, and the drip is caught in a small receiving vessel.

If carbonic acid is present in the air, it combines with the carbonate of soda, and forms a bi-carbonate, and in this solution the coloring disappears. The greater the proportion of carbonic acid present in the air, the less the time of the exposure must be to change the carbonate to a bi-carbonate, and the shorter the length of the carmine colored string. Behind the string is a scale showing the points at which the coloring should disappear for certain proportions of carbonic acid in the air. The discoloration is not sharply marked, but sufficiently well for a trained eye to fix the point to within a fraction of one part of carbonic acid in ten thousand of air.

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*Several different solutions of this problem have been given from time to time in the columns of this journal and are published in "Plumbing and House Draining Problems," pp. 154 to 177, but the example here shown illustrates a different arrangement from any heretofore described.

*With 100 cu. cm., 6 parts in 1,000; 200 cu. cm., 12 parts; 300 cu. cm., 8 parts; 450 cu. cm., 6 parts.—Billings. P. 22.

The carbonate solution must be renewed as often as once a month, and the string renewed or washed frequently enough to keep it clean. The greatest source of error is in judging the point of discoloration by the eye.

Mr. McClintock thought that the amount of air admitted into a room should never be left to the discretion of either the teacher or the janitor; it should be made absolute. The degree of temperature at which it is admitted may, of course, be left to the teacher; but the amount of air never should be, that is, the amount of air coming into the room should be through a certain sized aperture, based on the number of pupils that there are in the room, and the amount required per pupil per minute. The only opportunity of regulating it that should be left to the teacher should be in regard to whether the temperature should be 68 or 70 or 72.

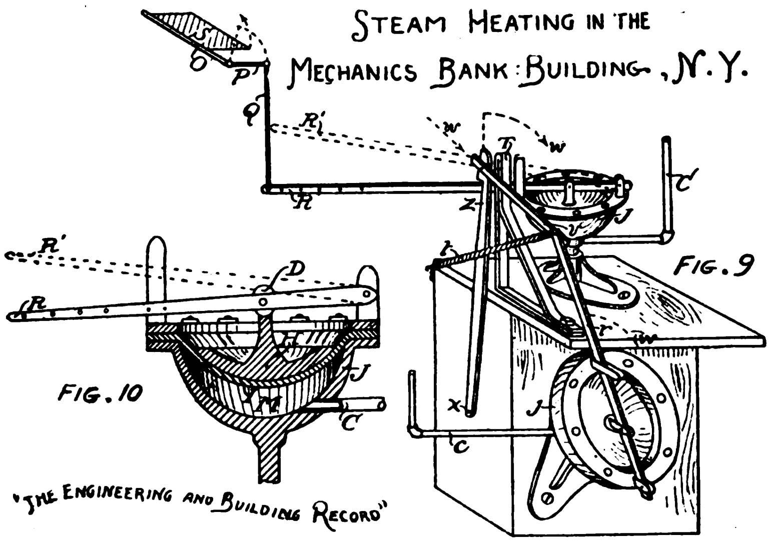
Mr. McClintock illustrated his remarks by the accompanying sketch (Fig. 1), in which A is the opening into the side of the building, where the cold air comes into a chamber B; leading out of the bottom of chamber B is a flue C; D is the heating apparatus, of whatever shape it may be desirable to have it, where the air is heated. The flues for warm air into the different rooms are, say, at E-E, so that the air passes up into different rooms. The air comes in from the outside, envelops the heater, and becomes warm; then it passes up one of these flues E at a temperature sufficient to warm the building. At F is a damper connected with the school-room, so as to be worked by the teacher by means of a chain passing over a pulley. In the first place this flue goes to the bottom, and has an opening G, so that the bottom of this is always full of cold air. When the damper F in the flue back of the heater is raised, the air, unwarmed, passes directly up the flue into the building. If you turn that damper down across the flue, then the air passes over the heater and becomes warm, and passes up at whatever temperature it may be raised to by reason of its coming in contact with the heater. Then if it is desired on the part of the teacher to change the temperature at all by working this damper, one way or the other, the cold and warm air are so mingled as to enter the room at the required temperature.

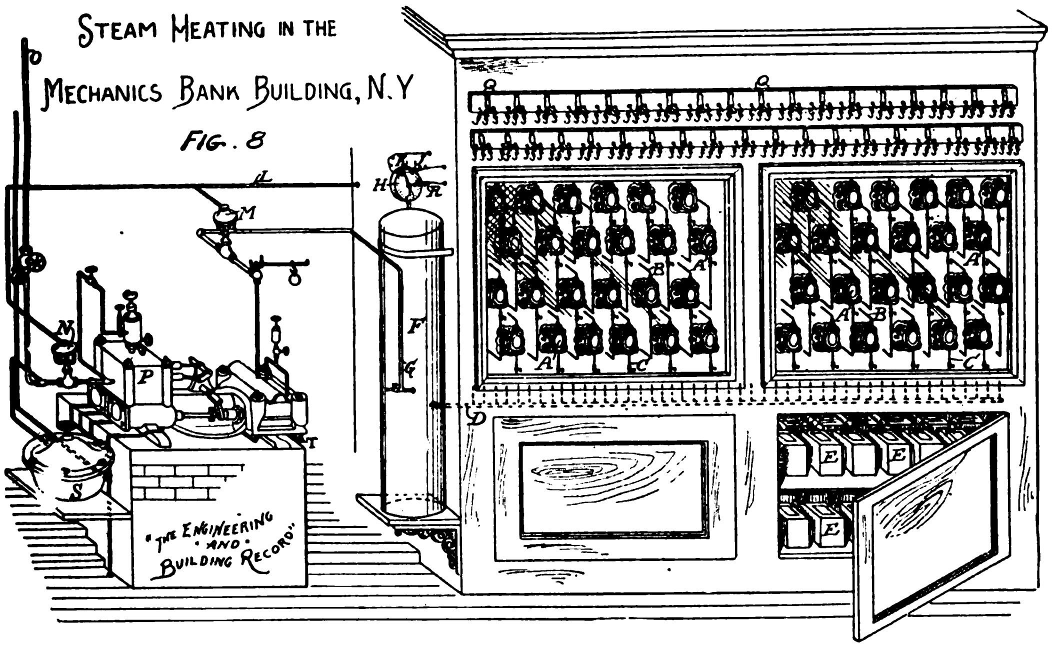
(To be continued.)

STEAM HEATING IN THE MECHANICS' BANK BUILDING, NEW YORK.

PART III.—ELECTRO PNEUMATIC VALVE ARRANGEMENT, AIR PUMP AND BLAST REGULATORS.*

FIGURE 8 shows the valve case in the engineer's room, A A, etc., are 54 valves (as shown in Figs. 4 and 5, p. 156) that control all the radiator valves and fresh air dampers in the building. Steam is delivered through pipe O to the special air pump P that discharges through pipe G to compressed air tank F, from which the pipe D supplies all the branches C C, etc., to the valves A A. B B, etc., are the pressure pipes to the radiator valves (see Fig. 7 p. 156), some rooms have two or more radiators controlled by one thermostat, in that case each steam valve has a separate pipe branched into pipe B so that all are simultaneously operated by one valve A. H is an ordinary pressure gauge whose needle I is connected to one wire R of a circuit which is completed when the needle indicates 10 pounds on the scale and makes a contact with wire K, or at 15 pounds with wire J.


STEAM HEATING IN THE
MECHANICS BANK: BUILDING, N.Y.
O
P
Q
R'
w
T
w
z
R
C
J
R'
D
R
FIG. 9
FIG. 10
M
J
C
x
J
c
"THE ENGINEERING AND BUILDING RECORD"


STEAM HEATING IN THE
MECHANICS BANK BUILDING, N.Y
FIG. 8
H
M
N
P
F
G
S
T
B
A
E
"THE ENGINEERING AND BUILDING RECORD"

J K and R are connected with one of the valves A that controls the pressure in pipe L and operates valves M and N simultaneously. When the needle is at K, M and N open and admit steam to the pump and air to the tank, when the rising pressure carries the needle to J. M and N close, shutting off the steam and preventing loss of pressure through pipe G.

Q Q, etc., are switches, corresponding to valves A A, etc.; each has three positions in which it will set the valve open, closed, or when in normal position allows the thermostat to control the valve, thus enabling the radiators to be regulated at will from the engine room regardless of the thermostats.

E E, etc., are the sal ammoniac batteries for the thermostat currents, reserve cells are also provided in excess of the number constantly required and are arranged so as to be instantly switched on and off for replacing, repairs, etc., without any trouble of connecting, moving, etc.

Figure 9 shows the apparatus governing the fresh air blast to the first and second floors through conduits M, Fig. 1, page 140. When the damper S is down, in the position shown, all the blast is forced through the radiator box L and delivered hot. When the temperature of the room rises to the point at which the thermostat is set, it operates the regulator J, whose arm K raises to R' and turns the damper, as indicated by dotted lines, stopping the passage of the air through the radiator box, and leaving it to be delivered through M directly from the blast main and at the temperature of the outdoor atmosphere. Since this blast may be too cool to deliver from the registers, its temperature is governed by the regulator *j*.

A certain temperature is fixed, say 50 degrees, below which the outside air shall not be admitted without warming or "tempering." A thermostat, set at this degree, is placed in the blast main and connected to regulator *j*. When the temperature is low the operation of *j* throws its lever *r* and the link *v* and latch *z* into the position shown, so that *z* engages lever R and prevents its raising damper S beyond a certain point, which is readily adjusted by connecting link Q to any one of the holes in R. This position of damper S admits part of the fresh air direct, and part from the radiator box L, the different proportions being readily determined by experiment. When the outside temperature rises above the fixed point, the thermostat shuts off the pressure in *j*, and *r*, *v* and *z*, moving in the directions indicated by arrows *w w w*, withdraw latch *z*, disengaging lever R, so that it may rise to its full stroke and close damper S so as to entirely shut off the heated blast.

C and *c* are compressed air pipes, and T is a stop to prevent lever R from being drawn backwards by the latch *z* on its back stroke.

z is pivoted at *x*, and is drawn towards R by the spiral spring *t*.

Regulators J and *j* are alike, and are constructed as shown in Fig. 10; their operation is similar to that of valve A, shown in Figs. 6 and 7, p. 156.

Compressed air from tube C enters the chamber M between shell J and rubber diaphragm I (which has an initial maximum curvature from a spring or imposed weight), and raising the diaphragm carries lever R to R'. When the air pressure is withdrawn the moving parts return to their original positions, as shown.

The reference letters have the same significance as in Fig. 6, p. 156.

The steam-heating in this building was done by Baker, Smith & Co., of N. Y., and the regulating apparatus is of the Johnson heat regulating system, and was furnished by the Metropolitan Electric Service Co. of N. Y., whose manager, S. J. Bailey, and superintendent, T. L. Bealle, explained its operation to a member of our staff, who prepared the sketches and description from the finished plant.

SIZES OF SEWERS.

IN his report on the Victoria, B. C., sewerage system, Mr. Rudolph Hering says that the least size of the public sewers should be eight inches, and that abundant experience has proven that a smaller size is objectionable. In Memphis, Tenn., where six-inch pipes are extensively used, from 100 to 200 stoppages occur per annum, which, in many cases, mainly from the absence of manholes, require a digging up of the street to remove them. Eight-inch pipe has been found quite suitable in many cities of the United States.

With regard to the size of the main pipe leading from the house to the sewer, the custom in most cities is to make this pipe six inches in diameter if made of earthenware. Mr. Hering fully indorses this custom. It is true that in a number of cities smaller pipes, even to four inches in diameter, have been used. If well laid, a four-inch pipe may give no trouble, and there are many instances of this kind. But there are also instances of considerable trouble due to this small diameter. In Memphis, again, the last biennial report states that there were as many as 2,000 stoppages per annum in the four-inch house pipes, requiring a plumber's services in each case to remove the same. In large cities, or in one where a strict control cannot be kept of the laying of house pipes, Mr. Hering thinks it is false economy to make them less than six inches in diameter, unless they are of cast iron from the house up to the sewer junction.

A TWO HUNDRED foot length of the new Lick Run sewer, at Cincinnati, O., has caved in, and about 1,000 feet more are expected to fall, owing, it is said, to faulty engineering.

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* Part I.—Arrangement of Exhaust Main Boiler, Feed Heater and Warming Fresh-Air Blast was published August 2. Part II.—Thermostats, Steam Valves, Electro-Pneumatic Valves and Direct Radiators, was published August 9.

Questions and Answers.

All questions relating to building construction, paving, sewerage, water supply, or kindred subjects, will be welcomed in this column provided they relate to matters of general interest and are not such as should properly be referred to a consulting engineer. Answers will be carefully prepared and a proof of both question and answer mailed to the inquirer as early as proper consideration will permit. They will be published for the benefit of other readers as soon as convenient. The full name and address should be given, not necessarily for publication, but as a guarantee of good faith, and to facilitate further correspondence in case the question is not sufficiently explicit.

Inquiries of the Editor, in order to secure prompt attention, should *not be written on the same piece of paper as a communication* to the *Publishing Department*. Letters renewing subscriptions are sent to a clerk in the publishing office, and matter for the Editor, if in the same enclosure, is likely to be overlooked unless it is on a separate piece of paper, so that it may be promptly sent to the Editor.

HOW MANY LEAKS ARE ALLOWED IN AMERICAN WATER MAINS?

David Franklin, of Saratoga Springs, N. Y., writes: "With regard to question raised by William Perry, Jr., in your issue of August 9, as to number of leaks allowed by American engineers in water mains per mile laid, I would say that in 1884 about four miles additional mains were laid in this place. The contractor, Adam Miller, guaranteed the work for six months; I was employed by him to do any repairs that might be needed. During the past six years I have only had to recalk six joints. Our system is the Holly. The ordinary pressure at works is 90 pounds and at the highest parts of the town, 45 pounds. I never heard of making allowance for leaks in mains."

PRACTICAL CIVIL ENGINEERING AND SURVEYING SCHOOLS.

S. P. Stabler, of Lower Peach Tree, Ala., writes: "Will you kindly furnish me the names of several good institutions where practical civil engineering and surveying is taught?"

[We are a little in doubt as to the exact meaning of our correspondent when he writes of practical civil engineering and surveying schools. For obvious reasons civil engineering practice cannot well be obtained in an engineering school, though practical surveying is embraced in the courses to a greater or less extent. On the whole it is little more than the theory of the science that the student can hope to obtain at the school. The practical training must be obtained by contact with actual engineering work. Courses of civil engineering are established at Columbia College, New York; Cornell University, Ithaca, N. Y.; the Rensselaer Polytechnic Institute, Troy, N. Y., and at several other colleges and universities. The schools will send catalogues, giving further information, on application.]

DEEP BOREHOLES.

In connection with the reference which we made some time ago to the bore hole at Schladebach, Germany—now the deepest in the world—it is interesting to note that the greatest depth reached until 1883 was 1070.2m. (3,478 feet) in the shaft at Pribram, Bohemia. This has since been exceeded in the following seven cases: Friedrichsane, at Aschersleben, 1080.22m.; Inowrazlaw, 1104.65m; Sennewitz, at Halle, 1111.45m.; Lübtheen, in Mecklenburg, 1203.70m.; Sperenberg, near Berlin, 1273.01m., Lieth, near Altoona, 1338.00m; and Schladebach, 1748.40m. The increase in temperature, which according to previous observations was about 1° Cent. per 39¼m, (1° Fahr. per 71 feet), averaged for an increase of 1° Cent., at Sperenberg, 32m.; at Sudenburg, 32.36m.; at Leith, 35.07m.; at Sennewitz, 36.66m.; and at Schladebach, 36.87m. In the last borehole, at a depth of 1716m., almost the highest temperature observed in the interior of the earth was recorded, namely, 45.3 deg. R. (135° Fahr.); but the increase was uneven in consequence of the different heat-conducting qualities of clay, limestone, sandstone, rock salt, &c., and also because of the influence of water from springs of various temperatures encountered during the boring, besides the artificial effects of the drilling work. The observations at Schladebach are the most reliable, particularly those bearing on the deepest points, because they followed the work in its progress, and were made in a borehole with no tubing. At a depth of from 1266m. to 1716m. the temperature rose 1° Cent. for 39.55m.

RULES FOR THE INSTALLATION OF ELECTRIC LIGHTING AND MOTIVE APPARATUS.

The following rules and regulations for the safe installation of electric plants are submitted by the Boston Manufacturers Mutual Fire Insurance Co., after a thorough and exhaustive revision and long consideration by competent experts. They are believed to be consistent with all that is yet known upon the subject of possible fire hazards from such apparatus. It may be stated that when electric lighting was first introduced, many years since, in mills or works insured by the above Company, mainly on the arc system, they had twenty-three cases of fire in sixty-one installations, but without any loss, within six months from the beginning. During that period the subject was thoroughly investigated and rules were prepared, by which they have been governed since that time. The rules now presented are a development rendered necessary by numerous inventions and improvements in the applications of electricity to illumination and to the transmission of power. It is claimed that there has not yet been a loss from any fire which could be attributed to electricity, generated for purposes of lighting, or for motive power, in any mill or works insured by the Company; and they hold that a well installed electric lighting system is the safest method of illumination.

The rules were prepared by C. J. H. Woodbury, F. E. Cabot, C. M. Goddard, and S. E. Barton, and are subject to change or amendment, consistently with the future progress of science in the development of electricity.

Dynamos and Switchboards.—1. Dynamos must be located in dry places, not exposed to flyings or combustible material, and must be insulated upon dry wood, filled to prevent absorption of moisture. They must be kept thoroughly clean and dry. They must be provided with a reliable, automatic regulating device, or a competent person must be in attendance near the machine whenever it is in operation. In wiring for motive power, the same precautions should be taken as with a current of the same volume and potential for lighting.

Each machine should be provided with a water-proof cover, which should be used whenever the machine is not in operation.

2. Switchboards, or other apparatus near the dynamos for controlling circuits and currents, should be so located that they will be accessible, and open on all sides, and entirely disconnected from all wood-work or combustible material; also kept free from moisture. They should be incombustible, and rendered non-absorbent of water.

Motors.—3. They must be located in dry places, not exposed to flyings or combustible material, and must be insulated upon dry wood, filled to prevent absorption of moisture. They must be kept thoroughly clean and dry. They must be self-regulating, or a competent person must be in attendance near the machine whenever it is in operation. All resistance boxes or devices should be made of non-combustible material, or so located that they cannot communicate fire to any surrounding combustible material. In wiring for motive power, the same precautions should be taken as with a current of the same volume and potential for lighting. The motor (and resistance box) should be protected by a cut-out, and controlled by a switch.

4. Motor cars driven by electricity from a single wire with earth or floor return circuit will not be approved in any building insured by this Company. The use of such single trolley tracks may be permitted, after special inspection, in mill yards where there is no liability of other conductors coming in contact with the trolley wire, and where the conditions of the position of the generator is such that the ground circuit will not impose any fire hazard on the property.

5. Wires for electric lighting or stationary motors will not be permitted in the same circuit with trolley wires with ground return—the Stock Insurance Companies will permit such installations, subject to special inspection and agreement, on payment of a suitable charge for the permit covering this increased hazard—although the same dynamo can be used, if desired, for both purposes, provided that the connection from the dynamo to each of the two circuits shall be by a double-throw switch, so that only one of the circuits shall be in service at the same time. In such case the wires for lighting or stationary motors shall be in the usual manner, entirely on a metallic circuit without ground.

Testing.—6. All circuits should be tested at least twice a day with a suitable magneto, or other approved device, in order to discover any escapes to ground that may exist. One test should be made in the morning, and another in ample time before starting, to remove any defect, should it be found to exist. The rules for testing should be observed in any separate or isolated plant the same as in central stations.

ARC SYSTEM.

Outside Wires.—7. All outside overhead wires must be covered with some material of high insulating power, not easily abraded; they must be firmly secured to properly insulated and substantially built supports. All tie wires must have an insulation equal to that of the conducting wires.

8. All joints must be so made that a perfectly secure and unvarying connection, fully equal to the cross-section of the conducting wire, will be secured—and they should be soldered. All joints must be securely wrapped with an approved tape.

The following formula for soldering fluid is recommended: Saturated solution of zinc, 5 parts; alcohol, 4 parts; glycerine, 1 part.

9. Care must be taken that conducting wires are not placed in such position that it would be easy for water or any liquid to form cross-connection between them, and they should not approach each other nearer than one foot. The wires must never be allowed in contact with any substance other than air, and their proper insulating supports; except that service wires with special insulation may be permitted to touch foreign substances.

10. Conducting wires carried over or attached to buildings, *must* be at least seven feet above the highest point of flat roofs, and one foot above the ridge of pitched roofs. Lines constructed subsequent to the adoption of these regulations should not be run over and attached to buildings other than those in which the light or power is being, or is to be used, but should be on separate poles, or structures, where they can be easily reached for inspection.

11. When they are in proximity to other conducting wires, or any substance likely to divert any portion of the current, *dead, insulated* guard-irons must be placed so as to prevent any possibility of contact in case of accident to the wires or their supports. The same precautions must be taken where sharp angles occur in the line wires, and also where any wires (telegraph, telephone, or others) could possibly, owing to their position, come in contact with the electric light wires.

12. Overhead wires from the main circuit or pole in the street to the terminal insulators attached to buildings, and at a point where they enter a building, must not be less than twelve inches apart They must be rigidly and neatly run and supported by glass or porcelain insulators or rubber hooks.

13. Service blocks must be protected by at least two coats of water-proof paint over their entire surface; and, when used to support rubber hooks, must have at least one inch of wood between the inner end of the hook and the back of the block.

14. For entering buildings, wires with an extra heavy water-proof insulation must be used from the terminal insulators through the walls from the outside to the inside of the building. They must loop down, so that water may drip off, without entering the building, and the holes through which they enter should, where possible, slant upward.

15. Wires must enter and leave the building through an approved cut-out switch, which must be "double contact," and should effectually close the main circuit, and cut off the interior, when turned "off." It must be so constructed that there shall be no arc between the points when thrown "on" or "off." It should be automatic in its action in either direction, not stopping between points when once started. It should indicate upon inspection whether current be "on" or "off." It must be mounted on a non-conducting base, kept free from moisture, and easy of access to firemen and police.

Inside Wires.—16. Wires must not be concealed, and they must be rigidly kept apart at least 1 foot, unless an *approved, moisture-proof, non-conducting, non-inflammable tubing* is used. This tubing must be sufficiently strong to protect the wires from mechanical injury. It may be fastened to the wall by staples, provided the tubing is not broken or injured thereby. Wires in this class of tubing may be run as near as 3 inches to each other.

17. Conductors in buildings must be thoroughly well insulated with non-absorbent water-proof material, as incombustible as possible, which will adhere to the wire and not fray by friction, and will stand a temperature of 150 degrees without softening.

In places liable to dampness, wires must be thoroughly and carefully run on glass insulators, rubber hooks, or porcelain knobs of suitable size and shape, and the wires must be separated at least 18 inches. They must also be provided with an approved water-proof insulation, or encased in an approved tubing.

When wires pass through walls, floors, partitions, timbers, etc., indoors, glass tubing or so-called "floor insulators," or other moisture-proof, non-inflammable, insulating tubing must be used.

18. All lightning arresters must be grounded outside of building, and preferably connected to a water pipe.

Arc Lamps.—19. The frames and other exposed parts of arc lamps must be carefully insulated from the circuit.

Each lamp must be provided with a proper hand switch, and also with an automatic switch that will shunt the current around the carbons should they fail to feed properly.

Stops of some kind must be provided to prevent the carbons from falling out in case their clamps fail to hold them; and these stops must always be in place.

20. For inside use, the light must be surrounded by a globe resting in a tight stand, so that no particles of melted copper or heated carbon can escape. When any inflammable material is near or under the lamp, the globe must be protected by a wire netting. Unless a very high globe, which closes in, as far as possible, at the top, is used, it must be provided with some protector or spark arrester, reaching to a safe distance above the light. Broken or cracked globes must be replaced by perfect ones immediately. (By inflammable material is meant dry goods, clothing, millinery, and the like in stores; flyings or goods in fabric factories; shavings and sawdust in wood-working shops, or any other substance that can

be readily ignited by droppings or flyings from the lamp.)

INCANDESCENT SYSTEM.

Incandescent Lamps on High-Tension Circuits.—21. The rules for running wires for arc lamps apply also to incandescent lamps on circuits having a potential of over 350 volts. Incandescent lamps in single series on high-tension circuits must be provided with a suitable hand-switch, and also with an automatic device capable of shunting the circuit across the terminals of the lamp, should the carbon filament break. When incandescent lamps are in multiple series, the hand switches must not control less than a single group of lamps, each of which may be provided with an automatic shunt, as above. Electro-magnetic devices will not be accepted as suitable for this purpose. Any method of distributing current to incandescent lamps on high-tension circuits, other than as above provided for, must receive approval before being put to use.

Outside Wires.—22. The rules 7 to 15 for outside arc wires also apply to outside incandescent wires, except that a cut-out switch in the circuit entering the building will not be required, but the wires from main circuit to main cut-out, inside of building, must be separated by a distance of not less than 6 inches, for currents having an electro-motive force of 350 volts or less, and this distance must be increased for currents of higher potential. They must also be rigidly and neatly run, and must be supported by glass or porcelain insulators, or by rubber hooks.

Underground Services.—23. Where underground service conductors enter a building, special care is necessary that they shall not come in contact with each other, or be placed where there is any risk of disturbance by moisture or mechanical injury.

There shall not be any free opening from underground wire conduits to buildings.

The service must not end in any place where it would be unsafe or undesirable to place a cut out, but should be continued by means of specially insulated conductors (and a space of 10 inches should be maintained between them) to a suitable location.

Inside Wiring.—24. For inside work, no wire smaller than No. 16 " B. & S.," or No. 18 " B. W. G.," will be approved. Before using any new form of insulation, the approval for its use under the proposed circumstances must be secured. The use of lead-covered wire, or wire the covering of which contains paraffine, is prohibited.

25. Moldings with open grooves laid against the walls or ceilings will not be approved. A wood molding with dividing strips between the grooves, at least half an inch in thickness, and having a backing of at least ¼-inch thickness to intervene between the wire and the wall or ceiling of the building, the backing to be protected by at least two coats of water-proof paint, and the molding of such shape as to protect the wire from moisture, will be approved. Moldings must not be used in wet places.

26. Wires laid in plaster, cement, or other similar finish, or run over surfaces furred off for plastering, will not be approved, no matter what insulating covering is used. An approved moisture-proof, non-inflammable, insulating tubing or conduit may be used in such places. This tubing must be of sufficient size and so placed that the wires may be withdrawn and replaced at will. All joints and bends in this tubing must be made with suitable devices adapted especially for the purpose. Where this is done in such a way that the joints are moisture-proof, a double-braided cotton insulation, rendered non-inflammable, may be used.

A separate tube must be laid for each wire, except in the case of "taps" for not more than fifteen amperes, in which case conductors having insulation of cotton or other material which will readily carbonize, will be required. If a moisture-proof covering is desired, it must be placed outside the two conductors, and not between them. In other concealed places, such as unfinished lofts, between floor and ceiling, in partitions, etc., all wires must be covered with approved moisture-proof insulation, and fastened at distances not exceeding ten feet so as to preserve at least 2½ inches between the wires or any other electrical conductor. In lieu of such construction an approved moisture proof, non-inflammable, insulating tubing or conduit with approved moisture-proof joints may be used, and the same rule as to insulation will be applied as in the case where the tubing is buried in plaster or similar material. Tubing passing through walls or ceilings must extend at least one inch beyond the finished surface, until the mortar or other similar material is entirely dry, when the projection may be reduced to one-half inch.

Tubes of such approved make may be laid side by side when imbedded in plaster or otherwise. At all outlets to and from cut-outs, switches, fixtures, etc., wires must be separated from gas-pipes or parts of the building by porcelain, glass, or other non-inflammable insulating tubing, and should be left in such a way as not to be disturbed by plasterers Wires of whatever insulation must not in any case be taped or otherwise fastened to gas-piping. If no gas-pipes are installed at the outlets, an approved substantial support must be provided for the fixtures.

Wires of the same polarity, but belonging to the different circuits, or leading to and from a double-pole switch, must not run in one groove, through the same tube, nor in the same slot in a cleat.

27. In dye houses, paper and pulp mills, and other buildings specially liable to moisture, all wires (except those used for pendants) must be separated at least six inches. The wire must be thoroughly and carefully put up, and must be supported by glass or porcelain insulators, or by rubber hooks. An approved, moisture-proof, non-inflammable, insulating tubing will be accepted in lieu of such construction.

28. In crossing any metal pipes, or any other conductor, wires must be separated from the same by a block of wood or other non-conductor of at least one-half inch, and so arranged that they cannot come in contact with each other by accident. Wires should go *over* water-pipes where possible. When wires pass through walls, floors, partitions, timbers, etc., indoors, glass tubing, or so-called "floor insulators," or other moisture-proof, non-inflammable, insulating tubing must be used. Wires must never be left exposed to mechanical injury, or to disturbance of any kind. Wires of the same polarity, but belonging to different circuits, or leading to and from a double-pole switch, must not run in one groove, through the same tube, nor in the same slot in a cleat. Cleats should be made of well-seasoned hard wood (filled to prevent the absorption of moisture), porcelain, or other approved material, and so made as to separate the wire at least one-fourth inch from the building. When secured by cleats not over four feet apart and tightly stretched, wires having a difference of potential of 120 volts or less, and carrying not over ten amperes, should be separated at least 1½ inches; when they are confined in molding, a ½-inch space is sufficient. Mains carrying currents of larger volume should be separated a greater distance.

The use of metal staples for securing wire will not be approved.

29. Where exposed to corrosive fumes, wires should be provided with an insulation that will not be injured thereby; and should be put up in the manner described in Rule 27.

30. All splices in wires must be soldered in accordance with Rule 8. A soldering bolt should be used for this purpose, if possible. Care must be taken not to render the wire brittle by overheating. The insulation of any joint must be equal to that of other parts of the same wire.

Safety Cut-Outs and Switches.—31. Every portion of each installation must be equipped with double-pole, safety cut-outs, that will interrupt the passage of a current in excess of the amount which any portion of the apparatus is adequate to transmit. A cut-out must be placed where the underground or overhead service joins the inside wires, and at every point where a change is made in the size of the wire (unless the cut-out in the larger wire is intended to protect the smaller). The plug or other device for inclosing or supporting the fusible strip or wire should be incombustible and moisture-proof, and so constructed that an arc cannot be maintained across its terminals by the fusing of the metal. No lead or composition strips carrying more than ten amperes before melting shall be used, unless provided with contact surfaces of some harder metal having perfect electrical connection with the fusible part of the strip. On any combination fixture, no group of lamps requiring a current of seven amperes or over shall be ultimately dependent on one cut-out. But there shall be a cut-out to each pendant and fixture.

32. Switchboards and cut-outs should be made of incombustible material, and arranged so that there will not be any leakage of electricity across them. They should be put in places not liable to contact with foreign substances, nor exposed to moisture.

33. All switches except those in lamp sockets should be double-pole.

They must have a firm and secure contact that will make and break readily, and that will not stick between "full on" and "off," nor get out of repair easily in other ways. The points of contact must not be allowed to scrape, or rub, the entire surface of an insulating material between the contact strips; an air space must intervene. The carrying capacity of the different parts must be sufficient to prevent heating.

Fixture Work.—34. In all cases where wires are concealed within or attached to fixtures, the latter must be insulated from the gas-pipe by some approved device.

When holes are drilled in fixtures, all burs or fins must be removed from the edge of the holes before the conductors are drawn through.

When wired outside, the conductors used must be so secured as not to be cut or abraded by the pressure of the fastenings or motion of the fixture.

All wire used for fixture work must have an insulation that is durable, and not easily abraded; and must not, in any case, be smaller than No. 19 " B. & S.," or No. 20 " B. W. G."

Each fixture must be tested for possible "contact" between wire and fixture, and for "short circuit" before current is turned on.

The tendency to condensation within the pipes or fixtures should be guarded against by sealing the upper end.

No combination fixture with less than one-fourth inch clear space between the inside pipe and the outside casing will be approved.

Pendants and Sockets.—35. Cord pendants must be composed of stranded wire, and protected by rubber bushings, or something equally good, where they enter the socket.

When exposed to weather, or used in wet rooms, care must be taken to keep moisture from the inside of sockets.

The weight of every socket and lamp suspended by a cord must be borne by a ceiling block, rosette, or cleat, and by a knot under the bushing in the socket, in order to take all strain from the joints and binding screws.

Flexible cord must not be used except for pendants, wiring of fixtures and portable lamps.

Secondary Generators or Converters.—36. Converters must not be placed inside of any building except central stations, and should be inclosed in a metallic or non-combustible case. They may be placed on the outer walls when in plain sight and easy of access, but must be thoroughly insulated from them. If placed on wooden walls, or the woodwork of stone or brick buildings, the insulation must be fire-proof. When an underground service is used, the converter may be put in any convenient place that is dry and does not open into the interior of the building; this location must have the approval of the inspector before the current is turned on.

37. If for any reason it becomes necessary that the primary wires leading to and from the converter should enter a building, they must be kept apart a distance of not less than 12 inches, and the same distance from all other conducting bodies.

38. Safety fuses must be placed at the junction of all feeders and mains, and at the junction of mains and branches when necessary; also in both the primary and secondary wires of the converter, in such manner as not to be affected by the heating of the coils. Secondary wires, after leaving the converter, will be subject to rules already given for inside wiring for incandescent lighting.

The secondary circuit may be provided with a film cut-out, which connects to the earth outside of the building; but permanently grounding the secondary circuit is unsafe and will not be sanctioned.

Foreign Wires.—39. No foreign wires of any kind shall be attached to buildings insured by this company, for the purpose of carrying electric currents across the yard to any point.

40 All electric wires which may be required by the insured shall enter the premises at one point, preferably near the headquarters of the night watchman, where they can be kept under supervision; each of said wires shall be guarded by a protector against strong currents, operating by opening the circuit, and by a lightning arrester.

41. Such protectors against strong currents shall be located in a dry, accessible place inside the building, and as near the point of entrance of wires as possible, and shall be without ground connection; such protectors shall be mounted on non-combustible and insulated supports, which shall be provided with a receptacle for the burning or melted parts of such apparatus.

42. The lightning arresters on all wires must be placed between the protector against strong currents and the electrical portion of the apparatus within the building to which such wires are connected. No ground wires for such lightning arrester shall be attached to gas pipes within the premises of the insured.

43. All electric wires which may enter the premises of the insured must be insulated between the line wire on the insulator attached to the buildings outside and the protecting device within, with the best quality of water-proof insulation. Moreover, such wires must enter at a distance of not less than three inches from any other wire or any conducting material.

44. If any wires carrying high tension or strong currents are to be carried over or under other wires on the property of the insured, they shall be attached to poles so near to each other, with one wire so far above the other, that if a break should occur, the pendant wire between these poles may not be long enough to come in contact with the wire below, or, if not carried on poles, these wires shall be so placed or protected with guard wires as to render a contact between different wires impossible.

45. If the high and low tension systems are in use in the same yard, even when developed within the works, the wires must be kept separate, and so wide apart that no contact or cross-arc can be made.

Notice.—46. The underwriters reserve the right at any time to add to, change, or modify these rules, and to enforce such modifications, changes, etc., as shall be deemed necessary for safety; all reasonable efforts will be made to notify promptly all electric light companies of any change.

TUNNELING THE NARROWS.

A SCHEME for tunneling the Narrows between Staten Island and Bay Ridge is the latest result of Erastus Wiman's plans for the improvement of New York as a railroad and commercial center. The best line for the tunnel has been thought to be between a spot near Fort Wadsworth, about at the foot of Vanderbilt Avenue, Staten Island, to Bay Ridge. The depth beneath would be about 35 feet, and the length of the tunnel about 1¼ miles.

According to Mr. Wiman, Heman Clark, whose work on the new aqueduct is already well known, has declared the scheme for the tunnel to be thoroughly feasible. The character of the river bed so far as known consists of a soft soap-stone, firm and trustworthy for the necessary strain, but easily worked. There would be two lines of tunneling, parallel and close together. Mr. Wiman thinks that $5,000,000 would easily cover the entire cost.

PUBLICATIONS RECEIVED.

NATIONAL ROAD FROM THE AQUEDUCT BRIDGE TO MOUNT VERNON, VA. Letter from the Secretary of War, transmitting, with a letter from the Chief of Engineers, a report of a survey for a national road from the Aqueduct Bridge to Mount Vernon, Va.

REPORTS FROM THE CONSULS OF THE UNITED STATES, No. 116: May, 1890. Issued from the Bureau of Statistics, Department of State.

CONTRACTING NEWS DEPARTMENT.

A WEEKLY RECORD

OF SPECIAL INTEREST TO CONTRACTORS, BUILDERS AND MANUFACTURERS OF ENGINEERING AND BUILDING SUPPLIES.

CONTRACTING INTELLIGENCE

Our readers will oblige us by notes, clippings, or any information which will put us in the way of obtaining early and reliable news for our "Contracting Intelligence." *Information of importance sent to us exclusively, and not elsewhere published will be liberally paid for.*

For works for which proposals are requested see also the "Proposal Columns,' pages i-ii-175.

WATER.

For Additional Water Items see Proposal Columns.

NEW BRITAIN, CONN —The water supply of this place is to be improved by laying an additional main from Shuttle.

ELGIN, ILL.— Important steps will soon be taken towards improving the local water-works system.

NEWMANSTOWN, PA.—The citizens of this place are uniting in favor of establishing a system of water-works.

IPAVA, ILL.—This place is to have water-works.

OXFORD, TENN.—Reports say that a petition is being circulated for signatures asking the Board of City Commissioners to order an election on the question of borrowing $50,000 for a system of water-works.

FROST, TEX.—The projected system of water-works for this place will probably be established at an early day. For particulars address J. H. Galbreath, as above.

SCOTTDALE, PA.—Reports say that the difficulties existing between the officials and others regarding the projected water-works have been overcome, and it is probable that the system will be established soon.

STATESVILLE, N. C.—Town Clerk E. B. Stimson writes: "The Board of Aldermen met August 4, and ratified a contract, made by a special committee on water-works, with L. W. Cox, of Washington City, for a system of water-works, at an annual rental of $2,000, payable semi-annually."

MASON CITY, IOWA.—Improevments are to be made to the local water-works plant.

ROCKVILLE, CONN.—At the recent meeting of the Common Council it was represented that the water protection against fire was very poor, and a committee was appointed to look up the matter and report suggestions as to what action was necessary.

CALAIS, WASH.—A complete new system of filtration is to be added to the plant of the Calais Water Company.

GALLIPOLIS, O.—The Board of Trade Committee, having in charge the project of establishing water-works here, has sent out 100 slips of inquiry to towns of equal size. The object is to ascertain whether the works should be constructed by private or public enterprise, and the actual cost of fire protection alone.

WELLSTON, O.—The people of this place have decided in favor of establishing a system of water-works.

JERSEY CITY, N. J.—Reports say that the Water Board has contracted with the Hackensack Water Company for a water supply.

GATESVILLE, TEX.—A water-works plant is to be established at this place by the Gatesville Water Supply Company, J. W. Sanders, Secretary

OPELIKA, ALA.—The people of this place have decided in favor of establishing a system of water-works, and particulars can be obtained by addressing F. M. Renfro, as above.

NAUGATUCK, CONN. — The Naugatuck Water Company has voted to increase its capital stock $5,000, and also to build a storage reservoir.

ABILENE, TEX.—Work has begun on a new artesian well. The contractors agree to bore 2,500 feet if necessary to insure a good flow of water.

PRATT MINES, ALA.—A system of water-works is to be established at this place by a newly organized company.

MINNEAPOLIS, MINN.—Important extensions are to be made to the water mains of this city. Address the City Engineer for particulars.

EAST PROVIDENCE, R. I.—The Riverside Water Company is seeking a franchise to supply this place with water, and a decision will be given at a special meeting to be held August 18.

MANCHESTER, N. H.—It is proposed to erect a high pressure reservoir on Oak Hill.

EASTPORT, ME.—The Eastport Water Company has decided to lay a main from Boyden's Lake. Materials, etc,, will soon be wanted.

MUSKEGON, MICH.—At a session of the Board of Public Works August 6, the bids for the lake work of the new water works system were found to be as follows: Thatcher & Braymen, of Toledo, all lake work complete, $52,608; Knapp & Gillen, of Racine, same work, $60,502; Dowagiac Construction Company, same work, $63,035; Moffat, Hodgkins & Co., of Syracuse, all lake work, both wells, 400 feet dock, all pipe laying, $137,000; J. C. Crowley Construction Company, bid informal. The job was let to Thatcher & Braymen.

SHELTON, WASH.—The City Council is considering the proposition to bond the city for the purpose mainly of putting in a water system for domestic and fire purposes.

STEELTON, PA. — Water-works, to cost $180,000, will, it is reported, be established at this place in the autumn.

CHURCHILL, PA.—Reports say that this place is to have a water supply.

BLOOMINGTON, IND.—Reports say that this place is to have water works, with 5½ miles of main pipe. The city is to take 60 fire plugs for 30 years, paying $45 per year for each plug, and the plugs are to throw a stream 100 feet high.

TRENTON, TENN.—The city has decided by a popular vote to issue $20,000 of bonds for the construction of water-works.

OCALA, FLA.—The election to consider the issuance of bonds to purchase the water works, which was to take place August 14, has been postponed to August 21.

YORKVILLE, S. C.—The National System of Water-Works Company, Washington, D. C., has made a proposition to construct water-works at this place.

IONA, MICH.—It is probable that steps will soon be taken by the proper officials to increase the water supply of this place.

ROCK SPRINGS, WYO.—New machinery is to be added to the local water-works plant.

GAINESVILLE, GA.—N. W. Davis, C. E., of Atlanta, Ga., writes: "I have just finished plans for a water-works system for this place. Bids will soon be opened." For details see our Proposal Columns.

PALMYRA, MO.—The Palmyra Light and Water Company has been organized at this place, and a plant will probably be established.

WYTHEVILLE, VA.—Mayor W. L. Yost writes: "The town last year built new water-works, which is supplied from Warm Spring, but are discussing the propriety of extending them to get water from another source six miles distant; main, 10,8 and 6 inches."

CORRECTIONVILLE, IOWA.—Town Clerk Henry Maennel writes: "Our town will hold a special election, August 18, for the purpose of allowing our citizens to decide whether we shall have a system of water-works."

FRANKLIN FALLS, N. H.—W. F. Daniell writes from this place as follows: "No steps have been taken as yet in regard to water-works."

GALT, ONT.—The people of this place have voted the sum of $125.000 for the purpose of establishing a system of water works.

CORTLAND, NEW YORK.—F. S. Pecke, of Watertown, Engineer for the Board of Water Commissioners, writes under date Aug. 9th: "The contract for the construction of the Water Works at Gouverneur, St. Lawrence Co., N. Y., was awarded to L. J. Richardson, of Cortland, N. Y., for the sum of $53,000, yesterday. The system will comprise about six miles of cast-iron pipe, furnished by M. J. Drummond, of New York, of the Donaldson Iron Co.'s make. Two 12" and 18½" x 11" x 18" non-condensing pumps, made by the Deane Steam Pump Co. of Holyoke, Mass. Two 60 horse-power steel boilers, made by the Phœnix Foundry and Machine Co., of Syracuse, 41 hydrants with the necessary valves of the Galvin Brass and Iron Works, Detroit, Mich. Water tower will be of steel, 30 feet diameter by 40 feet high. Water is to be taken from the Oswegatchie River, and passed through a filter, designed by the writer expressly for the requirements of the Water Commissioners. Spiral weel steel tubing will be used for the suction and for the river crossings, &c."

MARQUETTE, MICH.—A water-works system is to be established at this place at a cost of $25,000.

RICHLAND, VA.—John W. Spotts writes from here as follows: "The Richlands Water, Gas and Electric Light Company has obtained a charter, and I believe have organized. Steps will be taken at once to erect water-works, which from the proposed development of the town will necessitate a large and expensive plant, which the Company has ample means to meet. Mr. C. Graham, Pulaski City, Va., is secretary, and Mr. Wm. K. Hewson, Richlands, Tazewell, Co., Va., treasurer."

BROOKLYN, N. Y.—Commissioner Adams has forwarded a communication to Mayor Chapin, requesting that a special meeting of the Common Council be held at the earliest practicable moment for the purpose of considering and acting upon the question of improving at once the water supply of the city. The Commissioner's communication recommends the expenditure of $700,000 on additional water-mains, and $65,000 for a water tower. The Mayor has not as yet acted on the letter.

BUCHANAN, MICH. — The people of this place will hold a special election to decide the water-works question.

WATER-WORKS.—See our Proposal Columns for information regarding water-works and water-works furnishings at the following places: Quebec, Can., Cincinnati, O.; Canton, O.; Gainesville, Ga.; New York City; Pasco, Wash.; Hoboken, N. J.; Newport, Ky.; Allegheny, Pa.

SEWERAGE.

For Additional Sewerage Items see Proposal Columns

TUSKALOOSA, ALA.—An additional brick sewer is to be established at this place. For particulars address W. W. Thompson, as above.

GRAND FORKS, DAK.—Important information can be obtained regarding extensive sewerage work in this city by addressing the City Engineer, as above.

MOUNT VERNON, O.—The city officials have under discussion the question of expending several thousand dollars on sewerage improvements.

SAN ANTONIO, TEX.—Mayor Callaghan has issued a message advocating the immediate construction of a complete system of sewers and the purchase of the water-works plant by the city.

FINDLAY, O.—Important information regarding extensive sewer work can be obtained by addressing M. G. Foster, City Clerk, as above.

QUINCY, ILL.—It is probable that a new sewer will soon be constructed in the First Ward, this city. Address Alderman Higgins, of this city, for particulars.

LINCOLN, NEB.—Numerous sewer extensions are to be made here.

FORT HOWARD, WIS.—Extensive improvements will be made to the sewerage system of this place.

MEADVILLE, PA.—The city will soon need 5 miles sewerage.

WATERVILLE, ME.—The sum of $10,000 is to be expended in extending the sewerage system of this place.

LA SALLE, ILL.—The following bids for the construction of about 25,000 feet of sewers were received by Mayor F. W. Matthiessen, August 5: Division "A."—J. P. Fox, Eau Claire, Wis, $11,942.90; John Stuart, La Salle, Ill., $15,414.02; Rockford Construction Co., Rockford, Ills., $15,873.89. Division "B."—J. P. Fox, Eau Claire, Wis., $2,493. Division "C."—John Stuart, La Salle, Ills., $4,339; J. P. Fox, Eau Claire, Wis., $5,409 20. Division "D."—J. P. Fox, Eau Claire, Wis., $7,088.40; John Cummings, La Salle, Ills, $10,900. The following contracts were awarded: Division A, B and D to J. P. Fox; Division C to John Stuart.

TORONTO, ONT.—There is a scheme on foot to establish a trunk sewer in this city. City Engineer Jennings can furnish particnlars.

LYNN, MASS.—Numerous extensions are to be made to the local sewer system.

PAWTUCKETVILLE, MASS.—Important improvements are to be made to the sewerage system of this place.

LOWELL, MASS.—It is probable that work on the Belvidere sewer will commence soon. The Chairman of the Sewer Committee can furnish details.

KANSAS CITY, MO.—City Engineer Butts has completed plans, etc., for another section of the O. K. Creek sewer. Address him, as above, for particulars.

WILMINGTON, DEL.—Numerous sewer extensions are to be made at this place. For full particulars see our Proposal Columns.

DETROIT, MICH.—Several miles of sewer mains are to be constructed in this city. For particulars address the Board of Public Works, as above.

BOSTON, MASS.—The following proposals for the construction of sections 8 and 9, Metropolitan Sewerage System (East Boston), and sections C and D (Brighton), all in this city, were opened by the Board of Metropolitan Sewerage Commissioners, August 13. Only the total figures are given. The tables in detail will appear next week.

Section 8.—National Construction Co., Boston, Mass., $60,305.25; Charles Linehan, Cambridge, Mass., $65,225; O. P. Roberts, Cambridge, Mass., $78,321; R. A. Malone & Sons, Philadelphia, Pa., $99,155.

Section 9.—R. A. Malone & Son, Philadelphia, Pa., $96,792.50; Metropolitan Construction Co., Boston, Mass., $82,348.75; O. P. Roberts & Son, Cambridge, Mass., $80,-946.25. Charles Linehan, Cambridge, Mass., $70,530; National Construction Co., Boston, Mass., $69,121.25.

Section C.—John Cavanagh & Co., Boston, Mass., $91,925; Aaron A. Hall, Dorchester, Mass., $73,109.25; National Construction Co., Boston, Mass, $64,606 25.

Section D.—Aaron A. Hall, Dorchester, Mass., $66,255.75; Charles Linehan, Cambridge, Mass., $55,225; National Construction Co, Boston, Mass, $52,546.25.

SEWERS.—See our Proposal Columns for information regarding sewer construction at the following places: Binghamton, N. Y.; Trenton, N. J.; Galion, O.; Greensboro, N. C.; Ashland, Wis.; Wilmington, Del.; Cleveland, O; Key West, Fla.; Vancouver, B. C.; Para, Brazil; Danbury, Conn.

BRIDGES AND IRON STRUCTURES.

For Additional Bridge Items see Proposal Columns.

LOUISVILLE, KY.—A resolution has been introduced in the City Council to construct an iron highway bridge over Kentucky street at the expense of the city and the Louisville and Nashville Railroad Company.

CHESTERTOWN, MD.—It is proposed to either expend $5,000 in repairing the bridge over Chester River or replace it with an iron structure.

NEW HAVEN, CONN.—There are to be two new iron bridges built on the New Haven and Derby Road, one at Derby and the other at Ansonia. They will replace wooden structures.

Little Rock, Ark.—Mayor William G. W. Gipple writes: "The proposed free bridge across the Arkansas at this point, connecting the two sides of the city, is still merely a matter under consideration. Nothing can be done decisively until October when the County Court meets. Doubtless such a bridge will be built by the county, and commenced this fall."

Sedan, Kan.—The Lantz Suspension Bridge Company has been incorporated at this place, with a capital stock of $10,000. Address George M. Lantz, as above, for details of proposed operations.

Richmond, Va.—There is a project to erect a bridge over the river at this place. City Engineer Cutshaw can furnish information.

Trenton, N. J.—The bids for the iron work on the bridge over Bayard Pond, at Hickory Corner, ranged from $466 to $590, and for the stone work from $4 99 per cubic yard to $9.65.

Trenton, N. J.—The following bids for the erection of the iron-work of a high truss bridge, 70 foot span, 18 foot roadway, were received by Symmes B. Hutchinson, county solicitor, August 13th: Variety Iron Works, Cleveland, O., $2,185; King Iron Bridge and Manufacturing Co., Cleveland, O., $2,179; Groton Bridge and Iron Co., Groton, N. Y., $2,179; Wallis Iron Co., Jersey City, $2,211; Penn. Bridge Co., Beaver Falls, Pa., 2,247, Milliken Bros., New York, $2,300; Berlin Iron Bridge Co., East Berlin, Conn., $2,200; Dean & Westbrook, New York, $2,075; New Jersey Steel and Iron Co., N. J., $1,998. Contract awarded to lowest bidder.

Orange Grove, Ind.—It is reported that a bridge is to be erected over the Patapsco River at this place.

Apalachicola, Fla.—Reports say that Chief Engineer J. N. Cook, of the Augusta, Tallahassee and Gulf Railway, will soon let contracts for a bridge over the Ocklockonee River.

Augusta, Ga.—The sum of $8,000 is soon to be expended in building a bridge over the canal at Broad Street, this city.

Jackson County, W. Va.—Two steel bridges are to be erected in this county. Address the Clerk of the County Commissioners for particulars.

Lake Temiscamingue, Can.—Surveys are being made for a proposed bridge over the Ottawa River at the foot of Lake Temiscamingue. The clerk of the Department of Public Works can furnish particulars.

Bridges.—See our Proposal Columns for information regarding bridge construction at the following places: Toledo, Wash ; Montgomery, Ala.; Beeville, Tex.; Newport, Ky.; Rome, N. Y.; Marble Falls, Tex.; Prineville, Ore.; Steubenville, O.

NEW DEPOTS.

Norfolk, Va.—Car shops, to cost $200,000, are to be erected, in this city by the Norfolk and Western Railroad Company.

Jersey City, N. J.—The Pennsylvania Railroad Company will erect a new depot and sheds at its terminus in this city at a total cost of $1,500,000.

Milwaukee, Wis.—Reports say that the Milwaukee Belt and Terminal Company will erect an extensive depot in this city.

Perth Amboy, N. J.—Reports say that the Reading Railroad Company has secured an independent outlet to new York harbor, and that the site for the new terminal is situated on the New Jersey site of the Arthur Kill, near this place. Two large coal shipping piers, extending 700 feet from the shore line; a commodious freight and storage yard, comprising 24 tracks, each of 1,500 to 2,000 feet in length, and facilities for handling coarse freight of all kinds will be provided. A branch line of railroad 18 miles in length, to connect Bound Brook with the terminal yard and the Perth Amboy piers, will also be constructed.

STREET-WORK AND PAVING.

Alexandria, D. C.—Extensive improvements are to be made to the roads throughout the county, and operations will commence at once.

Dennison, O.—The bids for paving and sewering Grant and Fourth Streets were opened August 8, and were rejected, on account of being too high. New bids will be asked for.

Lincoln, Neb.—The City Council has authorized the paving of numerous streets, and proposals will soon be wanted.

Mount Vernon, O.—Extensive paving operations are contemplated at this place.

Hannibal, Mo.—Considerable paving is to be done in this city.

Keokuk, Iowa.—The officials of this city have decided to pave numerous of the public streets with hard brick.

Brooklyn, N. Y.—The Charities Commissioners are preparing estimates for the macadamising of five miles of road at the County Farm at St. Johnland.

RAILROADS, CANALS, ETC.

Ottumwa, Ia.—This town has voted to issue bonds in the sum of $35,000 to aid in building the C., Ft. M. and D. M. Railroad.

GAS AND ELECTRIC-LIGHTING.

McKeesport, Pa.—The plant of the Union Gas Company will be considerably extended.

Wooster, O.—The Wooster Electric Light Company has decided to make extensive improvements and extensions to its plant.

Orangeburg, S. C.—The people of this place have decided in favor of electric lights and a plant will be established soon.

Newton, Iowa.—This city will pay $13,000 for an electric light plant of 1,000-light capacity, which it is to own and operate.

Richmond, Va.—The Craylor Electric Light Company has been incorporated here with a capital stock of $100,000, for the purpose of establishing an electric light plant, selling electric motors, etc. President, A. W. Barber.

Shelbina, Mo.—The people of this place have voted the sum of $5,000 to be expended in establishing an electric light plant,

Abilene, Kan.—The Mosher Arc Lamp Company has been incorporated here with a capital stock of $50,000. Incorporators, J. A. Mosher and others.

Peabody, Mass.—At a special meeting of the officials, the town accepted the report of the Electric Light Committee, and voted to establish a town plant. Thirty thousand dollars was appropriated, and a committee was appointed to carry out the vote.

West Toronto Junction, Ont.—There is a project here to expend the sum of $15,000 on an electric lighting plant.

Pelham, N. Y.—The Pelham Bay Park Electric Light, Power and Storage Company has been incorporated here, with a capital stock of $10,000. Incorporators, George W. Cochran, Edward S. Becker, and others.

Williamette, Ore.—The Falls Electric Light Company, of this place, will increase the capacity of its plant by the addition of 1,500 incandescent and 100 arc lights.

Watertown, Wis.—The local electric light plant is to be extended.

Franklin Falls, Pa.—The business men of this place have formed a syndicate for making a proposal to furnish electric lights to the town.

Winchester, Tenn.—An electric light plant is to be established at this place.

Crafton, Pa.—A company has been incorporated for the purpose of establishing an electric lighting plant at this place.

Seattle, Wash.—The Metropolitan Electric Company has been incorporated here, with a capital stock of $3,000,000. Jacob Furth, A. B. Stewart, J. M. Thompson and others, incorporators.

Uniontown, Pa.—The Uniontown Light and Heat Company of this place contemplates putting in a large arc dynamo in the new gas plant building when it is completed.

Topeka, Kan.—The Johnson Fuel and Gas Company has been incorporated here, with a capital stock of $200,000. C. P. Baker and others are incorporators,

Electric Railways.—New electric railways will be built and improvements will be made to those already established at the following places: Fall River, Mass.; Savannah, Ga.; Cincinnati, O.; New Orleans, La.; Amsterdam, N. Y.; Austin, Tex.; Dundas, Ont.

BIDS OPENED.

Brooklyn, N. Y.—Neils Pedersen has been awarded the contract for the carpenter work on the new school house at Richmond Hill, at $7,883, and the contract for mason and brick work has been awarded to Thos. W. Styles, at $7,295.

Brantford, Can.—The contract for the erection of the new Central school house was awarded to Shultz Bros., at $38,744, and the contract for heating to Smead, Dowd & Co., at $3,840.

GOVERNMENT WORK.

Washington, D. C.—The following proposals for the work specified were opened on the given dates by the Supervising Architect of the Treasury Department :

Charlotte, N. C.—Plumbing of the United States Court House, Post Office, etc., opened August 7. Bidders: C. Bargamin, Buena Vista, Va., Perfection closet, $2,960, John F. Dalton, Chicago, Ill., Delta closet, $3,107; Shanks & Burrett, Richmond, Va., Inodora closet, $2,165; Crook, Homer & Co., Inodora closet, $4,121.02; J. E. Finsley, Charlotte, N. C., Perfection closet, $2,291.

Houston, Tex.—Extension of the United States Court House and Post Office at this place, opened August 8. Bidder: William Williams, $7,330.

New Orleans, La.—Steel linings, partitions and doors for the vault of the United States Mint Building at this place, opened August 8. Bidders: Farrett & Co., 1⅛-inches thick, $30,428; 2-inches thick, $43,958.

INDUSTRIAL.

St. Paul, Minn.—The Ways and Means Committee of the Board of County Commissioners has reported adversely on the proposition to pay $9,000 for a system of steam regulators for the city hall.

Aransas Pass, Tex.—Russell B. Harrison and others are interested in a new company called theAransas Pass and Harbor City Improvement Company, with headquarters at Topeka, Kan., organized for the purpose of building a city and improving the harbor.

Hot Springs, Ark.—The Jamestown Mining and Milling Company has been organized at Little Rock with E. A. Shipley President, and will build smelter works here.

PROPOSALS.

(Continued from page ii.)

NEW COURT HOUSE.

Notice to Contractors.

SEALED PROPOSALS WILL BE RECEIVED by the Commissioners appointed for the purpose by the County Court of Monongalia County, W. Va., at the office of the Clerk of the Circuit Court, in Morgantown, in said county, until 12 o'clock, noon, of MONDAY, September 1, 1890, for the labor and material and the construction and completion of a Court House at MORGANTOWN, WEST VIRGINIA, in accordance with the drawings and specifications furnished by John C. Fulton, architect, copies of which may be seen at this office.

First—All bids must be made upon the printed forms, to be obtained from this office, in a sealed envelope, directed to the undersigned, and marked "Proposals for Court House at Morgantown, W. Va."

Second—As an evidence of good faith every proposal shall be accompanied by cash or certified checks to the amount of three hundred dollars ($300), made payable to the County Court of Monongalia County, in case the successful bidder shall fail, for ten days after an award, to execute the required contract and bond for the faithful performance of the terms of the contract. The checks of unsuccessful bidders will be returned to them immediately after the contract is awarded or all bids rejected.

Third—The right is reserved to reject any and all bids.

Fourth—Bidders are requested to be present at the opening of proposals.

Morgantown, on the Monongahela River, may be reached by Baltimore and Ohio Railroad or from Pittsburg by daily line of steamboats.

R. E. FAST,
12 Secretary of Commissioners.

LEVEES, Port Allen, La.—Proposals are wanted until September 1, for the construction of numerous levees. Address T. G. Sparks, President Board of Levee Commissioners, as above.

BUILDING AND HEATING, Waltham, Mass.—Proposals are wanted until August 20, for the erection of a police station and court house, also steam heating and plumbing of the same. Address Hartwell & Anderson, No. 68 Devonshire Street, as above.

BRIDGE, Rome, N. Y.—Proposals are wanted until August 25, for the completion of the abutments of the bridge over the Erie Canal at this place. Address John Pugh, Highway Commissioner, as above.

BRIDGE, Marble Falls, Tex.—Proposals are wanted until August 25, for the construction of a bridge over the colorado River at this place. Structure to be 860 feet long, 50 feet high and 18-foot carriage track. Address Louis G Hester, C. E., Texas Mining and Improvement Company, as above.

PROPOSALS.

STREET PAVING.

SEALED PROPOSALS WILL BE RECEIVED for furnishing the materials and laying about 4,750 square yards of GRANITE BLOCK PAVING at the office of the Board of Road Commissioners of the city of Waterbury, City Hall, until 2 P. M., August, 20, at which time and place they will be publicly opened and read.

All bids must be upon proper blanks and must be accompanied by a bond for $300, with satisfactory sureties, conditioned for the execution of the contract within five days after notice of its award.

Certified checks for $300, payable to the city of Waterbury, to be deposited with the Board of Road Commissioners, will be received in place of the above bond.

Specifications can be seen at the City Engineer's office, at which place blank forms of proposal can be obtained as well as further information.

By order of the Board of Road Commissioners.

F W. WHITLOCK,
11 Acting City Engineer.

BUILDINGS, Portsmouth, N. H.—Proposals are wanted until September 1, for the construction of sick quarters. Address J. Mills Browne, Surgeon-General, Chief of Bureau, U. S. A., as above.

WATER PIPE, Canton, O.—Proposals are wanted until August 25, for furnishing the following quantities of iron water pipe: 35 tons 12-inch, 93 tons 8-inch, 125 tons 6-inch, 130 tons 4-inch, 20 tons 3-inch. Address Paul Field, Secretary Canton Water-Works Company, as above.

CHURCH, Roanoke, Va.—Proposals are wanted until August 27, for the erection of a stone church at this place. Address C. Ruehrmund, architect, as above.

BRIDGE, Hamilton County, O.—Proposals are wanted until August 23, for masonry superstructure of bridge over canal on Mosteller Road, Sycamore Township. Address Board of Hamilton County Commissioners.

DRY DOCK, Port Royal, S. C.—Proposals are wanted until November 1, for the construction of timber dry dock at Naval Station. Address N. H. Farquhar, Chief of Bureau of Yards and Docks.

HOTEL, Goshen, Va.—Proposals are wanted until August 27, for the erection of a brick hotel. Address Messrs. Yarnall and Goforth, 14 South Broad Street, Philadelphia, Pa.

GRADING AND PAVING, Washington, D. C.—Proposals are wanted until August 30, for improving streets and avenues. Address Office of Commissioners, D. C.

HEATING APPARATUS, Hamilton, O.—Proposals are wanted until August 30, for heating stone building on Infirmary Farm. Address Richard Brown, Auditor.

PIER, New York City.—Proposals are wanted until August 22, for the construction of a new wooden pier at the foot of One Hundred and Thirty-fourth Street, North River. Address the Department of Docks, Pier A, North River, as above.

SEWERS, Ashland, Wis.—Proposals are wanted until August 23, for the construction of certain sewers. Address the Board of Public Works, as above.

BOILERS, ETC., Brooklyn, N. Y.—Proposals are wanted until August 20, for furnishing 4 horizontal tubular boilers and fixtures, including setting, etc. Address Beruard Lamb, Secretary Department of Charities and Corrections, of Kings County, as above.

ENGINEER'S SERVICES, Vancouver, B. C.—Proposals are wanted until September 15, for furnishing the services of an engineer to take charge of the sanitary and general engineering of the city. Address Thomas F. McGuigan, City Clerk, as above.

BOILERS, Flatbush, N. Y.—Proposals are wanted until August 20, for setting boilers and fixtures at Kings County Almshouse. Address Department of Charities and Correction, Kings County, N. Y.

WATER-WORKS, Coshocton, O.—Proposals are wanted until August 22, for furnishing boilers and pumping machinery for water-works. Address E. J. Kuntz, Village Clerk.

DREDGING, Albany, N. Y.—Proposals will be received until August 21, for dredging and excavating Hudson River channel. Address Superintendent of Public Works.

HOTEL, Wytheville, Va.—Proposals are wanted until September 1, for building Jackson Park Hotel. Address A. A. Campbell, Secretary.

PUMPING ENGINES, Cincinnati, O.—Proposals are wanted until August 23, for furnishing two compound duplex pumps and four vertical pumps. Address A. P. Butterfield, Clerk of the Board of Public Improvements, as above.

DREDGING, ETC. Albany, N. Y.—Proposals are wanted until August 21, for doing certain work on the State Canals. Address Edward Hannan, Superintendent of Public Works, as above.

SEWERS, Trenton, N J.—Proposals are wanted until August 19, for the construction of certain sewers. Address John C. Owens, City Clerk, as above.

WATER-WORKS, Allegheny, Pa.—Proposals are wanted until October 1, for the construction of a complete system of water-works. Address James Brown, Comptroller, as above.

WATER MAINS, Quebec, Canada.—Proposals are wanted until August 19, for laying numerous water mains in this city. Address Jer. Gallagher, Water-Works Engineer, as above.

DAM, Quebec, Canada.—Proposals are wanted until August 26, for repairing and raising the dam at the Chateau D' Eau, Lorette. Address Charles Baillainge, City Engineer, as above.

PROPOSALS.

WATER-WORKS, Gainesville, Ga.—Proposals are wanted until August 26, for the construction of a complete system of water-works. Address E. P. Chambers, Water Commissioners' Clerk, as above.

BRIDGES, Steubenville, O.—Proposals are wanted until August 23, for the construction of 11 new steel bridges in different parts of this county. Address the Board of County Commissioners, as above.

BRIDGES, Prineville, Ore.—Proposals are wanted until September 3, for the construction of a suspension bridge over Crooked River. Address Arthur Hodges, County Clerk, as above.

POSITIONS VACANT.

TOO LATE FOR CLASSIFICATION.

TWO EXPERIENCED BRIDGE WORK Draughtsmen are wanted in a bridge works near New York. Address, with particulars, and mentioning this paper, BRIDGE BUILDER, Box 81, this office. 12

COMPETENT DRAUGHTSMAN TO MAKE shop-picture plans on bridge work. Apply to CONTRACTOR, Box 57, this office. 12

WANTED.—A DRAUGHTSMAN FOR TRACing and plain structural drawings. F. W. S., 277 Pearl Street, New York.

POSITIONS WANTED.

A PRACTICAL PLUMBER DESIRES EMPLOYment. Understands his business thoroughly. Ten years' experience. Best of references. Address Box 25, this office. 12

Building Intelligence.

NEW YORK.

S w cor Madison av and 87th st, br flat; cost, $100,000; o, Golden & Carroll; a, F A Munith.

N s 70th st, 223 e av A, 4 br flats; cost, $60,000 all; o, F Rohrs; a, W H C Hornum.

N w cor 10th av and 143d st, br factory; cost, $60,000; o, I Kauffmann; a, J A Webster.

N s 70th st, 225 w av A, 2 br tens; cost, $28,000 all; o, T McMahon; a, J C Burne.

S s 115th st, 275 e 8th av, 7 br flats; cost, $140,000 all; o, C Muller; a, A Spence.

W s West End av, 50 n 88th st, 3 br dwells; cost, $27,000 all; o, R G Platt; a, C True.

N s 78th st, 100 w 9th av, 3 br dwells; cost, $33,000 all; o and a, J Turner.

232 E 123d st, br flat; cost, $20,000; o, T Lyons; a, Cleverdon & Putzel.

W s Broadway, 150 s Church st, 2 fr dwells; cost, $8,000 all; o, P Crosby; a, S L Berrian.

239 W 24th st, stone flat; cost, $20,000; o and b, Cummings & Ferguson; a, M V B Ferdon.

226–28 W 25th st, 2 stone flats; cost, $25,000; o, m and c, A Quackenbush; a, M V B Ferdon.

321 W 41st st, stone flat; cost, $20,000; o and b, Gieb & Held; a, M V B Ferdon.

205–09 E 42d st, br and st buildings; cost, $200,000; St Bartholomew's Church; a, Renwick, Aspinwall & Russell.

235–37 E 51st st, br and st flat; cost, $40,000; o, J Graham; a, J C Burne.

N w cor 115th st and Madison av, 5 br and st flats; cost, $93,000 all; o, Alice C McQuade; a, Ogden & Son.

S s 62d st, 250 e Amsterdam av, 4 stone flats; cost, $20,000 each; o, M Hayes et al; a, J W Cole.

N s 63d st, 300 w 8th av, 2 stone flats; cost, $37,000 each; o, Everett & Carey; a, G F Pelham.

S s 82d st, 120 w Central Park West, 3 stone dwells; cost, $16,000 each; o, Mary Gault; a, J W Cole.

ALTERATIONS—NEW YORK.

17 and 19 Rose st, br shop; cost, $9,000; o, E T Lynch; a, Thone & Wilson.

96 5th av, 5-story extension; cost, $75,000; o, Demorest & Little; a, C B J Snyder.

27 and 29 W 16th st, roof raised, 1-story extension; cost, $15,000; o, Rev D A Merrick, pres; a, T H Poole.

BROOKLYN.

E s Louis pl, 20 N Atlantic av, 6 fr dwells; cost, $9,000 all; o and a, W D Bogert.

W s Morgan av, 50 N Harrison pl, 4 fr dwells; cost, $20,000 all; o, Mrs Catharine Daunenhofer; a, Th Eglehardt.

1007–9 Dean st, 2 br dwells; cost, $10,000 all; o, G H Cook; a, Fowler & Hough.

N s Gates av, 140 E Broadway, 2 br dwells; cost, $8,000 all; o, Milsen & Priestley; a, J E Dwyer.

BUILDING INTELLIGENCE.

BROOKLYN.—Continued.

N s S 4th st, 75 E Keap st, br dwell; cost, $8,000; o, E Lehmans; a, Th Egelhardt.

S s Huron st, 125 W Oakland st, 2 br dwells; cost, $12,000 all; o, E Rehil; a, P Tillion.

N s Macdonough st, 26 E Ralph av, 4 br dwells; cost, $18,000 all; o and a, J R Pitt.

N s 8th st, 95 E 4th av, 4 br dwells; cost, $30,000 all; o, Keenan & Sanderson; a, W M Coots.

S s Sullivan st, 90 W Brunt st, br Sunday school; cost, $15,000; o, Christ Church; a, L C Merry.

N s 11th st, 97 W 9th av, 6 br dwells; cost, $30,000 all; o, F Peterson; a, not given.

N s Melrose st, 100 W Hamburg av, fr hall; cost, $13,500; o, St Leonard's church; a, Th Engelhardt.

N s Metropolitan av, 402 E Olive st, 4 fr dwells; cost, $16,800 all; o, J Rele; a, J Plano.

N s Lafayette av, 300 E Sumner av, 4 br dwells; cost, $23,000 all; o, A McKnight, a, S Harbison.

N s 45th st, 200 E 3d av, 5 fr dwells; cost, $12,500 all; o and a, J F O'Rourke.

N s Hancock st, 215 N Tompkins av, 6 br dwells; cost, $48,000 all; o, W Reynolds; a, I D Reynolds & Son.

S s Halsey st, 100 e Patchen av, 4 b s dwells; cost, $21,000 all; o Jane McDicken; a, Dennis; b, J McDicken.

New York av, n e cor Park pl, br dwell; cost, $16,000; o, Richard Major; a, G P Chappell; b, not selected.

ALTERATIONS—BROOKLYN.

S s Verona av, 200 E Sumner av, br asylum; cost, $13,500; o, Roman Catholic Orphan Asylum; a, F Haughton.

MISCELLANEOUS.

BOSTON, MASS.—403-05 West Broadway, 2 br mer bldgs; cost, $28,000; o, R L Barstow and E Baker; a, Winslow & Wetherell; b, Clark & Lee.

Farnsworth st, fr mfg bldg; cost, $12,000; o, Boston Wharf Company; a, M D Safford.

6-8 Hazel Place, 2 fr dwells; cost, $7-500; o, Joseph Vogel; a, Ourish & Rich.

Morton st, fr dwell; cost, $7,000; o, Ella G Hunter; a, Swanson & Murray; b, G F Murray & Co.

7 Waltham st, br apart, cost, $14,000; o, Mary M Adams; a and b, E C Heath.

25 Blue Hill av, fr dwell; cost, $7,000; o, Isabelle Davis; a, A B Pinkham.

Plans being prepared for alteration, extension and raising of old cathedral, Washington st cor Castle st, by Rand & Taylor. It is proposed to remodel for theatre.

BUTTE, MONT.—The city has voted to bond itself for $50,000 for sewers and $20,000 for a city hall.

CAMBRIDGE, MASS.—Mt. Auburn st, fr addn to church; cost, $8,000; o, St Paul's R C Church; a, P W Ford; b, A Sullivan.

Linnaean st, fr dwell; cost, $6,000; o, Mrs Anthony, a, C H Blackwell; b, A Y Currie.

Mt Auburn st, block fr dwells; cost, $7,000; o, A S Harriman; a, T B Fink; b, Sewell & Co.

Creighton st, fr dwell; cost, $4,250; o, W M Colby; b, as above.

Concord av, block fr dwells; cost, $6,300; o, J F Sullivan; a, Geo Fogarty; b, Geo Chaplin.

CANTON, O.—A 3-story business block will be erected on the northwest corner Piedmont and 8th sts. Address G D Saxton, Canton, O.

CINCINNATI, O.—A new asylum for the epileptics will be built by the State at Gallipolis. Three commissioners have been appointed to select plans and buy ground for building. J W Vance, of Gallipolis, is chairman of the commission.

2d and Broadway, alteration to br store; cost, $9,000; o, Samuel Shaw; a, Geo Vogel.

FOSTORIA, O.—A Presbyterian Church is to be erected at this place to cost $25,000. Architects Crapsey & Brown, of Cincinnati, O. Wm. Alcott, of this place, is Chairman of the Building Committee.

BUILDING INTELLIGENCE.

DENVER, COL.—Murdock bet 33d and 34d avs, br dwell; cost, $10,000; o and a, Thos Freeman.

Downing bet 19th and 20th avs, double br dwell; cost, $10,000; o, Mr Hinsell; a, Balcomb & Rice.

Broadway bet 1st and Ellsworth, br block; cost, $23,500; o, Flembing Bros; a, Miller & Janisch.

Wazee cor 17th st, bus block; cost, $100,000; o, Fledhauser & Co; a, F E Edbrooke & Co.

Lafayette bet 15th and 16th, stone dwell; cost, $35,000; o, O L Haskell; a, as above.

Downing bet 16th and 17th, br dwell; cost, $13,000; o, P D Gannons; a, as above.

13th av cor S 3d st, br terrace; cost, $10,000; o, A McAlister; a, A Dutchie.

Wynkoop bet 15th and 16th sts, br warehouse; cost, $12,000; o, Jackson & Co; a, D A Cole.

DETROIT, MICH.—Gratiot av, 2-story br schoolhouse; cost, $30,000; o, Board of Education; a, Geo C Oldfield.

Russell, High and Windsor sts, fr market; cost, $25,000; o, City of Detroit; a, Wm Voigt, Jr.

N w cor Grand River av and Perry st, 8 2-story br stores; cost, $20,000; o, Joseph Perrien; a, Hess & Raseman.

W s 4th st near Cherry st, 2½-story br residence; cost, $7,000; o, Robert Bell; a, Harry J Rill.

N s Alexandrine av, bet Woodward av and John R st, 2½-story br residence; cost, $7,000; o, John J Alley; a, A C Varney & Co.

N e cor Palmer av and Beaubien st, 2-story br residence, cost, $7,000; a, Scott, Kamper & Scott; b, W H Hollands & Son.

ERIE, PA.—A $20,000 building will be erected here. For details address J T Steen, architect, 36 6th st, Pittsburg, Pa.

INDIANAPOLIS, IND.—The Catholics of this city will erect a cathedral at a proposed cost of nearly $250,000. A bishop's residence will also be built, to cost $25,000. Bishop Chatard, of Indianapolis, can give information.

LANSFORD, PA.—Ricey, fr church; cost, $7,700; o, English Cong; a, W D Hill; b, contract not let.

MEADVILLE, PA.—East Pine st, hospital; cost, $10,000; o, Sisters of Charity; a and b, W E Morrison.

MEDIA, PA.—An annex to the court house at this place will be erected at a cost of $40 000. Address City Clerk, as above.

MILWAUKEE, WIS.—Kinnekinnic and Lincoln avs, storehouse; cost, $7,000; o, Aug Hermes; a, B Kolpacki; b, E Stollenwerk.

Prospect av, dwell; cost, $15,000; o, Marcus Cohen; a, Ferry & Clos.

MINNEAPOLIS, MINN.—2642 Portland av, fr dwell; cost, 8,000; o, C C Whitney; a, O M Barber.

Main st and 1st av S E, alterations; cost, $10,000; o, Minneapolis Ind Expos; a, C F Struck.

9 E 17th, br block of flats; cost, $26,000; John B Long; a, L Jepron.

Lake Cemetery, br chapel and vault; cost, 20,000; o, Lakewood Cemetery Asso; a, C C Yost.

2401 S Irving av, br and s dwell; cost, $16,000; o, a and b, J S O'Donnell.

NASHVILLE, TENN.—Market, 5-story br bldg; cost, $20,000; o, Craighead; a, Desmukes; b, Ed Laurent.

Church, 2-story store and office bldg; cost, $25,000; o, Dr Noel; a, Thompson & Gibel; b, S H Bowen.

Market st, 6-story s bldg; cost, $24,000; o, Craighead; a, same as above.

Sumner st, 5 s bldgs; cost, $10,000; o, Jesse French; a, Jno Lewis.

Broad and McSemne, church; cost, $40,000; o, Christ Church.

Cherry st, 6-story restaurant and hotel; cost, $25,000; o, M M Gardner; a, H C Thompson.

BUILDING INTELLIGENCE.

NEWCASTLE, WYO.—Conover & Porter, of Madison, Wis., have prepared plans for a brick school house at this place, to cost $10,000.

PALESTINE, TEX.—R C Church, gothic; cost, $25,000; o, Rev J Thion, pastor; a, N J Clayton & Co; b, not let yet.

PHOENIXVILLE, PA.—A $15,000 res will be erected here by Ernest Knapp.

POTTSTOWN, PA.—Hill School bldg; cost about $30,000.

PROVIDENCE, R. I.—Taylor and Comstock av, 2 fr ten dwells; o, Mrs Herbert West; a, Gould & Angell; b, Robert Paterson.

Westminster st, alterations and additions to Merchants' National Bank; a, Gould & Angell; b, Cutting & Bishop.

Stimson av, fr dwell; o, Mary Jackson.

Melrose st, fr and br dwell; o, Fred E Field.

Lexington av, fr dwell; o, Louise M Hopkins; a, Gould & Angell.

SEDALIA, MO.—L C and W M Buckley, architects, of St. Louis, will make plans for a $40,000 business block.

SIOUX CITY, IOWA.—N w cor Pierce st, fr dwell; cost, $8,000; o, E E Selsmer; a, J P Martin; b, not let.

2d and 3d sts, Union station; cost, $250,000; o, railroads; a, sketches made not decided.

SPRINGFIELD, ILL.—Charles F May, architect, St Louis, Mo, has completed plans for a theological college for the German Lutherans, to cost $30,000, and be heated by steam.

ST. LOUIS, MO.—Page and Prairie avs, br dwell; cost, $8,500; o, Mrs E Jones; b, J H Keefe.

Cates and Clara aves, br dwell; cost, $8,000; o and b, T C Higgins.

Lindell and Taylor aves, br dwell; cost, $12,000; o, Mrs R Jacoby; b, Goesse & Remmers.

N w cor Grand and Finney aves, br dwell; cost, $10,000; o, E Pugnet; b N Pelligreen.

15th and Gratiot sts, br machine house; cost, $7,500; o, Laclede Gas Co; b, F C Bonsack & Co.

Grand and Cook aves, br dwell; cost, $8,000; o, Dr. Hall; b, N Pelligreen.

N e cor Washington and Jefferson aves, br store and dwell; cost, $90,000; o, Ills Dairy Co; b, G W Pipe.

28th and Locust sts, br dwell; cost, $35,000; o, G M Maverick; a, Peabody & Stearns.

Francis st and Clifton Place, br dwell; cost, $7,000; W D Grant; b E B Scott.

McB Elfatrick & Sons, architects, have prepared plans for a new theatre for M Kaufmann.

ST. PAUL, MINN.—The Board of Education took out a permit for the construction of a 2-story school house on Jenks st, bet Edgerton st and Payne av (Arlington Hills District), to cost $30,000.

E 4th st, nr Minnesota st, 4-story br office bldg; cost, $30,000; o, H Broadbent.

Fairmont st, nr Dale st, 3-story stone and br dwell, cost, $12,000; o, F B Kellogg.

TERRE HAUTE, IND.—S. Hannaford's Sons, of Cincinnati, O., have the plans under way for a passenger station at this place, for the Vandalia Railroad, to cost $100,000. A freight depot and the passenger train sheds are estimated to cost $150,000 additional. Pressed brick and brown stone will be the material used.

WILMERDING, PA.—A $20,000 depot will be erected here by the Pennsylvania Railroad Co.

BUILDING.—There is nothing over $7,000 in value to report at the following places: Charleston, S. C.; Clinton, Iowa; Geneva, N. Y.; Harrisburg, Pa.; Galveston, Tex.; Worcester, Mass.; San Antonio, Tex.; Denison, Tex.; Pottsville, Pa.; Springfield, Mass.; Montclair, N. J.; Dayton, O.; Braintree, Mass.; Ogdensburg, N. Y.; Baltimore, Md.; Findlay, O.; Topeka, Kan.; Madison, Wis.

THE ENGINEERING & BUILDING RECORD

AND

THE SANITARY ENGINEER.

A JOURNAL FOR THE ARCHITECT, ENGINEER, MECHANIC, AND MUNICIPAL OFFICER.

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A LESSON FOR BUILDING DEPARTMENTS.

THE letter which was published in THE ENGINEERING AND BUILDING RECORD of last week regarding the defective trusses in Herrmann's Theatre now being erected in Brooklyn, elicited very general comment from the daily papers of that city and those of New York, and the public attention thus drawn to the matter has caused the owner to suspend work on the building until the defects are remedied or some more satisfactory method of construction devised. Meantime we have received another letter from the same source, showing the danger to be even greater than at first suspected, which has been more than corroborated by an investigation made by our representative, and, in the opinion of Building Commissioner Platt, the defective trusses will probably be removed.

This might be the end of the matter, and a very satisfactory one as far as this particular building is concerned, or as we are concerned with it through our correspondent's letter, but the facts brought out in the course of this discussion and investigation, coupled with a letter published in this issue from another Brooklyn correspondent, also a well-known civil engineer, who has been in charge of important work in New York and Brooklyn, indicate that there is something seriously wrong in the Brooklyn Department of Buildings.

The duties of such a department are twofold; first, to see that no building is undertaken until satisfactory plans for it have been approved; second, to see that the building is erected in accordance with those plans and the regulations of the department. The first requires the careful examination of the plans by some one thoroughly conversant with the mathematics of stresses and strength of building materials and also with the requirements of good modern construction. Either there is no such person in the Brooklyn Department or he has greatly neglected his duty in regard to the plans of the building in question. What other explanation can there be of the statement by the Commissioner, that the floors were figured for a load of 120 pounds per square foot, when a very simple calculation shows that that load would probably be sufficient to break the tie rod of at least one of the supporting trusses even if no weight were transmitted to it from the floor above by the intervening partition? The inadequacy of the cast-iron columns supporting the steel beams is another illustration of the same thing, and the slipshod way in which they have been set up indicates gross neglect in the inspection of the work after the plans had been approved. Even the plain provisions of the Brooklyn Building Law regarding cap and bond stones in the walls under such pillars have been entirely disregarded, and instead of a cut stone 8 inches thick and 24 inches long, as required, there is a bit of blue-stone about 4 inches thick and 20 inches long, on one end of which the pillar sets, while the bond stones are entirely omitted.

It seems as if the most probable cause of these shortcomings on the part of the Building Department is the inadequacy of the appropriation for its work. This for the current year is $39,000, out of which must be paid $3,000 to the Commissioner, and $1,500 to each of 17 or 18 inspectors, besides a deputy commissioner and clerks. This force has to keep track of some 5,000 buildings per year, aggregating in value $25,000,000 or $30,000,000; which, allowing them to average four months in construction, would mean that about 1,700 buildings are constantly in course of erection, giving each inspector about 100 buildings to look after, even supposing operations to be conducted uniformly throughout the year.

It is obviously out of the question for any one man to properly keep track of 100 buildings at once, and this may, in a measure, account for such oversights as have been mentioned, while it, of course, does not justify them. Another reason is the increasing number of heavy buildings that are being erected in the city. Until recently Brooklyn was largely a city of residences, and, except for an occasional church or warehouse, almost all her new buildings were dwelling houses. In recent years, however, this has been very much changed, and a class of buildings is being erected there for stores, offices, public assemblies, etc., that will compare favorably for size and finish with those in most of our large cities. It is natural that the Building Department should follow, rather than lead, in such a change, and that the methods of computation and inspection which answered well enough for the regular three-story brown-stone, or even the Clinton Avenue mansion, or an occasional church, should be found sadly inadequate for the structures with which it now has to deal.

If the millions which are yearly spent in making Brooklyn a bigger and better city to live and do business in are to be wisely and safely expended, it seems very obvious that the methods of her Building Department should be thoroughly and speedily revised, and enough money appropriated to enable the Commissioner to secure the services of a sufficient number of competent men to make sure that all buildings hereafter erected are properly designed and carefully constructed.

EXHAUST STEAM HEATING.

IT is not so very long ago that the idea of using exhaust steam for heating was first suggested. The economy of utilizing what, with a large number of non-condensing engines, was really a waste material seemed so obvious that the matter was entered into with a good deal of enthusiasm, and many owners of power plants congratulated themselves on having placed within their reach a means of getting something for nothing. Live steam was in many instances wholly abandoned as a heating agent; in others it was retained merely as an auxiliary. There was, to use a popular trade term, a boom in exhaust steam heating.

Before long, however, there were, in many quarters, misgivings as to whether exhaust steam was really so inexpensive an article as it had been supposed to be. Strange to say the new heating agent did seem to cost something,—a good deal in some cases,—more, in fact, than live steam. At least such were the indications of the coal bills To those of an investigating turn of mind there was little mystery about the matter. It was soon found that exhaust steam had been applied under conditions which were fatal to economy. The old pipe systems which had worked very well with live steam, but which were more or less inadequate for the requirements of exhaust heating, had, in many places, been retained, with the result that high back pressures were created in the engines, and heat in the buildings was obtained at an expense of power which considerably overbalanced the calculated savings. In other cases, again, where the amount of steam required for heating was very small compared with the amount exhausted by the engine it would have proved much more economical to fit the latter with a condenser and to use live steam for heating.

Taken altogether there was abundant evidence to show that the theory of heating by exhaust steam was but imperfectly understood by many who attempted to apply it. Disappointment and discouragement were, therefore, natural results. Experience and good judgment have since led to a better appreciation of the requirements of successful exhaust steam heating, and under competent advice the system now rarely fails to give satisfaction. A good illustration of what may be accomplished by it is furnished by a correspondent, whose letter we publish in another column. The figures there given speak for themselves and tend to confirm the early impression that exhaust steam, under certain conditions, costs practically nothing. There are, however, as we have attempted to show, limitations which cannot be overstepped without giving the benefits of the system a wholly imaginary character.

WAS IT PREMATURE?

Referring to a letter received from Professor Herrmann regarding the criticisms on his new theater building, the Brooklyn *Standard-Union* takes credit to itself for having previously "published a report of an interview between his architect and Building Commissioner Platt, completely setting forth the fact that the new theater building was prematurely criticised by 'Civil Engineer' in The Engineering and Building Record, and that, when the work is completed as contemplated, it will be one of the safest of structures."

In view of what was found by our representative in his investigation of the theatre building, which is detailed on another page, it would seem that the criticism was anything but premature, and that Professor Herrmann and the public, for whose entertainment he is building, have abundant reason to be grateful to our correspondent for his timely warning.

Would the *Standard-Union* have had our correspondent wait until the structural parts of the building were concealed by the ornamental ones, or until competent authority could point out what made the building fall down rather than seasonably indicate what would make it stand up? It is easy to be wise after the event, but it takes a wise man to show where danger lies in time to avoid it, and that is the part most men prefer to play when possible.

There is no reason to doubt that Professor Herrmann intended to erect a safe and suitable building; but, in view of recent developments, it seems to be very doubtful whether his expectations would have been realized had not a man trained to critically observe such matters chanced to note the structural defects of the new building and taken the trouble to call public attention to a matter of public concern. It would be well if this were done oftener.

THAT DANGEROUS TRUSS WILL COME OUT.

As we go to press we learn that Professor Herrmann has ordered the removal from his new Brooklyn theatre building of the floor truss, to whose faulty design attention was called by "Civil Engineer" in our last issue.

DISINFECTING CANDLES.

Of late, owing to its proved germicidic power, the vapor of bromine has come to the front as a disinfectant. According to *Industries*, the bromine is converted into the organic bromine compound dibromonaphthalene, an almost inodorous substance, and this is dissolved in any desired quantity in the fat or wax, before it is run into the molds. The result is a candle or night light which in shape and appearance resembles an ordinary candle or night light, but differs from it in this respect, that when burnt it produces free bromine vapor, at the same time emitting the usual amount of light. The night lights are put up in hygienic iodine night lights and candles which, on burning, liberate iodine vapor in any required quantity, in the same manner as the bromine night lights liberate bromine, and are made in a similar way.

FLOATING THE OHIO CONNECTING RAILWAY CHANNEL SPAN.

The Ohio Connecting Railway, about 13,000 feet long, is essentially a belt road built chiefly as a transfer between north and northwestern and south and southwestern railroads at Pittsburg, and includes a bridge 4,558 feet long across the upper part of Brunot's Island and the Ohio River, a little below Pittsburg, Pa.

The channel span of this bridge is a steel single track through single intersection span with intermediate subpanels and members. The trusses are 25 feet apart and have a maximum depth of 65 feet. They are 523 feet long and have curved top chords. The masonry piers are about 80 feet high and between them an enormous river traffic of steamboats, barges and rafts constantly passes. To avoid obstructing this traffic, as well as to be somewhat less exposed to danger from flood, it was decided not to build any false work, trestles or piling whatever between the piers, but instead to assemble the span at the required level, with its axis perpendicular to the final position and far enough removed to be clear of the main waterway, then to float it to its required position and secure it to the abutment seats.

In the shallow water along the shore of the island piles were driven on which to erect the false work and span. The piles were driven in an area of about 100x600 feet, the short side of the rectangle about parallel to the line of the bridge and 300 feet below it at the upper end. The piles were arranged in rows corresponding to the panel of the bridge. Each row was cut off and capped about 13½ feet above normal water level, and several lines of 20-inch steel I beams were laid across the caps. These formed stringers on which timber trestle bents, 54 feet high and 90 feet wide at the bottom, and 30 feet at the top, were erected and secured by wooden bracing and special adjustable iron tie rods.

On this false work the iron and steel bridge members were hoisted, assembled and connected in the usual manner from a traveling wooden erecting tower nearly 100 feet high. This part of the work was rapidly executed in 15 working days. Nine specially constructed barges were then floated into position under the 20-inch steel beams, and between the rows of piles. The barges were 130'x25'x8' deep, strengthened by longitudinal and transverse bulkheads, and contained inlet valves through the bottom of every chamber. These valves were opened and the barges submerged sufficiently to pass under the steel beams. The valves were then closed, and on August 18 the water was pumped out in about five hours by steam pumps on three adjacent tug boats, and as the barges rose they finally received the entire weight of the bridge span and supporting false work and floated it clear above the piles.

The false work was securely connected and braced to the barges, which were connected together by longitudinal timbers and temporarily bolted with iron plates to the piles. Decked barges were secured to the others and to the false work at the ends, and carried four multiple spooled hoisting engines, besides which two others were set up on shore, all of them being supplied with about 60,000 feet of lines. The span was secured against overturning by heavy steel guy ropes from each end of each barge, and on the morning of August 19 guy ropes were attached to the floating mass, the barges disconnected from the piles and the hoisting engines, winding upon tackles made fast to the shore, slowly drew the barges clear of the piles. Stringers across the rear of the barges and extra braces were then placed where the piles had previously interfered and the barges and their burden again drawn forward, swung through an angle of about 90 degrees and drawn up stream between the bridge piers which had about 25 feet clearance from the end barges. The movement was very slow, occupying several hours, and was always in very short stages, preceded by careful adjustment of the guy lines. The bridge was thus brought approximately to position 21 inches above the required level. Guide bolts were passed through the shoes and inserted in holes prepared in the masonry, and the valves in the barges being opened the false work gradually sunk until it deposited the span safely on its seats and left it there free and clear at about 7.30 P. M. The total weight moved by the barges was about 1,800 tons, 915 of which was the weight of the permanent span.

The bridge site is near the head of a "riffle," and the normal current is very swift there, but was, at the time of bridge launching, reduced to an estimated velocity of three miles an hour by closing the wickets of the United States Government dam across the river at Davis Island, a few miles below. The conditions were mainly favorable to the movement of the bridge, but rainy weather inconvenienced the thousands of spectators, and several times drove the workmen off and interrupted the operations. Once there was a gust of wind sufficient to accelerate the motion of the barges and strain their guys.

The false work will be removed and used to erect, in its required position, another span of the same bridge. Large spans over the Hawkesbury River, Australia, the St. Lawrence River, the Missouri River, and perhaps elsewhere, have been erected in a somewhat similar manner by the use of floating false work, but so far as we remember none of them were as long as this span, nor was the false work for them built on piles and afterwards transferred to barges, but was originally constructed on them. The Keystone Bridge Company, of Pittsburg, are the contractors for the building and erection of the bridge. C. L. Strobel is the Chief Engineer of the Keystone Bridge Company, Max J. Becker, Chief Engineer of the Ohio Connecting Railway Company, and George R. Buchan is Superintendent of Outside Construction for the Keystone Bridge Company.

We hope soon to publish detailed descriptions and illustrations, that are now being prepared, of the superstructure of this bridge and the false work, traveler, barges and general erection plant.

MAKERS OF STEAM ROAD ROLLERS.

In reply to an inquiry from Willard Beahan, Engineer of Maintenance, City Hall, St. Louis, Mo., for the names of makers of steam road rollers in the United States, we give the following: The foundry and machine department of the Harrisburg Car Manufacturing Company, Harrisburg, Pa., and W. C. Oastler, 43 Exchange Place, New York, who handles the English roller made by Aveling & Porter. Among makers of other road rollers are The American Road Machine Company, Kennett Square, Pa., and the F. C. Austin Manufacturing Company, of Chicago, Ill.

Ex-Governor Gilpin, of Colorado, is said to be now developing the railway project for the construction of a line through America and across Behring Straits into Siberia, thence through Asia and Europe to the eastern shore of the Atlantic.

PERSONAL.

William S. Bacot is the engineer of roads at Stapleton, S. I.

H. D. Ludden has been appointed City Engineer of Detroit for a term of four years from 1st July ult.

Davis & Hulbert, Fuller's Wedge Building, Schenectady, N. Y., have opened an architect's office, and would be pleased to receive catalogues and office samples from manufacturers of builders' supplies.

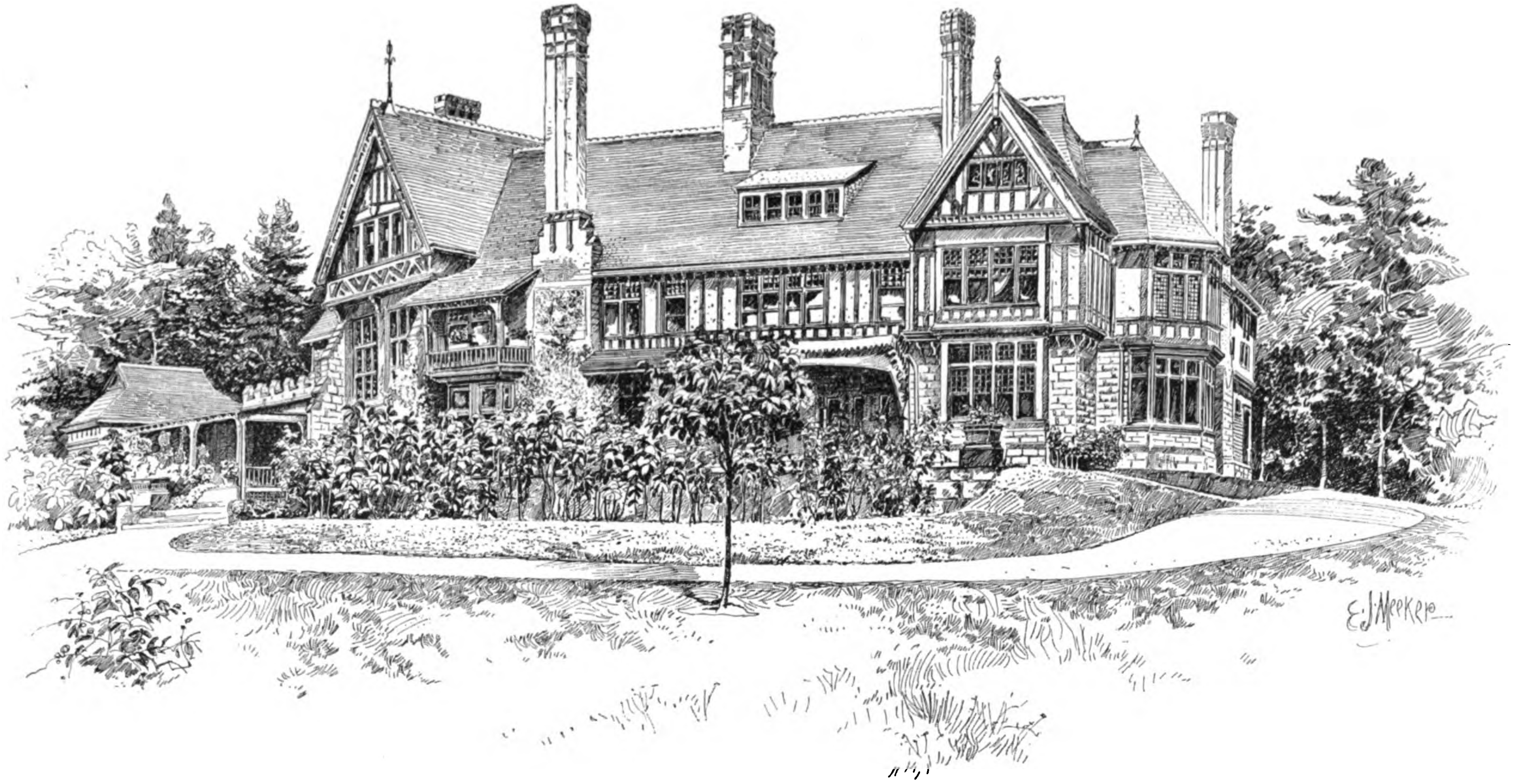
Col. Jedediah H. Baxter, Chief Medical Purveyor of the army, has been nominated by President Harrison to be Surgeon-General, with the rank of Brigadier-General. He succeeds General John Moore, who has been placed on the retired list, having reached the age of 64 years.

Mr. J. J. R. Croes, Chief Engineer of the Suburban Rapid Transit Company, of New York City, returned on the "Alaska" on August 3 from a tour of 12,000 miles, including the sea voyages, and extending from Edinburgh on the north to Tunis and Malta on the south, and from London, Paris and Algiers on the west to Syracuse, Vienna and Berlin on the east. Immediately on his arrival in New York he received orders to extend the Suburban Rapid Transit Road a mile, and work has already been begun on the foundations by Allston, Gerry & Co., and on the plate girder superstructure by the Wallis Iron Works.

OUR ARCHITECTURAL ILLUSTRATIONS.

HOUSE AT WELLESLEY, MASS.
ALLEN & KENWAY, ARCHITECTS, BOSTON, MASS.

RESIDENCE OF E. A. P. NEWCOMB,
ARCHITECT, BOSTON, MASS.



THE ENGINEERING AND BUILDING RECORD ILLUSTRATED SERIES.

HOUSE AT WELLESLEY, MASS.

ALLEN & KENWAY ARCHITECTS, BOSTON, MASS.

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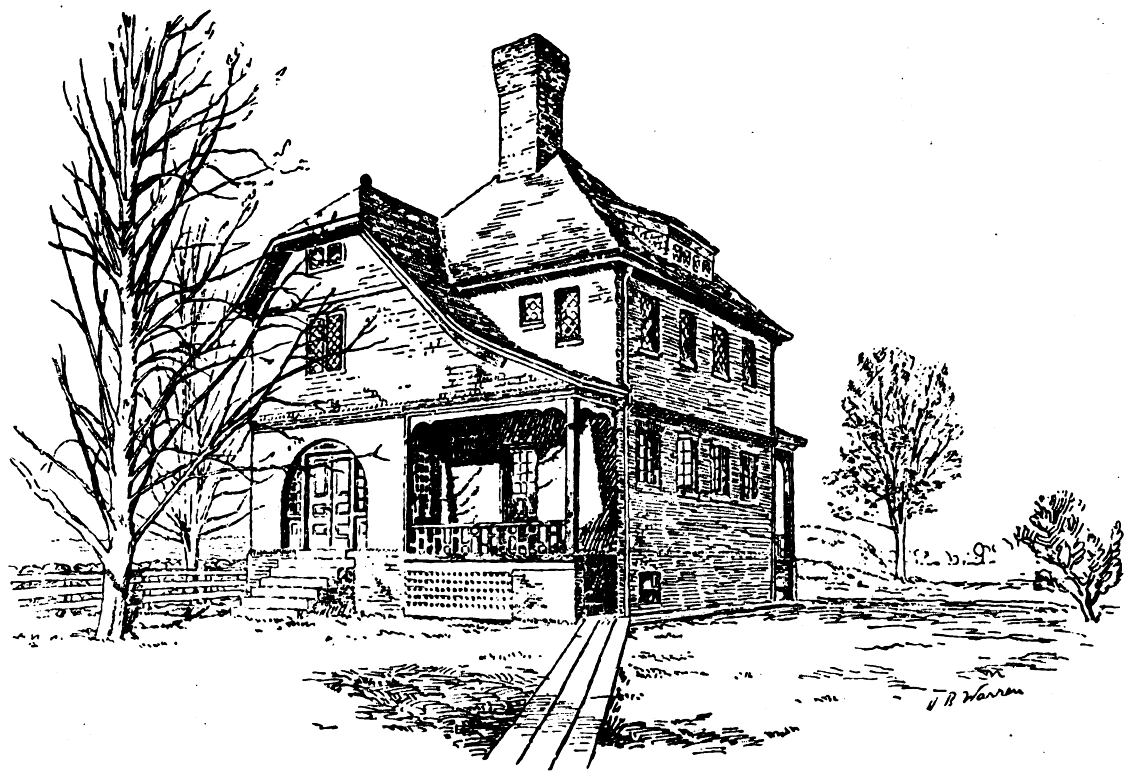
ENGINEERING SOCIETIES.

THE Civil Engineers' Club, of Cleveland, O., held a meeting on August 12, 1890, with President Searles in the chair. Sixteen members and two visitors were present. The minutes of the last meeting were read and approved. A communication from the Western Society of Engineers was received, requesting the Club to appoint a committee to meet in Chicago, on Tuesday, October 14, 1890, to aid in formulating a plan for holding an International Congress of Engineers at Chicago, in connection with the World's Fair, and the President was instructed to appoint a committee of three for this purpose.

The application for membership of George C. Lucas was received.

The President announced that the "Technischer Verein" would hold a convention in Cleveland before the next regular meeting of the Club. The Executive Board was authorized to take the necessary action to extend the courtesies of the Club to the visiting scientists.

The paper of the evening was by Jas. Ritchie on "Some Recent Constructions in Railway Bridges," but in his absence it was read by Walter P. Rice. It was followed by a discussion on the use of iron and steel in construction, of kinds of steel to be used, relative length of plate girders and latticed bridges, and the relative merits of the pin-connected and riveted bridges.



RESIDENCE OF E. A. P. NEWCOMB, ARCHITECT, BOSTON, MASS.

A CIRCULAR just issued by the American Society of Mechanical Engineers announces that the library fund accumulated for the purchase of books now amounts to upwards of $2,000. The Council have authorized the expenditure of this fund in part for such books as the profession of mechanical engineering calls for most loudly and often. The help of members is requested in deciding upon this list and the library committee invite suggestions so as to be assured that in preparing their catalogue they are acting under the advice of many who are best qualified for this duty.

THE twelfth semi-annual convention of the National Electric Light Association was held this week at Cape May, N. J.

A COMPANY is being organized at Atlanta, Ga., for the purpose of manufacturing an improved paving brick, together with ornamental and first grade building brick.

LETTER FROM ENGLAND.

(Regular Correspondence.)

LONDON, August 8, 1890.

A VERY interesting judgment was delivered in the House of Lords a few days since in the case of the Institution of Civil Engineers *vs.* the Commissioners of the Inland Revenue. The Commissioners some years since had sought to assess the Institution on an annual value of £1,619 ($7,771.20), to which the Institution, through their Secretary, Mr. James Forrest, replied, claiming exception, a claim they have maintained from year to year. The Commissioners went to the Divisional Court and obtained a judgment, the judge holding that the Institution was not exempt. From the Divisional Court Mr. Forrest went to the Court of Appeals, where Lord Justice Lopez reversed the decision, giving judgment in favor of the Institution. The Commissioners next took the matter to the House of Lords, where the case was heard by the Lord Chancellor and the Law Lords Watson and Macnaghten. In giving judgment last week the Lord Chancellor held that the Institution was not exempt, on the ground that a large proportion of its work was not pure science, but science as applied to engineering art. He held, further, that the Institution was a society founded for the advantage and in the interests of civil engineers, affording valuable and important means for their training and instruction, to the interest and advantage of the members of the Institution. The other two judges gave their judgment on the other side. Lord Watson held that the mere fact of membership being confined to those who were actively engaged and who have attained a degree of eminence in the profession did not militate against the objects of the Institution; he did not doubt that membership was accompanied by a certain amount of prestige, a prestige of some service to the individual in his professional career, but at the same time he held that there is a science of civil engineering, that its development is of the utmost consequence to our national interest, and that the Institution of Civil Engineers was founded and is maintained in the interests of that national weal.

Lord Macnaghten, in the course of his judgment, put the question at issue as follows: "Is the property of the Institution of Civil Engineers legally appropriated and applied for the promotion of the science of civil engineering, or is it legally appropriated and applied for the benefit of civil engineers in order to enable them to practice their profession to greater advantage?"

He did not doubt that the Institution had raised the standard of the profession, a fact which doubtless was advantageous to the civil engineer, but he held that that result was merely incidental to the purpose and object of the Society; he held with the Master of the Rolls that the Society does something higher than the mere education of students for the profession of civil engineering. The judgment being for the Institution by the balance of two votes to one it is, therefore, declared to be exempt from the assessment.

The Institution of Mechanical Engineers has held its meeting this year at Sheffield, and it is a notable fact that several larger works were closed to the Institution as a body, although open by special individual invitation. It is openly stated, without contradiction, that the origin of this unusual step was that a large number of foreigners, Americans, Germans and others were with the members, and that Sheffield, being strongly protectionist in its feeling, declined to exhibit to the world its special features of manufacture. Sheffield in the present as represented by the firms in question is not to be congratulated on the narrowness and smallness of its views.

IN celebrating the completion of the harbor improvements at Ciotat, the manager, M. Robert, recently gave a remarkable dinner to the press and the engineer corps. The caisson was decorated and brilliantly illuminated, and the banquet in the working chamber, at the bottom of the harbor, 26 feet below the surface of the sea. The banquet was followed by a concert, and the guests remained for several hours without any other inconvenience than the slight buzzing in their ears caused by the atmospheric pressure.

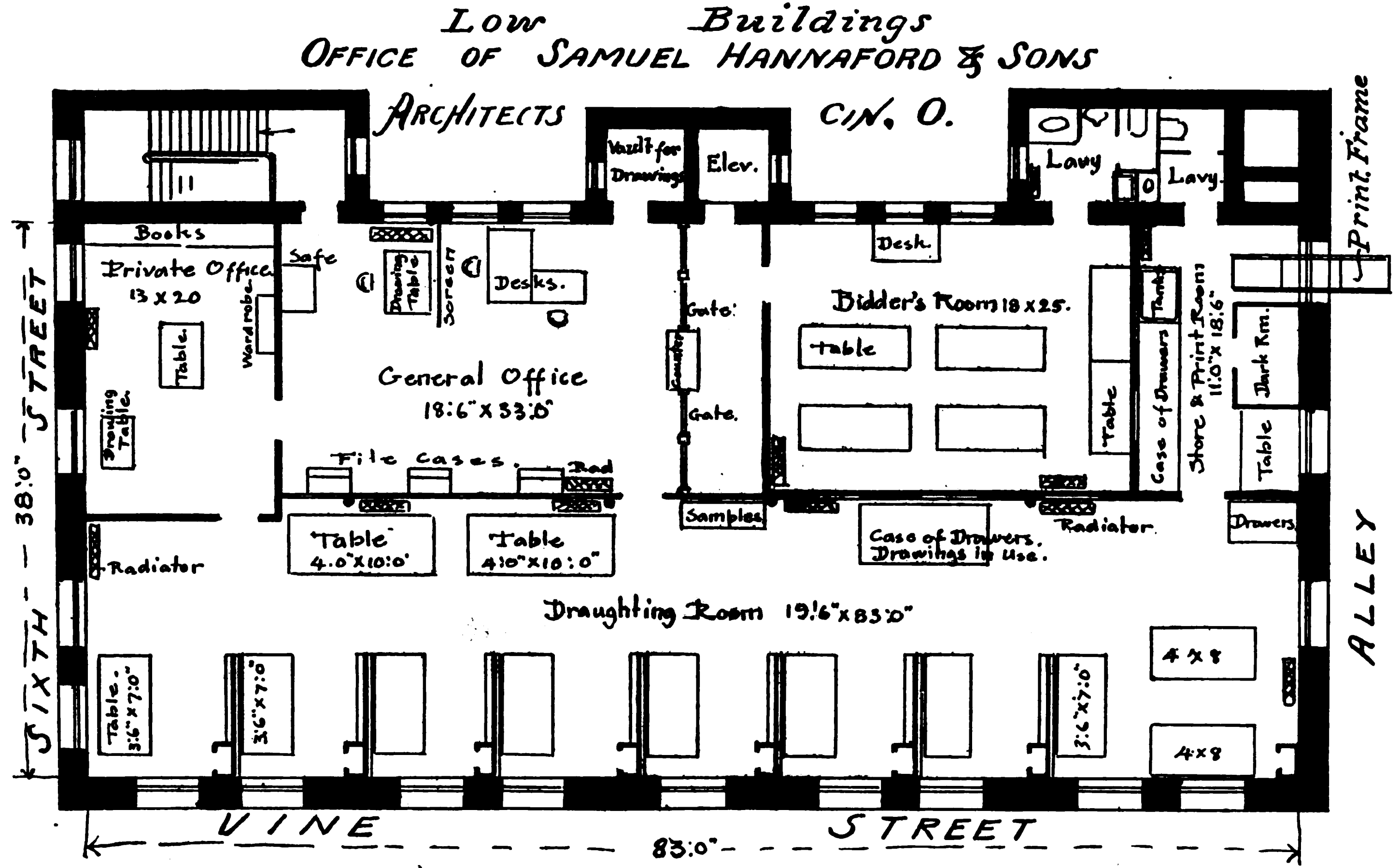
THE latest two canal projects in France are attracting much attention. One of the proposed canals is to run from Narbonne to Bordeaux, connecting the Mediterranean Sea and the Atlantic Ocean, and the other is to connect Paris and Rouen, and is thus to put Paris in direct communication with the sea. It is reported that the necessary capital has already been raised.

NEW OFFICES OF SAMUEL HANNAFORD & SONS, ARCHITECTS, CINCINNATI.

IN connection with what we have published within the past year on architects' offices,* the accompanying plan, showing the arrangement of the newly fitted office of Samuel Hannaford & Sons, architects, cf Cincinnati, O., will prove interesting. For the sketch and particulars we are indebted to Mr. Louis G. Dittor.

The office occupies the top story of Hulbert Block, corner Sixth and Vine Streets. The entrance to the elevator is by a corridor leading directly through the center of the building from the main entrance on Vine Street.

In the draughting room a dozen men can work conveniently, and in case of necessity more than twice that number can be handled without becoming uncomfortably crowded. One of the features is the convenience of the stalls, which are constructed of narrow partitions about 6 feet 6 inches high, with a projecting ledge on each side of about 6 inches, and high enough to admit of placing ordinary drawing boards under them. In the angle of partition and wall is built a neat closet arrangement—locker and drawers above, with closet below. The tables are made to raise or lower to any required height, and to tilt from a horizontal to a vertical position.



THE AMERICAN INSTITUTE OF BUILDING ARTS.

AUGUST 11 was "Inspection Day" at the American Institute of Building Arts, at Chicago. The latter, according to the Chicago *Inter-Ocean*, is conducted by the Illinois Chapter of the American Institute of Architects. In its present form it is quite a new institution, although it was established several years ago. To understand the true meaning of inspection day it is necessary to comprehend the objects of the institute as now conducted. It contains an exhibit of building materials in their manifold forms. It furnishes architects, owners, and those otherwise interested in building with information on all subjects connected with architectural construction. It is a meeting place for the chapter of architects, and has other functions as well. Inspection day has been established as a bi-monthly occasion for the meeting of architects and building contractors, manufacturing agents, and others on a common ground. It is the intention of the management to give all who are interested in building materials a chance to meet the architects of the city without the necessity of visiting the various offices. The average architect is too busy a man to spare time during his office hours to talk with those who may desire to present new ideas or materials to him for consideration, but on inspection day the contractor will be given his opportunity.

According to Mr. H. W. Perce, who is the manager of the institute, the institute has only been under its present management since last May. Previous to that time it had been merely a private enterprise, and, although successful and useful, its scope was comparatively limited. As conducted now it is an educational institution, and its aim is to advance the building arts. Its income, small or great, will always be used to extend its sphere of usefulness.

THE OCMULGEE, GA., CANAL.

IN the report recently submitted to the Macon, Ga., Canal and Manufacturing Company, on the project of bringing water to Macon from the Ocmulgee River through a 10-mile canal, Col. B. S. Church recommends a canal 50 feet wide on the top or water line, 30 feet in width on the bottom, with a depth of 10 feet of water during maximum flow, and a grade 0.528 of a foot per mile.

The above dimensions, according to Colonel Church, will convey 1,288 cubic feet per second to the vicinity of the city, which is nearly the minimum supply of the Ocmulgee River. It gives what will be required for all purposes for many years to come. In the future, when more is desired, the canal may be enlarged by a floating dredge, or, still better, a supplementary canal can be constructed on the other side of the river, giving two independent sources of supply, which is an advantage.

Then only a part of the supply would be shut off when repairs are needed.

This canal, 50 feet wide, delivering 1,288 cubic feet, and having effective head or fall of 48 feet back into the river at its lower end, will create 7,000 theoretical horse-power almost within the city limits, which equals 6,000 actual horse-power outside of the water needed for the city supply. This converted into electrical energy will produce 5,000 salable electrical horse-power.

Such command of power and water can hardly fail to attract manufacturing interests of many kinds to Macon, and give the city an unwonted impetus to growth and increase in the value of real estate.

The cost of the canal, distributing system, and power installation is estimated at $548,000.

THE formal opening of the Boynton Bicycle Railway, between Boynton Junction and Brighton Beach, Coney Island, took place last week. The cars and engines are constructed on the bicycle principle, and run over a single rail of the old road from Gravesend to Coney Island.

VILLAGE WATER SUPPLY.

THE village of Earls Barton, England, has recently been supplied with water by a scheme of which a few particulars may prove interesting.

According to accounts given in several English papers, the population is only 2,500, and the inhabitants did not wish to carry out works involving a large capital outlay or annual maintenance. Four wells have been sunk through porous strata, situate on rising ground above the village, and good water was found on the surface of a thick clay strata at a depth of 20 feet. Neither of these wells would yield sufficient in itself to supply the village, but an ample supply can be obtained by connecting the four wells together with a collecting pipe laid just below the surface of the clay. The length of the 9-inch earthenware socketed collecting pipe will be 300 yards, and it will have open joints at the top of the pipe to admit water. A 4-inch iron surface main will be connected to the end of the collecting pipe, and will convey the water to the distributing pipes in the village. The collecting pipe is sufficiently high in level to enable the greater part of the village to be supplied by gravitation. The part of the village which is too high to be supplied by gravitation has already a good supply from surface wells, but the scheme is arranged so that a small pump can be put down at any time to raise the water into a tank, which would increase the pressure sufficiently to supply this part also. The cost of the gravitation scheme to supply those parts of the village now in need of water would only be $5,500, and the annual expense would be practically nothing. If a pump and water tank is added to supply the high part of the village, the extra cost would be $2,000.

THE ROCHESTER, N. Y., WATER-WORKS.

IT is reported that a proposition to have a private company furnish water to the city of Rochester, N. Y., is under consideration. The proposition, as stated in a local paper, is to purchase the present water-works from the city at a price which will reimburse it for all expenditures for the rights at Hemlock Lake and the conduit line to Mt. Hope Reservoir, and then to contract to deliver at Mt. Hope Reservoir any amount of water the city may need up to 15,000,000 gallons per day, at 3 cents per 1,000 gallons.

THE New York Street Cleaning Department now has a fire engine to help it keep the streets clean. It has obtained from the Fire Department an Amoskeag engine, a two-wheel tender and other apparatus, to be used in flushing the streets with water, especially those on the east and west sides.

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* See pages 83, 165, 181, 195, Vol. XXI., and page 5, Vol. XXII.

THE KINGSTON-ON-THAMES SEWAGE WORKS.

THE discharge of the sewage of Kingston, a town near London, in a crude state into the Thames involved such a serious nuisance to the population lower down the river, that the authoriites have been obliged to construct disposal works. The following account is prepared from notes furnished by our London correspondent, with additions from accounts of the same work in the *Engineer* and *Engineering*.

The Kingston sewage works have been erected by the Corporation of that borough, at a cost of about £23,000. A lease is granted to the Native Guano Company, who treats the sewage by the A B C process, and receives a subsidy equal to a rate of 3*d*. in the pound, retaining for its own benefit the "native guano" obtained from the sewage. This manurial product is stated to receive a ready sale at £3 10*s*. per ton. The works at Kingston are designed not only for the treatment of the Kingston sewage, but likewise that of Surbiton and Hampton Wick. The sewage of the last named locality is not yet under treatment, but will shortly be made available by being transferred to the works through one of Shone's ejectors, which will send the sewage over the railway bridge. Kingston has a population of 26,000, Surbiton 12,000, and Hampton Wick 2,500. The works have been designed for treating the sewage of 35,000 people, but could be enlarged, at a very moderate cost, so as to answer for 50,000. The works were designed by Major Macaulay, Borough Surveyor of Kingston, in conjunction with C. E. Robinson, M. Inst. C. E., the Consulting Engineer to the Native Guano Company.

The works, which were opened June 29, 1889, occupy a plot of land about 800 feet long by 250 feet broad, on which there has been erected a comparatively small building two stories high, which differs but little in appearance from an ordinary dwelling house, and in this building are placed the engines, boilers, pumps, mixers, filter presses, and drying cylinders required for conducting the process.

The engines were constructed by Willans & Robinson, of Thames Ditton, and are of the central valve triple-expansion type, running at speeds ranging from 350 to 550 revolutions per minute. In all there are eight engines, namely, two of 40 indicated horse-power, used alternately for driving the pug mills, revolving cylinders, etc., and six 15 horse-power pumping engines, driving centrifugal pumps of the Invincible type constructed by J. & H. Gwynne, of Hammersmith. Three of these pumps dealing with the Kingston sewage have 10-inch suction and delivery pipes, and are each capable of raising at least 100,000 gallons of sewage per hour to an average height of 10 feet. The three pumps for the Surbiton district have 7-inch suctions, and can each raise 45,000 gallons of sewage per hour to an average height of 13 or 14 feet.

Two mortar mills are used for grinding the chemicals, which are then mixed in vats and discharged into the pump well. A small centrifugal pump supplies water from the river for the boilers, mixing the chemicals, and other purposes. Either of the two 40 horse-power engines can be used for driving the mortar mills, sludge and water pumps, the drying cylinder and mill elevators.

It was originally intended to deal with the Kingston sewage only, and to use horizontal engines of the ordinary type for performing the pumping and driving the mixing and other machinery. With this arrangement an engine house, 50x40 feet, would have been required; with the eight high-speed engines above mentioned, driving a plant of nearly double the capacity of that required for Kingston alone, the engine room measures only 25x14½ feet, and sufficient space is left for the erection of an additional engine, should it ever become necessary to do so. Steam for the engines is supplied by three boilers of the locomotive type, one of 80 and two of 60 horse-power each, also constructed by Willans & Robinson. The largest of these is 12 feet 6 inches long by 4 feet in diameter, the other two being each 11 feet 6 inches long by 3 feet 6 inches in diameter; all three have been designed for a working pressure of 150 pounds per square inch, and are placed in a boiler house measuring 24 feet 3 inches by 23 feet 9 inches. One advantage of this type of boiler, in the present instance, has been that as no tall chimney stack is required, it has been possible to give all the chimneys the same shape and appearance as those of an ordinary dwelling house.

The land was the property of the corporation. The cost of the buildings and works amounted to a rate of three halfpence in the pound.

The contract for the whole of the works was let to W. Cuncliffe, of Dorking, the sub-contractors being Willans & Robinson for the engines, boilers and pumps, and Holroyd, Horsfield & Wilson, of Leeds, for the filter presses and drying cylinders.

Kingston is situated below the intakes of the London water companies, and is removed from tidal influence by the intervention of Teddington Lock. The sewage on reaching the works passes through a screening chamber, which intercepts coarse matter likely to choke or injure the pumps. Thence it proceeds through a culvert to a pump well 25 feet deep and 14 feet in diameter, under the main building, where it receives the B. C., or deodorizing and purifying mixture. This consists of clay and charcoal, mingled with a small quantity of blood. The sewage thus partially treated is raised about 12 feet by centrifugal pumps, of which there are three, each driven by a 15 horse-power engine, and capable of lifting 1,650 gallons per minute.

These pumps discharge into a meter chamber, where the sewage is measured and the quantity registered. The Surbiton sewage is separately received and screened, and is forced by centrifugal pumps through a meter into the Kingston pump well. For this purpose there are three pumps, each driven by an 8 horse-power engine, and capable of lifting 750 gallons per minute.

The sewage of Kingston and Surbiton having been alike dosed with the B. C. mixture, emerges from the

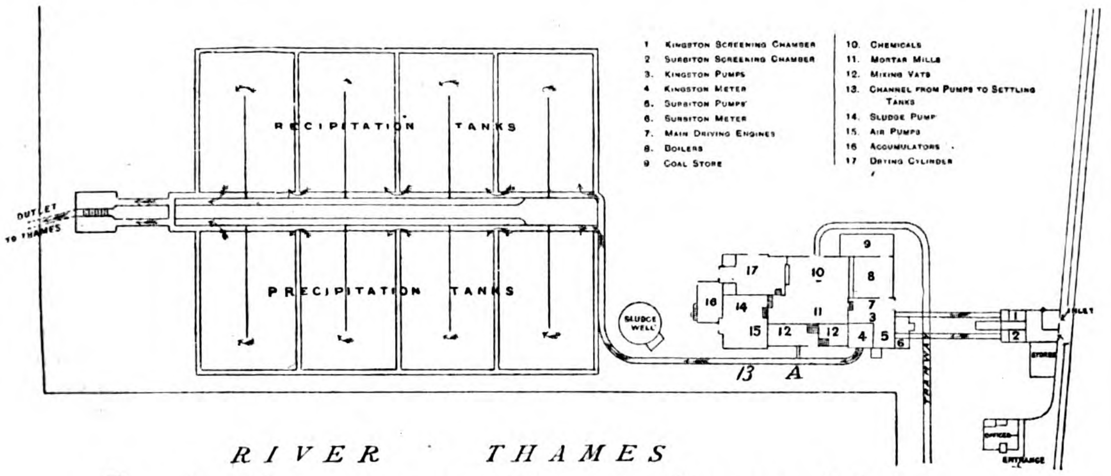


FIG. 1 KINGSTON-ON-THAMES SEWAGE WORKS

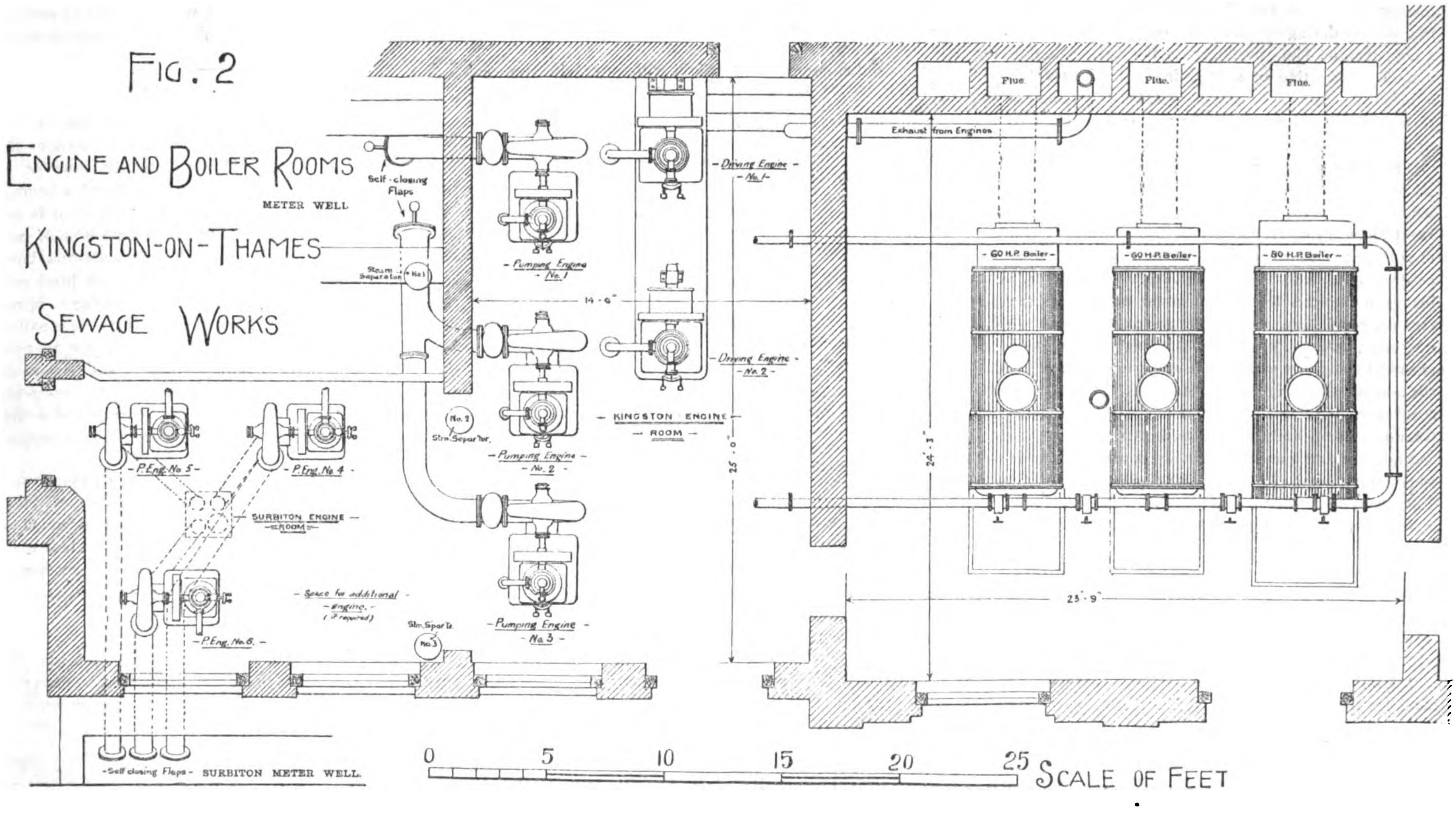


FIG. 2 ENGINE AND BOILER ROOMS KINGSTON-ON-THAMES SEWAGE WORKS

building as one stream into an open channel. Here it receives a solution of alum, dropping into it from a little serrated bridge. This acts as a precipitant, curdling the particles held in suspension. The sewage thus prepared travels onward to the settling tanks. These are eight in number, arranged in two sets of four each with a walk between. The sewage is made to flow along two separate conduits, each flanked by four of the tanks. Each of the eight tanks has a capacity of 150,000 gallons, each being 85 feet in length and 50 feet broad, with an average working depth of 6 feet. The eight tanks are therefore capable of holding 1,200,000 gallons, equal to 30 gallons a head for 40,000 people. Each tank is of twin construction, having a baffle wall running out about three-fourths of its length from its inner end. The tanks are worked in pairs and are interchangeable and auxiliary, flood-gates in the channel courses diverting the sewage into or from each, as desired. Flowing into the first tank as a black and repulsive looking liquid, though without any bad odor, the sewage undergoes precipitation in two stages. It is first passed into the first division of the first pair of tanks in use and runs around the baffle wall until the tank is full. Then, the heavier particles having in great measure settled, the effluent overflows into a head leading to the inner of the double row of channels. This effluent is then comparatively clear and free from smell; it is, however, directed into the second of the tanks, which it also fills to the overflow, when it is run into the outer channel and passes off perfectly bright and clear into the Thames.

In its course to the outlet the channel is "flared" out with an inclined plane, so that the fluid is spread with very little depth over a large surface so that it may be oxygenated. Underground conduits connect the tanks with a double-action Tangye-Holman sludge pump, by which the sludge is periodically pumped from the settling tanks into a sludge well by a Tangye-Holman double-acting pump at the rate of 500 gallons per minute, and from this well it is drawn up into four sludge receivers or accumumulators by exhausting the air from them. They are each 4 feet 6 inches in diameter and 12 feet 6 inches high. When the receivers are full the valves are reversed and air is pumped into them at a pressure of 100 pounds per square inch, which forces the sludge into a set of filter presses, eleven in number, situated on the first floor of the building. The air pumps, which are used alternately for exhausting and forcing, are two in number, and have been constructed by George Scott & Sons, of London. They have cylinders 6 inches in diameter by 6 inches stroke.

The filter presses express from the sludge about 80 per cent. of the contained moisture, the residuum taking the form of hard flat cakes of a black color, free from smell, which are removed by hand. As soon as a sufficient quantity of "press cake" has been stored it is subjected to a further drying process by being passed down through a hopper into an improved form of Borwick's patent drying cylinder, consisting of a large iron cylinder revolving in a furnace. The dried cake is afterwards ground and returned by an endless band elevator with buckets to the upper floor, where it is bagged and sold as native guano.

The meter referred to was designed by Mr. Robinson, and consists of an undershot water-wheel of special design, which is rotated by the sewage as it passes through. The revolutions, being recorded an a dial, indicate the amount of sewage passed in a given time, with an error not exceeding, it is said, 1 per cent. The meter is 5 feet 6 inches in diameter and 5 feet broad, and passes 483 gallons per revolution. The meter can also be made to work the machinery employed for feeding in the purifying chemicals, so as to supply the latter in an exact ratio to the amount of sewage measured. Its use was rendered requisite by the terms of the agreement between the Native Guano Company and the local authorities.

Figures 1 and 2 are, respectively, a general plan of the works and a detailed plan of the engine of boiler-house. The course taken by the sewage is indicated by the arrows in Fig. 1, though it must not be supposed that all the sewage flows at all times in all the directions shown by the arrows in the settling tanks, which merely indicate alternate or alternative routes, as while some of the tanks are in use, others are being cleaned out. The alum is added to the sewage at A.

"A Subscriber," of Philadelphia, is requested to send his name and address before we can undertake to answer his letter.

RECENT CONSTRUCTIONS IN RAILWAY BRIDGES.

In a paper on the above subject, read at the last meeting (August 12) of the Civil Engineers' Club, of Cleveland, O., Mr. James Ritchie pointed out that the largest recent bridge of note is that across the Ohio River at Ceredo, W. Va., known as the Ceredo bridge. It consists of one channel span 518 feet, two side spans 298 feet each, and a series of approach spans, the total weighing upwards of 3,250 tons. A large number of other bridges are in process of construction, including many plate girders, and fixed and draw spans up to 212 feet. In the Southwest considerable iron bridge construction is going on, and in the Northwest there is an increasing number of iron bridges. In the Northeast, also, many bridges are building. The Maine Central road is replacing its wooden bridges with iron ones, while the New York Central is building several bridges of steel.

Particular mention was made of a plate girder span of the New York Central, 115 feet in length and 9 feet deep, in which the web plates are placed with the fibre vertical.

The new swing bridge on the Lake Shore Road, across the Cuyhago River at Cleveland, was described as a double track through bridge 306 feet long with steel eye bars, and the balance of iron. The total weight of the superstructure is 328 tons, and of the turn-table, 133 tons. A table of actual weights of spans from 30 feet to 200 feet was given.

In commenting on specifications of bridges Mr. Ritchie regards those by Mr. George S. Morrison, for the Memphis bridge, as the most complete and systematic, and on account of the minuteness of their details they are not likely to be evaded. Nothing impossible to comply with should be written in specifications, but all reasonable conditions should be rigidly enforced. The use of steel in bridges seems to be increasing, and many roads allow Bessemer steel or open hearth to be used, while the New York Central allows the use of acid open hearth only.

In testing full sized iron eye-bars to destruction Mr. Ritchie has noticed that failure takes place near one head or the other, indicating that the material might have been injured in manufacturing. He, therefore, recommends annealing as is done with steel bars. This might not produce the desired result, but a few experiments in this manner might be of great benefit.

THE EFFICIENCY OF FACTORY CHIMNEYS.

In an article on "The Height of Factory Chimneys," published in The Engineering and Building Record, July 5, 1890, attention was directed to the prevailing tendency to build chimneys for boiler plants of much greater height than is necessary. Bearing further on this subject the following, taken from the *Journal du Gaz et de l'Electricit* and credited to a German source, is of interest:

"An old chimney, 67 feet high, with internal diameter of 19.6 inches to 13.8 inches, and with total passage, from fire to chimney top, of 98 feet, was taken down, and a new chimney, with an intended total draught of 95 feet, and a minimum internal diameter of 25.5 inches was planned out. When the chimney had gone up 39 feet, it was tried. Already there was a great improvement on the old chimney; again at 46 feet, still better, and at 52½ feet the draught was excellent, and there was an economy of from 15 to 20 per cent. in fuel. The chimney was therefore finished off at that height. Herr Huth thinks chimneys are usually made too narrow, and the mischief is aggravated by increasing their height, so fuel escapes unburned. Herr Ramdohr, of Gotha, confirms this, and recommends a uniform internal diameter as being more rational, and as protecting the brickwork from the hot and rapid axial stream. The cross section of the chimney should be from one-fourth to one-eighth the grate area, and the height, not less than 50 feet, should not exceed 100 to 120 feet (the diameter being made to suit), unless the chimney is at a distance, in which case it may be 160 to 200 feet, the diameter being regulated according to the amount of soot which escapes."

GROWTH OF BAMBOOS.

Stories as to the rapidity with which bamboos grow are current all over the East, and the newcomer is often regaled with some rather tall stories in this connection. According to *Indian Engineering*, however, Dr. Trimen records in his Administration Report of the Peradeniya Gardens, Ceylon, for last year, that one of the culms of giant bamboos in the gardens grew last April at the rate of 13½ inches in 24 hours. As this is properly authenticated, the circumstances is notable.

CORROSION FROM SOFT WATERS.

In a paper on the Sheffield, England, water-works, recently read before the British Institution of Mechanical Engineers, Edward M. Eaton, the chief engineer of the works, referred to the extreme energy displayed by the soft Sheffield water in attacking metals exposed to its action. This was shown by specimens of a wrought-iron screw spindle, nuts, bolts and washers. These had been wholly immersed in the water to a considerable depth for a period of more than forty years, and the manner in which the pure metal was eaten away was most remarkable. It has been found also that steel blades, such as razors, scissors, pocket and table knives, and also files suffer complete deterioration to a considerable depth from the surface of the metal, when immersed in the water for several years. This has been proved by the recovery from time to time from the reservoirs of bundles of such steel articles which had doubtless been placed there in connection with trade outrages in times past. The steel was found to have been converted into plumbago, whole bundles of blades being capable of being scraped away with a penknife.

Referring to this, Mr. C. Cochrane pointed out that in the manufacture of cast-iron water pipes the use of graphitic grey iron was not usual, it having been abandoned for the harder white iron. E. P. Martin said that at Dowlais they had had much the same experience with regard to corrosion in the case of a boiler fed with very pure water. They had, however, put a few cart loads of lime into the stream from which the feed water was obtained, and from that time forth the trouble ceased.

Mr. Eaton said that wrought-iron pipes could not be used with the Sheffield water, as they would be eaten through or choked up in three years; but cast iron lasted well, although they were sometimes troubled with "tubercles" of oxide of iron combined with peaty matter, the cause of which was obscure. These formed in spite of a constant stream with a pressure due to a head of 400 feet. Under these tubercles the ordinary coating of scale was found to be intact. Within the last few years they had had much trouble with lead pipes, and the water did seem to act on lead in a remarkable manner, in fact, it seemed at first hungry for any impurity and would take up anything, and if the first thing was lead it would take up that. This, however, was a property common to other waters besides those of Sheffield. In some other places a lime treatment for this defect had been tried. In Sheffield they had met with some encouragement in the use of finely divided chalk. A curious feature about the action of the water on lead was that it was found to be more active at certain seasons of the year. There was no doubt that iron pipes were often affected by the acids in the made ground in which they were buried. Sulphur was the chief cause. Some of the iron which was made soft by remaining in the water became hard again when exposed to the air.

BLACKENED CEILINGS.

It is generally supposed, says *Industries*, that the use of the incandescent electric lamp completely obviates the blackening of ceilings. This is a mistake, however, as incandescent lamps do to some extent cause blackening. It is probable that the blackening from a gas lamp is not due to unconsumed carbon, but to the deposition of particles from a current of hot air. The incandescent lamp causes a current of hot air, which also deposits black particles; but, unless the lamp is near the ceiling it is not easily observed, as the current of air is, of course, smaller. It may be noticed in connection with this subject, that the mica guards and glass bells arranged over gas burners do not themselves blacken, and do not appreciably lessen the blackening of the ceiling. It is therefore probable that the deposit only takes place from hot air to a cold surface.

The Nordenfelt submarine torpedo boat, launched a few years ago, of which so much was expected, is no more. On her way to Cronstadt last year she stranded on the coast of Jutland, was got off and repaired, since when the vessel has been lying in Copenhagen roads awaiting a buyer. At last the torpedo boat has been purchased as old iron and broken up.

English papers contain accounts of a new gun, the propulsive agent in which is carbonic acid gas, compressed to a liquid condition and capable of giving a pressure of 500 pounds per square inch.

THE PROPOSED LONDON TOWER.

FOLLOWING the general illustrations of competitive plans for this structure which have been published in recent issues of THE ENGINEERING AND BUILDING RECORD, we give herewith one of the plans in considerable detail, prepared from the drawings and specifications of the author, so as to present the principal features and solution of a construction problem that is interesting from its exceptional novelty and magnitude.

COMPETITIVE DESIGN AND ESTIMATE FOR A TOWER, 1,400 FEET HIGH, FOR THE TOWER COMPANY, LIMITED, OF LONDON, BY EDWARD S. SHAW, CONSULTING ENGINEER, BOSTON, MASS, 1890.

The tower will present a curved outline, from the principal floor, 360 feet high, to a point near the top. This is attained by making the tubular columns in comparatively short lengths, which are placed as the chords of a curve, and by connecting them at the intersection of the diagonals by junctions which are also chords of, or tangent to, the curve at these points. Besides the floors shown in the illustrations, there is a room about 10 feet in diameter, surrounded by a balcony, at a height of 1,388 feet from the ground, to be used for an electric light lantern. On the top of this room will be a deck or standing room, 10 feet in diameter, protected by a railing at a height of 1,400 from the ground.

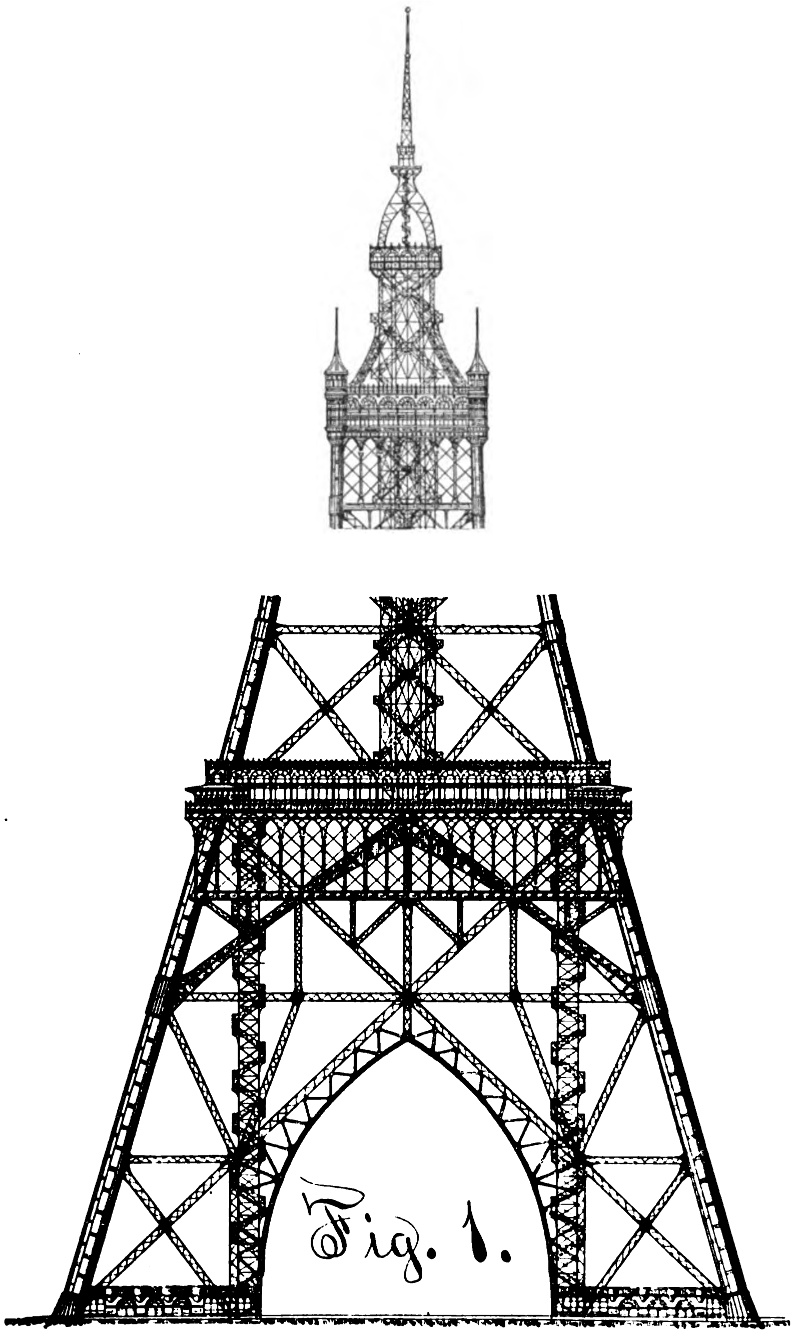


Fig. 1.

TOWER 1400FT. HIGH DESIGNED BY EDWARD S. SHAW.

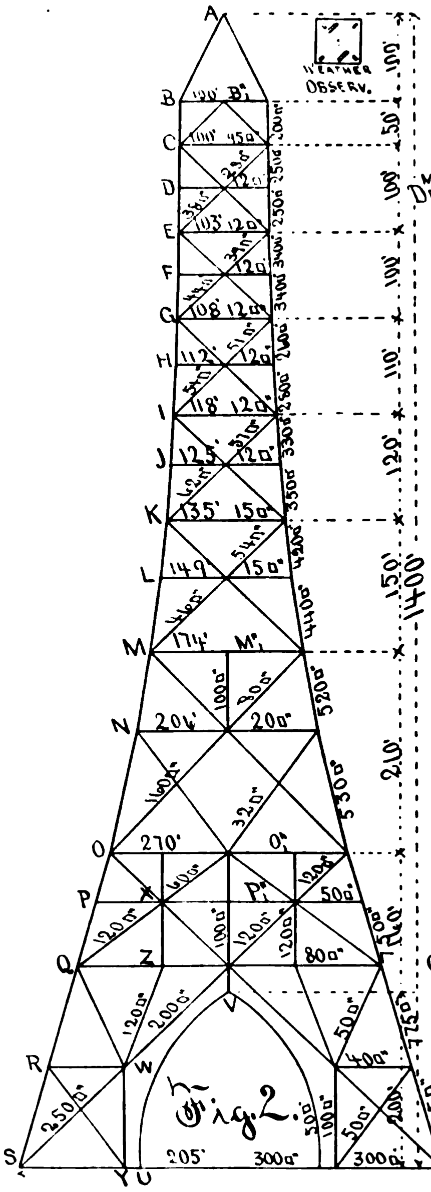
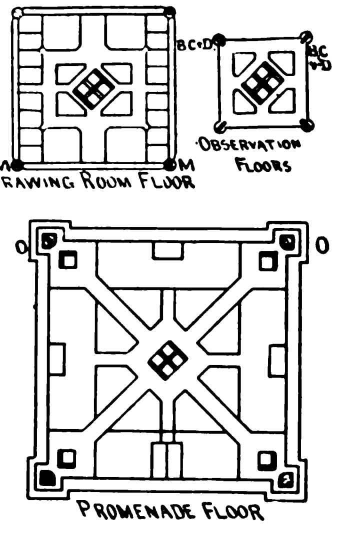


Fig. 2.



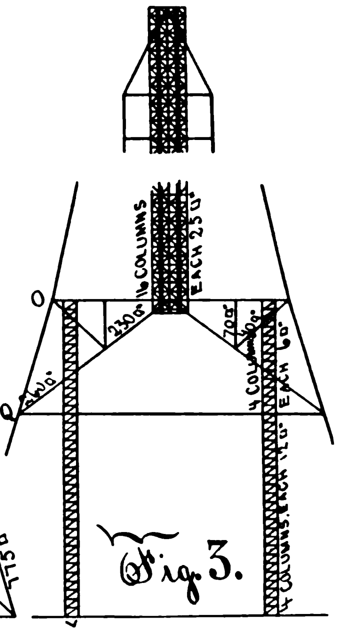
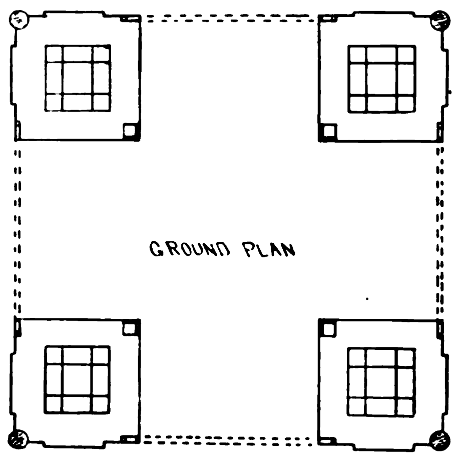


Fig. 3.



1400FT TOWER
DESIGNED BY
EDWARD S. SHAW
BOSTON MASS.

Access is had to the several floors by means of four shafts, carrying staircases and lifts from the ground to the principal floor (360 feet in height), and from this floor to the top of the tower, by a single shaft, having four wells for lifts and provided with staircases. This latter lift shaft is placed at an angle of 45 degrees with, or diagonally to, the main tower, in plan, and is connected horizontally with the principal tubular columns, by diagonal members passing through it.

FLOORS.

The ground floor consists of four pavilions, each 140 feet square, covering a total area of about 74,000 square feet, and situated adjacent to the four corners of the tower, and contains offices, restaurants, shops, etc.

The first and largest floor above the ground level is termed the promenade floor, from the covered promenade 1,200 feet long and 15 feet wide surrounding it. It covers a net area of about 75,000 square feet, and is situated at a height of 365 feet above the ground. It contains a general public hall, 50x160 feet; kitchens and toilet rooms.

The drawing room floor is at a height of 575 feet above the ground, and contains a net area of about 28,000 square feet. It is proposed to have this floor fitted and furnished in a more elaborate and expensive manner than the other floors, and to charge an extra price for admission. It may contain a general drawing room (for both sexes), restaurant, gentleman's room (smoking), ladies' drawing room, private drawing rooms (may be hired by the hour or day), toilet rooms, etc.

The upper public floors of the tower will be situated at a height of from 1,200 to 1,230 feet from the ground, and will consist of a covered floor 100 feet square inclosing an area of 10,000 square feet; a covered gallery 10 feet wide extending around the four sides of the tower directly above the principal floor; and a flat roof or deck, which may be used by the public in fair weather, and which covers the same area as the floor below. The total available area of these floors and galleries is about 20,000 square feet.

At a height of 1,318 feet from the ground is a floor 50 feet square, inclosed and covered, which may be used as a weather observatory or signal service station, and fitted up with the proper instruments for this purpose. Above this, at a height of 1,388 feet, is a lantern 10 feet in diameter, which may contain a powerful electric light. The roof of this lantern is surrounded by a railing and constitutes the highest standing room upon the tower, 1,400 feet from the base. Above this point extends a tapering latticed column, the upper portion (30 feet) being a circular column of uniform diameter. This staff will serve as a lightning protector and a signal staff upon which flags denoting the condition of the weather may be hung. The principal upper floors are further protected from lightning by four iron poles extending upward from the tops of the four turrets which surmount the principal columns at the corners of the tower.

ELEVATORS AND STAIRCASES.

From the ground floor to the promenade floor are four vertical shafts for elevators, 15 feet square, each shaft being surrounded by a staircase. From the promenade floor to the weather observatory floor, a distance of 950 feet, there is a single shaft situated in the center of the tower and provided with four wells for elevators, each about 13 feet square. All staircases are 3 feet wide, with steps having a rise of about 7½ inches and landings 3 feet square. They will be protected upon both sides by fenees or railings 5 feet high, the lower portion of which are solid girders carrying the steps.

The elevators from the ground to the promenade floor are 13 feet square inside, with two floors, each elevator having a capacity of 60 persons without crowding. The elevators from the promenade floor to the top of the tower are 11 feet square inside, with two floors, each elevator having a capacity of 50 persons. It is proposed that one-half of the elevators shall have a speed of 400 feet per minute, and the other half a speed of 200 feet per minute, as it is unpleasant to many persons to ride in fast elevators. The time occupied by one trip, including loading and unloading is estimated as follows: Ground to promenade floor, fast elevators, 2 minutes; ground to promenade floor, slow elevators, 3 minutes; total capacity per hour to promenade floor, 3,000 persons. By increasing the speed of the slow elevators the capacity can be raised to 3,600 persons per hour. From promenade to observation floors, fast elevators, 3½ minutes; from promenade to observation floors, slow elevators, 6 minutes; total capacity to observation floors, 1,350 persons per hour. This can be increased to 1,500 per hour by running three of the elevators at a speed of 400 feet per minute.

The tower is designed to sustain, first, its own weight; second, a live or moving load, covering all of the floors, of 56 pounds per square foot, this load being increased to 112 pounds per square foot upon members directly supporting portions of the floors liable to be crowded; third, a wind pressure of 56 pounds per square foot, acting upon double the exposed side area of the tower, with a deduction of one-half for tubular members, and plane surfaces inclined at an angle of 45 degrees to the direction of the wind. The total wind pressure upon the tower is estimated at 3,000 tons. With the above loads the stresses per square inch employed are as follows: Upon steel in compression 5 to 7.5 tons per square inch; upon steel in tension, 6 to 7.5 tons per square inch; upon iron in compression, 3 to 5 tons per square inch; upon iron in tension, 4 to 6 tons per square inch; according to position and duty, the stress being reduced, as the ratio of live to dead load and minimum to maximum stress increases.

The details of construction of the principal parts of the tower are in many respects similar to the details of the Forth bridge. The principal columns at the four corners of the tower are plate iron tubes 16 feet in diameter and ¾-inch thick at the base, and 8 feet in diameter and ⅜-inch thick at the top. They are built up of 16 plates in the circumference at the base, 12 plates at the middle portion and 8 plates at the top, with internal ribs of I-shaped section and stiffening rings. The diagonal and horizontal members are generally four channel shaped sections, with triangular web bracing of angle section. They are connected with the tubes and at their junctions by plates. The junction members of the tubes are flattened upon the inside surfaces to facilitate the attachment of diagonal members, and provided with four internal webs extending across from side to side. The floors are supported by steel trusses and girders, with steel I-beams for floor joists, the space between the beams being filled with flat arches of hollow terra cotta, and covered with asphalt or tiles bedded in cement. The elevators and staircase shafts are constructed of vertical columns of channel or Z section connected by horizontal struts and diagonal ties. Steel is used for all the heavier members and iron for the lighter ones, the rule being to use iron where the section required for steel is less than ⅜-inch.

FOUNDATIONS.

It is proposed to make the foundations principally of Portland cement concrete. Those under the principal columns are 25 feet in diameter at the top, 40 feet deep, and 60 feet in diameter at the base, in the form of truncated cones. The upper courses of these foundations are of cut granite. The estimated vertical pressure upon the top of each of these foundations is 6,400 tons; the weight of the foundation is 3,500 tons, and the pressure per square foot upon the ground at the base of the foundations 3.5 tons. The horizontal thrust of the columns due to the vertical load is taken up by horizontal ties just under the surface of the ground, leaving a horizontal thrust of not exceeding 900 tons upon each foundation. Anchors will extend down to a point near the base of the foundation, and be connected there to heavy girders embedded in the concrete.

The cost of rolled bars, plates and shapes is estimated at £9 to £10 per ton for iron, and £10 to £11 for steel manufacture; erection and painting of the same at £13 to £14 and £14 to £15, respectively.

The summary of estimates gives—

(A.) Constructional steel and iron, 17,790 tons, £437,916; balustrade railings, cost, £1,080; ground floor, walls, partitions, floor and roofs, cost, £30,570; promenade floor, walls, partitions, floor and roofs, cost, £31,758; drawing-room floor, walls, partitions, floor and roofs, cost, £15,653; observation floors, walls, partitions, floor and roofs, cost, £8,195; weather observatory floor, floor and roofs, cost, £1,013.

(B.) Foundations, £28,400; excavation, £3,750; lifts, £9,600; plant for operating lifts, £8,000. Total cost of tower, £575,933.

11,987 tons of steel, at £302,671, and 790 tons of iron, at 18,491 £ for the tubes, diagonals, trusses arches and buttresses are included in item A. In item B the foundations of the principal columns are estimated at 10,800 cubic yards, at £2 per cubic yard.

Excavation throughout is estimated at £3 per cubic yard, and the elevator plant is of 100 h. p., with electric generator and motor for the upper elevator.

Figure 1 is a general elevation of the tower, Fig. 2 a diagram of principal sections and dimensions, and Fig. 3 shows the arrangement of elevator shafts.

ANNUAL REPORTS.

REPORT ON THE PROJECTED WORKS OF THE TULARE IRRIGATION DISTRICT, TULARE COUNTY, CAL.; by the Board of Directors and the Engineers.

On September 21, 1889, the Board of Directors of the Tulare Irrigation District was organized, and undertook to ascertain the most available and acceptable routes for irrigating canals and works, and to estimate and determine the amount of money necessary to be raised for construction. For this purpose John S. Urton, C. E., of Hanford, was engaged to make the necessary surveys, investigations and estimates, and his report forms part of the pamphlet. The result of his investigations was the conclusion that further and more detailed surveys of the proposed irrigation works were necessary. The services of P. J. Flynn, C. E., of Los Angeles, were therefore secured, and to his report the greater part of the pamphlet is given up. The line recommended by Mr Flynn has been adopted, and it is intended to call for bonds to the amount of $500,000 for the work of construction.

Mr. Flynn estimates that $353,476 will suffice for building the line, but the Board of Directors believe it advisable to have an ample surplus as a contingency fund for purchasing water rights, etc., if occasion shall arise.

REPORT ON THE OPERATIONS OF THE SANITARY DEPARTMENT OF THE CITY OF GLASGOW; for the year ending December 31, 1889; by Peter Fyfe, Sanitary Inspector.

THE report shows that during 1889, 13,128 persons died in Glasgow, making a death rate of 25 per 1,000 of the population. This as compared with the year 1874, when the death rate was 32 per 1,000, shows a marked improvement in the sanitary condition of the city. A review is given of the different city districts, and their evil features are pointed out. An appendix contains a report on the stabling of cows within the city. Comprehensive tables also are given, furnishing details of the epidemic and nuisance inspectors' work, and of the sanitary inspector's work.

A DOVER, N. H., despatch states that suit was entered against the city on August 15, by John H. Leavitt, who contracted to build, and built, the upper well of the Dover water-works. In constructing the well it caved in badly, and cost him a good deal more than he expected. He claims pay for the extra work that the caving in caused him, to the amount of $3,390.12, with interest, making a total of $3,713.05. The city denies that it is under any obligation to pay for extra work, as Leavitt took the job for a fixed sum, and took his own risks.

Correspondence.

Communications giving information or opinions on matters of general interest to the engineer, the architect, the contractor, or the municipal officer, will be welcomed in this column. Fairness will suggest that when communications are sent simultaneously to this and other journals we should be informed of it at the time. Anonymous letters will not be noticed.

THOSE DANGEROUS TRUSSES AGAIN.

BROOKLYN, N. Y., August 19, 1890.

To the Editor of THE ENGINEERING AND BUILDING RECORD:

SIR: I am glad to see that my letter about the dangerous trusses in Hermann's Theatre, published in your last issue, has attracted considerable attention to the matter, and, according to the daily papers, has led to some changes being made in the trusses and in the supports of the iron beams. I shall watch with some interest to see if the proposed changes are really improvements. It is reported in the *Standard-Union* that the iron pillars "are to be reinforced with substantial *wooden* posts;" rather an unusual construction certainly in a new building. Why not put in proper iron pillars to begin with, especially as only one of them has so far been put in place? As white or yellow pine compresses about ten times as much as cast iron under a given load it is very obvious that it will be next to impossible to get supports of such dissimilar material to work together to any sort of advantage. It will be like the "new cloth in the old garment," only more so.

In the Brooklyn *Eagle* it is said to be the architect's "intention to strengthen the trusses by means of two rows of braces, and although this is not by any means what the plans call for," it is said that the commissioner would be satisfied with it. Apparently this can only mean that diagonal braces are somehow to be inserted between the vertical struts shown in the sketch accompanying my first letter, and it is obvious that though this may be so done as to give a somewhat better support to the center of the timbers that form the top chord it adds nothing whatever to the effective depth of the truss. Right here I may say that though it is claimed that the truss rod is 1½ inches in diameter instead of 1¼ inches as I supposed it to be, yet the correctness of my calculation is in no wise affected thereby, for, willing to be liberal where the discrepancies were so great, I assumed the rod to have its full area at all points, but as a matter of fact its section is reduced by having a screw thread cut upon it for the turn-buckle in the middle and the nuts at the end, so that even if it was 1½ inches in diameter to begin with it has, at the critical points, only the effective area of a 1¼-inch rod. It is not even as good as if its effective area had been reduced in the same proportion for its whole length, and for the same reason that it is safer to cross a brook on an inch board than on a two inch plank that has been cut half through in the middle, for in the latter case the tendency to break has been concentrated at one point and it will not spring or "give" as much before breaking.

Since my first letter was written I notice that a partition has been put up in the first floor, distant perhaps 6 feet from the side wall, which may in a measure reduce the load on one of the trusses, although the shrinkage and compression of the plates and beams render that very uncertain; but I was astonished to see also that a partition had been put up on the second floor right over the most heavily loaded truss. The beams of the floor above break joint on this partition which thus transmits to the truss below full half the weight of another floor, and taking the dimensions given in my last letter, and assuming the weight at only 100 pounds per square foot, this is 30 × 16 × 100 = 48,000 pounds, an additional load of nearly five times what I showed last week would be safe for the truss to carry even if properly braced. Altogether, even supposing the partition below to take its full share of the load, this unhappy truss is, to all appearance, liable to have to sustain seven or eight times as much as would be safe to put upon it, or about twice its breaking load. Comment is unnecessary.

If there is anybody in the Department of Buildings who is capable of figuring such matters it is charitable to assume that he is enjoying his vacation, and it is to be hoped that work on the building, which seems to have been suspended since your publication of my letter, will not be resumed until he has returned and given the matter his most careful consideration.

I notice that Mr. Allen, the architect, is quoted as saying that "'Civil Engineer' has labored under a mistake in his figures, his calculations are wrong, and he don't know what he is talking about," but as not the slightest evidence is offered in support of this sweeping statement it is perhaps safe to assume it to be merely the expression of a very natural irritation in which "the wish was father to the thought." CIVIL ENGINEER.

[As the accuracy of some of the statements and calculations regarding Hermann's Theatre contained in the letter from "Civil Engineer," which was published in our last issue, appeared from the daily papers to have been questioned by the architect of the building and others, a representative of THE ENGINEERING AND BUILDING RECORD visited the theatre, where he found work suspended pending the settlement of the matters in dispute. On examining the plans it appeared that the description of the trusses was substantially correct, differing, however, in the following particulars: The truss rod was 1½ inches instead of 1¼ inches, although as the ends were not upset its effective area was only 1¼ inches. The top chords were only 4x12 inches instead of 4x14 inches as estimated, while the total length of the truss was 33 feet 2 inches instead of 30 feet as estimated, the center struts being 6 feet 6 inches apart.

The effect of these differences on the timbers of the top chord, considered with reference to their transverse strength for the middle portion of their length, is to make that strength about 26 per cent. less than estimated, and to make the bending moment of the load, supposed to be the same per square foot, about 15 per cent. greater than estimated, altogether making the disproportion between load and strength over 50 per cent. greater than estimated.

If, however, the truss were so braced as to properly support the upper chord its strength would then be limited by that of the lower chord, provided the wooden struts did not split or crush. In this case, as the truss is about 10 per cent. longer than was supposed, the bending moment of the same load per square foot would be increased about 20 per cent., which, with the slight reduction in the effective depth due to the lessened depth of the top chord, would make the disproportion between load and strength about 25 per cent. greater than estimated by our correspondent.

These calculations are based on the state of things noted in his first letter; since then, however, the partitions described in his second letter have been added: the apparent effect of the upper one would be to more than double the load on one of the trusses. The Commissioner of Buildings stated that floor loads of 120 pounds per square foot had been allowed for. The floor area supported by one of the trusses, making all allowance for the relief afforded by one of the partitions below, and adding the area of the third floor if supported by the upper partition, would be 864 square feet. This would give a distributed load of 864 × 120 = 103,680 pounds, and give a stress on the truss rod of 160,000 pounds. Taking the ultimate strength of the rod at 50,000 pounds per square inch, which is good iron, the rod would break at 50,000 × 1.23 = 61,500 pounds. The safe load would be about 12 pounds per square foot, or about what the bare floors would weigh.

From the above figures it would appear that the danger to be apprehended from the use of these trusses is considerably greater than "Civil Engineer" had supposed when he wrote his first letter, and the facts, as ascertained by our representative, fully justify the confidence which we placed in our correspondent's statements and calculations. None of them has been successfully questioned except the size of tie rod which, as he said, he was obliged to estimate, and that difference was fully covered by the ample allowance he had made in his calculations. Of his other statements, though strongly condemned in general terms by interested parties, not one has even been specifically questioned, much less disproved.

The rolled beams to which our correspondent called attention are 20-inch steel weighing 64 pounds to the foot, and are 30 feet long. Their safe distributed load would be 81,500 pounds. They were to be supported at each end by cast-iron pillars 6 inches in diameter, 1 inch thick and 16 feet 6 inches long. The breaking strength of such pillars is about 170 tons each if bearings are perfectly true; if such is not the case the safe load will not exceed $\frac{1}{16}$ of that or about 11 tons, little over half of what the beams would safely carry. The upper ends of these pillars are rough, but the lower ends are turned. The one in place rests directly on a piece of rough blue stone about 16x20 inches, its center being about 4 inches from the end of the stone, which, in its turn, rests on a 16-inch wall 8 or 10 feet high, in which there do not appear to be any bond stones. These pillars are to be reinforced by yellow pine posts.

One of these posts has been put in place. It is 8x10 inches. At the bottom it rests on 14 inches of plank blocking laid on the side, giving an indefinite amount of compressibility, and has not even been squared off to get a fair bearing on that, as the end of the finger could be run under it for some distance. At the top it is cut away for more than half its width to accommodate the capital of the cast-iron pillar, which is some 14 inches square.

On this unfinished capital, which, from the draught of the pattern is quite crowning, the steel beams are shimmed up with wooden wedges, while under one side of the lower end of the iron pillar the end of a rule can be readily inserted, so poor is its bearing on the stone.

The plans for the additional bracing of the trusses had not been received up to the time of going to press, but the Commissioner stated that they merely contemplated putting diagonal bracing between the struts without increasing the depth of the trusses. In view of the fact that work on the building, which has been stopped by the owner since last Saturday, has not yet been resumed, the Commissioner thinks that the trusses will probably be replaced by some more satisfactory construction, especially as the owner did not appear to be favorably impressed by their appearance when his attention was called to them.

The architect of the building is J. D. Allen, of Philadelphia, and the general contractors are R. C. Ballinger & Co., of the same place.]

BUILDING INSPECTION IN BROOKLYN, N. Y.

To the Editor of THE ENGINEERING AND BUILDING RECORD:

BROOKLYN, August 11, 1890.

SIR: The subject of building inspection is a serious one, and I am one of those who think the liberty of our institutions should be allowed to govern all things. If public sentiment and private interests could so shape our policy that only skillful architects and engineers would be employed, we should be safe in trusting all, as we must trust much in any event to them.

Building inspectors are not generally skilled men, and rarely ever architects or engineers. Somewhere should rest the power to insist that only good men should plan and build structures in and over which human beings must live and move.

The criticism of your correspondent, "Civil Engineer," recalls several instances of faulty construction in buildings in this city. Our administration of such matters is different from that in New York City, and probably inferior thereto. Our interests are just as essential and very similar to those in the greater city. For three purposes at least—health, police and public works—the two cities should be served by the same rules, if not by the same officials.

I noticed the other day, in the repairs being made at a large brick building, necessitating the introduction of a heavy iron floor beam to carry wooden beams, till then resting on a partition wall which was being removed, that the new beam was made to rest on the outer edge of a cast-iron column cap. The end of this beam did not extend over the body of the column at all, and had only about four square inches bearing on the outer edge of the column cap. It would have been easy to attach supporting angles of sufficient strength to transmit the shear of the new beam to a cross girder already resting squarely on the column. Instead of this the beam was left to exert a bending stress on a 6-inch cast-iron column, or to shear off the ornamental cap, or both.

In the demolition of the old Brooklyn Theater one of the outside columns, carrying a heavy canopy, broke in handling and exhibited a section 8-inches in external diameter, the metal on one side being 1⅜ inches thick, while that on the other side was about $\frac{3}{16}$ inch thick. The special Providence that watches over drunkards and children had prevented serious disaster during the life of this eccentric old column.

An excavation something like 100 feet square is being made in a thickly settled portion of the city and will be carried about 30 feet deep; for economical reasons no sheeting or bracing was provided for. The slopes in clean sand which were left and intended to stand at a slope of about 60 degrees have caved in so as to endanger neighboring fences and buildings and seriously inconvenience the workmen in starting the foundation walls. An ordinary heavy rain might easily bring the slopes down to 45 degrees and endanger buildings and streets. A casual glance at the present condition of the work will show that the inconvenience to construction will overbalance the saving in omitting sheeting. Should serious slides occur, heavy damage will result.

No doubt many have observed the peculiarly light and airy construction in the repairs of the building corner De Kalb Avenue and Fulton Street, where semicircular arches of iron beams are made to support the front wall of brick of the old upper story; the thrust is intended to be taken up by tie rods and the total weight ultimately rests on cast-iron columns. The construction contrasts strikingly with the strong modern buildings designed by our best architects and is certainly very close on the margin of safety.

The problem is left almost entirely to the owner, which on my theory is correct, if he can only be induced to give the design and inspection of his work and the consequent cost to conscientious architects of acknowledged ability.

BROOKLYN.

[Our Brooklyn correspondent, who is in position to speak with authority, outlines a condition of things which is well known to exist in many places, but which unfortunately too often requires disastrous practical illustration before receiving proper attention. The instances, above cited, of dangerous building practices in Brooklyn, are probably only a few among the large number which have hitherto escaped detection, and we would commend them to the attention of the Brooklyn Building Department as samples of what might be looked for and guarded against by any system of inspection worthy of the name.]

STEEL FOR WATER AND OTHER PIPES.

To the Editor of THE ENGINEERING AND BUILDING RECORD:

SIR: The article in your issue of August 2 seems to have been prepared in some misconception of the nature of the question which is now under discussion in engineering circles. So far as I am aware, there is no discussion as to whether cast iron, steel or wrought iron is the best material for pipe manufacture. In the American Water-Works Association the debate took a practical turn, and hinged on the question—understood by the speakers if not clearly formulated in words—whether the superior advantages of steel as a material was not offset by the passive resistance to destructive oxidation in the ground of the heavy and clumsy cast-iron pipes hitherto used. In the New England Water-Works Association, as I learn from a study of their transactions for several years, the discussion has assumed much the same character—cement pipe being contrasted with cast iron, not because it was open to debate whether iron or cement is the better pipe material, but simply which rendered the better service during a long term of years.

I venture the prediction that the days of the cast-iron pipe are nearing an end. They represent too much dead weight for too little strength. Wise engineers long ago reached the conclusion that the most costly and least satisfactory way of protecting iron against oxidation is with mere bulk of its own substance; and those most concerned in the future of the cast-iron pipe, for business reasons realize most keenly the fact that it is destined soon to take its place among the materials forced into disuse by the progress of the arts. Mr. Hamilton Smith, Jr., who stands very high in the profession of hydraulic engineering, in a paper contributed to the British Iron and Steel Institute, and published in Volume I. of their Transactions for 1886, furnished data as to the life and strength of light wrought iron and steel pipes for water conveyance, which left little room for further discussion. He concludes as follows:

"The query presents itself: Why should not wrought iron, or still better, steel, be used for conduit pipes in preference to cast iron? If it answers the desired purpose in California, why should it not do so in other parts of the world? To one like myself, who has for years been accustomed to the California practice, it seems as irrational to build a pipe carrying water under considerable pressure of cast iron, as it would be to build a suspension bridge with the supporting chains made of cast iron.

"Experience in the United States has shown that the practicable limit of size for cast-iron mains is a diameter of about 4 feet, even when the pressure is less than 100 feet. It is evident that a pipe of wrought iron or mild steel can be safely made of almost any desired size, and this may be of much advantage if it be desired to conduct a large supply of water through pipes for city or other use. For instance, with an inclination of 3 feet per mile a single pipe 8¼ feet in diameter will carry 280 cubic feet per second, while seven pipes, each 4 feet in diameter, would be required to transport the same quantity of water with the same inclination. The cost of the large pipe, made of steel or wrought iron, would be considerably less than one-half the cost of the seven small pipes made of cast iron.

"The ideal conduit for high pressures is a welded steel tube; such tubes could probably be subjected to a tensile strain of 25,000 pounds with perfect safety, and would be much preferable to riveted pipe, not only on account of superior strength, but also by reason of almost perfect interior smoothness. * * * The adaptation of a superior and cheap metal, such as mild steel, for conduits will permit the construction of hydraulic works in many parts of the world which now appear to be impracticable, owing to the cost of many of the methods still in use for the transportation of water."

The problem of the protection of steel tubes in the ground is no longer one which causes the engineer any anxiety. A steel tube $\frac{1}{8}$-inch thick, properly coated with asphalt applied in the right way, will, under normal conditions, have a longer useful life in the ground than a cast-iron pipe ¼-inch thick. Meanwhile it will be, what cast iron is not, impervious. The experience in the streets of New York with cast-iron gas and water pipes shows how long they will outlive their usefulness as conduits. The pipe of the present and future is the welded steel tube; and the fact that, the demand for these has always been greater than the available supply would seem to dispose satisfactorily of the idea that they are regarded with a prejudice which must be overcome before they can be generally introduced.

Respectfully,
JAMES C. BAYLES.

THE Columbian Government has passed to the Senate the petition of Lieutenant Wyse, the Panama Canal Company Commissioner, who recently arrived from Paris. Lieutenant Wyse asks for six years' prolongation of the canal company's concession without recompense, and that the Government concede to the company 10,000 hectares of land for the lake which will be formed by the Chagres River, the Government receiving 12,000,000 francs, which sum the company will pay in installments.

SOUTH BALTIMORE was temporarily deprived of water on the 15th inst. owing to a break in a water main.

Notes and Queries

on Domestic Engineering.

Communications relating to the practical details of plumbing, heating, lighting and ventilation will be welcomed in this column. The writer's true name and address must always be given, but an assumed name may be used for publication if preferred.

HOT-WATER RADIATORS ON A LEVEL WITH THE BOILER.

WILLIAM J. BALDWIN, New York, writes: In your issue of August 9, page 153, "Architect" asks, "Can a hot-water heater be set up as well on a level with the ground floor—that is, in the first story of a house as in the basement or cellar? Can it work to as good advantage in heating the first and second stories? In this town there are no cellars."

In reply, you say in your issue of July 12, 1890: "We show an arrangement of securing circulation through hot-water radiators placed below the level of the boiler. The flow pipe from the boiler is first carried up some distance, in this case to the top of the first story, and is then brought down to supply the radiators.

"The plan has given entire satisfaction. * * * The working conditions of such radiators correspond very nearly with those on 'Architect's' first floor, the boiler and radiators there being on the same level. If our correspondent, therefore, will apply the principle illustrated in our former issue he will have no trouble in getting proper circulation in his first floor radiators."

You evidently do not intend to convey the idea that the plan will give as good results as a *circulation above the boiler*. Still this is the construction many of your readers will be apt to apply to it; hence my letter to you on the subject.

When you tell your correspondent to apply the principles shown in your issue of July 12, and tell him he will have no trouble in getting proper circulation, of course you mean that he will get as good circulation as can be expected under such conditions, always assuming, of course, that his pipes are properly run and sufficiently large. Circulation below the boiler is seldom satisfactory. It is always sluggish and requires very much more heating surface to accomplish a given result than would be required for similar conditions when the boiler can be below the heaters. My advice to "Architect" is *not to do it* if there is any other way out of the difficulty.

Would it not be better to put coils near the ceilings?

[From the nature of "Architect's" inquiry, we took it for granted that he contemplated a job in which the lowest radiators had to be used either on a level with the boiler or not at all. In our reply we, therefore, attempted to show how the problem could be solved under such unfavorable conditions. As Mr. Baldwin points out, they are to be avoided if in any way possible.]

WHEN IS IT ECONOMICAL TO USE EXHAUST STEAM FOR HEATING?

"M. E.," of Jersey City, N. J., writes: "The inquiry in a recent number of your paper as to the economy of using exhaust steam for heating, and your reply to it, suggest a few thoughts on the subject in general.

"Where a manufacturing establishment is using steam for heating as well as for power, or where there are two establishments adjoining, one of which is using steam for power and the other for heating, and the amount of steam required by each is nearly the same, a plant can be erected to generate the steam for use in the two places at a small advance on the cost of a separate plant for each. The reason for this is, that while it is necessary to add about 1,147 heat units to every pound of water of a temperature of 32° Fahr. in order to change it into steam at atmospheric pressure, it requires the addition of only 33 heat units to give us the same weight of steam at a pressure of 75 pounds above the atmosphere. With this work can be performed in the engine, and then the steam can be delivered for heating at a reduced pressure, with but slight loss as compared with the gain resulting from its double use.

"In practice a good automatic cut-off non-condensing engine requires about 30 pounds of steam, of 60 pounds pressure, per hour for each horse-power. Of this about 22 pounds will be delivered as exhaust steam in the neighborhood of atmospheric pressure, and is available for heating purposes; or 71½ per cent. of the heat imparted to the steam in the boiler is actually available for heating after having passed through the engine. The difference between this available heat and the theoretically available quantity is lost in the engine by cylinder condensation, etc. In this manner it would be possible to obtain power and afterwards deliver the exhaust steam for heating. The proportionate cost of the coal would be about $\frac{3}{10}$ for the power and $\frac{7}{10}$ for the heating.

"In other words, if an establishment had been paying $5,000 a year for the coal used in generating its steam for power, and it could subsequently deliver the exhaust steam for heating purposes to some one else, the quantity so delivered would have cost the one using it $3,500 a year for coal if generated by himself, leaving the cost of coal to the one using the steam for power $1,500 instead of $5,000 as before. This can be stated also in another way. If a party is paying $3,500 per year for coal for steam for heating purposes the addition of $1,500 worth of coal will add sufficient heat to enable this steam to be first used to generate power, and then the same quantity of heat can be delivered for heating as before.

"Recently I was called upon by a large candle factory to determine what charge should be made for steam and power which was furnished to a lard refinery next door, where they were using about 4,150 pounds of live steam per hour for general purposes, besides from 15 to 20 horse-power requiring about 64 pounds of steam per hour each, or altogether about 100 cubic feet of water per hour in the shape of steam. To generate this steam from water at a temperature of 122° Fahr. required about three tons of coal per day, or one pound of coal to 7¾ pounds of water changed into steam of 60 pounds pressure. The exhaust steam from the engine was used in the candle factory to heat the feed-water before entering the boilers, and also for heating a portion of the establishment, with such favorable results that it was estimated that an actual saving was effected in coal consumed of 80 tons per year for heating the feed-water, and 30 tons for the heating done during one winter, being about 13 tons saved per month in winter time by the exhaust steam generated by the consumption of 17 tons of coal per month. In this instance no back pressure in the engine was produced."

HOT-WATER HEATING IN PUBLIC BUILDINGS.

"**ARCHITECT**," Hamilton, Ont., asks; "Can you give me the names of some public buildings heated by hot water and where can any information regarding same be obtained?"

[A great number of the United States Treasury buildings in various parts of the country are heated by hot water, probably the latest example being the new Court House at Boston which is now being fitted up. The hot-water heating plant of the State, War and Navy Department Building at Washington, D. C., was described and illustrated in THE ENGINEERING AND BUILDING RECORD of January 22, 1887, and practically the same matter is given in William J. Baldwin's book on "Hot-Water Heating and Fitting." Mr. Baldwin, in this book, describes also the hot-water system at the Westchester, N. Y., Almshouse. Reference to these articles will give our correspondent some of the desired information.]

Questions and Answers.

All questions relating to building construction, paving, sewerage, water supply, or kindred subjects, will be welcomed in this column provided they relate to matters of general interest and are not such as should properly be referred to a consulting engineer. Answers will be carefully prepared and a proof of both question and answer mailed to the inquirer as early as proper consideration will permit. They will be published for the benefit of other readers as soon as convenient. The full name and address should be given, not necessarily for publication, but as a guarantee of good faith, and to facilitate further correspondence in case the question is not sufficiently explicit.

Inquiries of the Editor, in order to secure prompt attention, should *not be written on the same piece of paper as a communication* to the *Publishing Department*. Letters renewing subscriptions are sent to a clerk in the publishing office, and matter for the Editor, if in the same enclosure, is likely to be overlooked unless it is on a separate piece of paper, so that it may be promptly sent to the Editor.

SILVER EXTRACTION FROM SULPHURIC ACID SOLUTIONS.

AN English correspondent asks: "Can you give me any information concerning the extraction of silver from a sulphuric acid solution? Can you refer us to any American manufacturers of machinery for accomplishing this by electric methods?"

[Sulphuric acid solutions of silver are generally obtained in treating alloys of gold and silver in which the latter metal always predominates. The gold is separated from the granulated alloy by boiling in concentrated sulphuric acid, which converts the silver into sulphate of silver in the form of a pasty mass. This is dissolved in boiling water and the finely divided gold is left as a black powder, which, when accumulated in sufficient quantity, is well washed and dried. The sulphate of silver solution is drawn off into leaden troughs, where it is left in contact with copper shavings.

The copper enters into solution, forming sulphate of copper, or blue vitriol, as it is commonly called, and the silver is separated, in a finely-divided state, as a gray powder. This is allowed to settle, the solution of copper sulphate is run off into another cistern, and the silver is washed with fresh water, drained and compressed by hydraulic pressure in cast-iron boxes, making cakes of about 60 pounds each. These are dried, melted in plumbago crucibles, and cast into ingots.

The sulphate of copper is crystallized out, after concentration by boiling, and is disposed of for various purposes. When there is no market for the copper sulphate, the solution is decomposed by scrap iron to recover the metallic copper.

We know of no electric method of treating the silver sulphate solution and have been unable, on inquiry, to obtain the names of any makers of electric machinery for the purpose.]

HOW MANY LEAKS ARE ALLOWED IN AMERICAN WATER MAINS?

G. H. **BENZENBERG**, City Engineer of Milwaukee, Wis., writes: "Regarding Mr. W. Perry's inquiry in your issue of August 9, I would say that I do not think any water-works engineer or superintendent will allow any leak to exist knowingly in any length of lines of water main, and I cannot conceive how any one would permit them to exist to a given number per mile or upon any ratio. A leak in a joint under pressure, however small, is too dangerous to permit its continued existence when discovered. It occurs to me that the article referred to may have had reference to leaks that do and will exist on fixtures and along a line of water main, but whose locations are unknown to the authorities, yet the existence of which must be acknowledged and possibly considered in questions touching the consumption or waste of water, etc., and was not meant to convey the idea that American engineers allow their vigilance to slumber to the extent of seven established leaks per mile. That number may have been the result of examinations of long lines of main made for the purpose of locating leakage where the consumption indicated that a leakage must be taking place."

W. L. **CAMERON**, Superintendent of the Artesian Water Company, Memphis, Tenn., writes: "I should say that 'seven leaks' (on an average) per mile of water pipe put down would show a very poor job of pipe laying. I assume that is the question Mr. Perry wants answered. We have 70 miles of pipe, and have put in some 30 miles during the past few years, and I think it is safe to say we have not averaged two leaks to the mile. The fact is that all pipe should be carefully tested before being put in the ground, and their joints carefully yarned, run and calked. We have put in miles of pipe that has never so far developed a single leak."

EDWIN DARLING, Superintendent of the Pawtucket, R. I., Water-Works, writing on the same subject, says: "I do not allow any leaks per mile. We expect perfect work, and a guarantee for one year. I have had laid under my superintendence 70 miles of pipe within the last ten years and have never had 15 leaks on the whole line. If you have a contractor that means to do good work you will have no trouble; if not you can expect more than seven leaks to the mile."

L. H. **GARDNER**, Superintendent of the New Orleans, La., Water-Works, writes: "I have laid a great deal of pipe and claim some experience, but have never heard of such a thing as wilfully providing or allowing leaks in such work. I doubt if your correspondent is serious in his question."

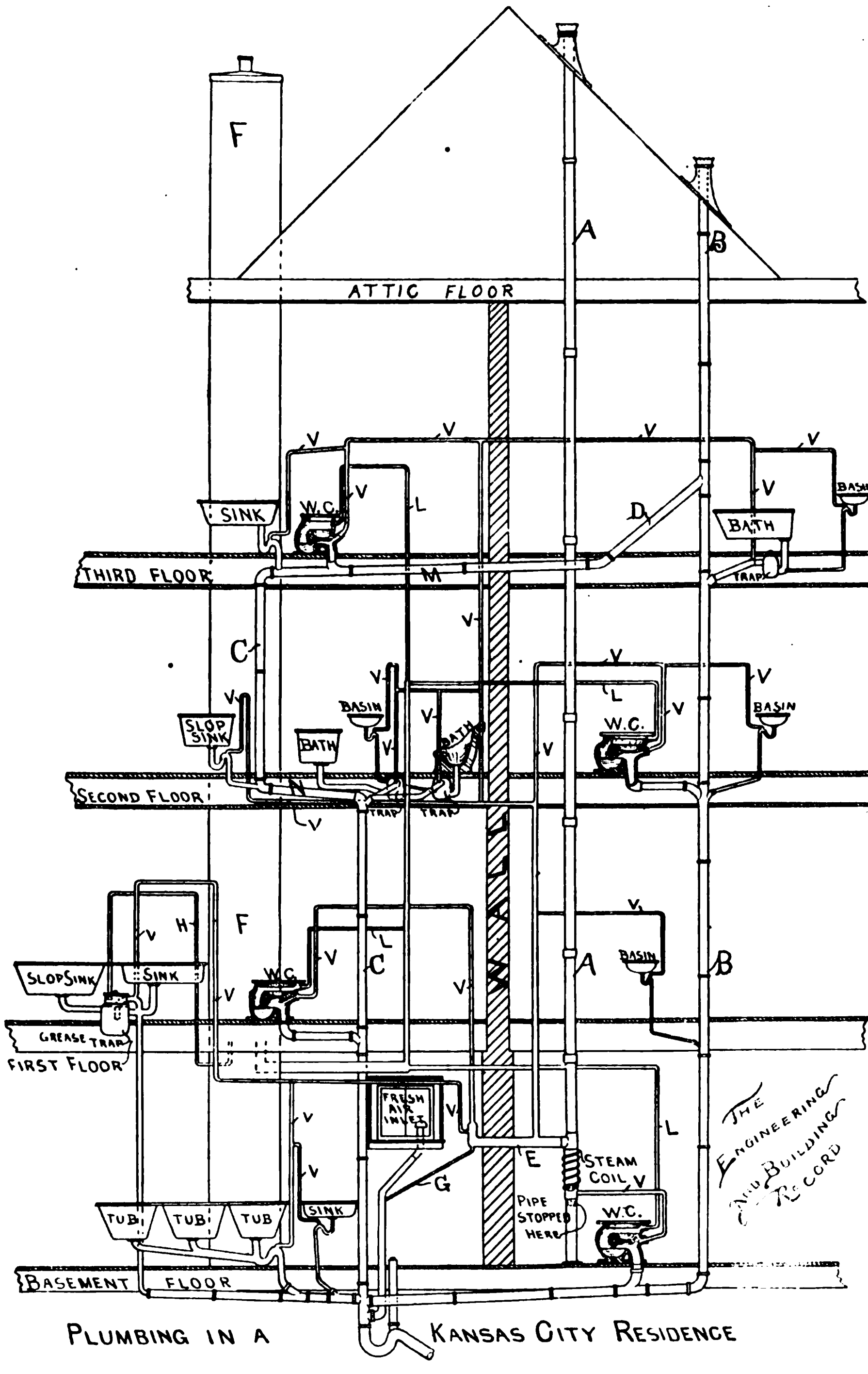
ACCORDING to a Western paper the little city of Lebanon, north of East St. Louis, has taken the initial steps toward the establishment of water-works. A distributing tank or reservoir is to be erected on the public square and water will be pumped into it by the engines of the Lebanon factories.

DOMESTIC
PLUMBING HEATING LIGHTING & VENTILATION
ENGINEERING

PLUMBING IN A KANSAS CITY RESIDENCE.

We print herewith a letter from an old plumbing friend and an illustration prepared from his tracing.

We believe such letters are of especial interest, and that they show and develop interest in the proper arrangement of work and that they will elicit practical discussions and replies, both from the masters in the craft and members who may see points to make and questions to ask.



Plumbing in a Kansas City Residence

The arrangement and laying out of a job, and the efficiency and economy of the system, as a whole, are of great importance, and in these points the young plumber especially has most difficulty. The details of the work, making the joints, fitting the pipes, setting fixtures, etc., are important, but each is separate in itself and only requires skill of hand. It may be tested and criticized by any person of fair mechanical training; a workman may make it perfectly and yet be incompetent to lay out the simplest system. The latter requires ability to apply and follow out principles, the consideration of ordinary and extraordinary conditions, and the best or most available methods at hand.

These qualities are acquired by study, observation and experience; nowadays all plumbers can easily acquaint themselves with the scientific principles involved in their work, and nothing will more assist them in understanding and designing work than to see the jobs actually constructed by others, as in this case, and to study their good and bad points, follow out the operation of the system, understand its reasons and devise changes to produce certain effects or remedies. Such suggestions should be criticized by others, some of whom may have had similar cases in their own experience, and can describe their own solution or approve or object to a proposed one.

Such hints from practical men are interesting and may be valuable to the wisest; they raise live questions and show real interest, progress and pride in creditable work.

Our columns are open for such communications, and we invite our observing, thinking readers to write whenever they see an interesting point; it may be plain to them and puzzling to others, or the reverse; no matter how rough the pencil sketch or diagram, or how brief the description, or whether or no the sketch needs description. Do not waste time and labor on scale drawings or elegant and grammatical writing, the facts and practical ideas are the points desired; our draughtsman can make the drawings clear and accurate, and the editor can easily smooth and correct the language.

If a detail or a system is wrong or unsatisfactory, so much the more interesting; far more is to be learned by mistakes than successes.

Our correspondent, who signs himself T. H. S., Kansas City, Mo., writes: "Inclosed I send you a tracing of the system of plumbing just completed by Mr. A. Grey, in a private house, where all the trap vents V V, etc., are carried to foot of stack A, which has a steam coil intending to promote circulation. The local vents L L, etc., from the water-closets and H from a grease trap open into a brick flue F.

"I would like to hear what other master plumbers and journeymen think of the system."

HEATING AND VENTILATING SCHOOL-HOUSES.

(Continued from page 171)

In the paper of Mr. Theodore P. Perkins an account was given of what was accomplished at Lynn, Mass., during the last five years in ventilating several primary and grammar school buildings under the general direction of Dr J. G. Pinkham, of the School Board. Mr. Perkins furnished more or less advice for all the improvements here mentioned.

The Chase Avenue school-house, at West Lynn, although modern and well built, had no efficient airing appliances, and chemical analysis of its air, when in use, showed $\frac{29}{10000}$ of carbonic acid, a greater proportion than in any other building examined. This fact, and the testimony of the noses of persons interested pointed to dangerous organic contamination, and alterations were resolved upon, following the general method described by A. C. Martin, architect, in the report of the Massachusetts State Board of Health for 1871.

The old chimney in the rear wall was torn down and a new one built in its place, with two plain flues in it each two feet square, the chimney being covered with a galvanized iron cap. These outlet flues were connected, by rectangular openings at the levels of the respective floors, with platforms about eight inches high, two in each room, running from the chimney each way along the rear wall, then turning and running along the side walls toward the front. One of these platform ducts in each room was cut off by the chimney from direct connection with its proper flue, and connection was made by boxing around the chimney. Twelve rectangular holes in the edges of the platforms, obstructed by iron registers, connected them with each room.

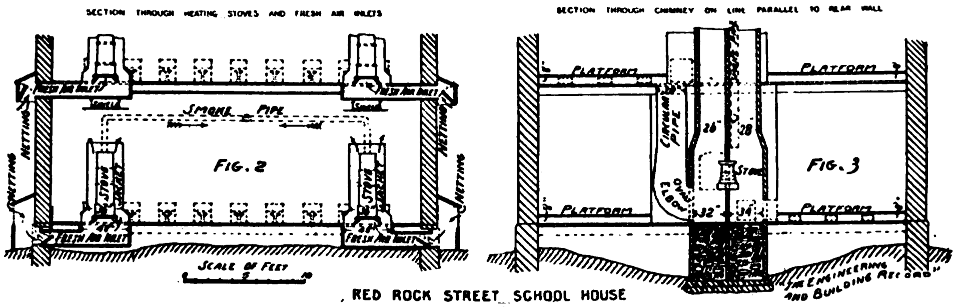
Fresh warm air was supplied through jacketed stoves. The stoves were of the "pyramid" style, about 6½ feet high, 18 inches in diameter at the base and about 15 inches at the top. Each was encircled by a "jacket" or cylinder of galvanized sheet iron, 3 feet in diameter, resting on the floor, and open at the top, the front being cut into for access to the stove doors. The floor boards were cut away inside the jacket, the stove being supported on special strips, and a cold-air duct was built, starting from the space under the jacket and running horizontally through the side wall of the building, to the outer air, the outside opening being protected by a hood and wire netting, and provided with hinged flaps or valves for shutting the air-box when not in use. The stoves were placed near the front of the room in each case, and within a few feet of the side wall, so that the cold-air ducts were short. These ducts were supposed to be large enough to give a full supply of air when only one stove (and therefore only one inlet), was in use in each room. The smoke-pipes in each room were united, and run up through the middle of the chimney flue for that room and through the top of the cap, ending above everything else. Mr. Perkins' attention was first called to this apparatus in January, 1885, when it had been in use some weeks

The Sanitation Committee which had been appointed, seeing that the heat from the stove pipes did not move as much air as was desired, had broken through the *with* or partition between flues, at the base, and put in a kerosene stove to heat both flues, but this device was not working well. A current of air was observed to blow horizontally across the stove, causing the flames to flare, and sometimes to go out, thus adding kerosene fumes to the other malodorous substances in the school-rooms. This air-current was accounted for by the peculiar construction of the chimney-cap, which resembled in general appearance a bird house, having a pitch roof and metal slats on four sides. It was divided by an upright partition, which was virtually a prolongation of the with of the chimney. The wind blowing against this partition was deflected down one flue, and, to get out, had to go up the other flue or into the school-room. It did both, usually.

The upright partition was removed and the blind-slats changed to admit air more freely, but other things remained to be done. The inlets from the platforms into the chimney were, as aforesaid, at the levels of the respective floors, one of them being about 5 feet and the other about 16 feet above the point where most of the heat was applied. There being no chance for air to get in below this point (for the door from the cellar into the chimney was kept closed) it followed that most of the school-room air must go down before it could go up—in other words, there must be in the lower part of each flue two currents, one upward and one downward, or else there must be a downward current in one flue and an upward current in the other, the result in either case being to take away about half the efficiency of the apparatus. This was changed—the high inlets were stopped, all air was carried through 28-inch tin pipes (one of them running through the lower school-room) to the very bottom of the chimney. The oil stove was abandoned, and a small "ring cylinder" cast-iron coal stove was set in the with of the chimney, a foot or two above the point where the foul air entered, the two flues being wholly separated by the stove and brickwork. Again tests were applied, but the draught was still too feeble. Search was made, and it was found that the spreading bases of the large stoves blocked up a large part of the air space in the lower parts of the jackets. Then the bases of the jackets were made flaring, to allow as much air space at those points as in other parts of the air channels, and the fresh air inlets for the lower room were enlarged. Air-meter tests taken just after these changes were made indicated the passage of about 40,000 cubic feet per hour through the lower room, the temperature out of doors being 15° to 20° Fahr., and in the school-room 63° to 66° Fahr. The draught in the upper room was a little less, probably on account of the small size of the fresh-air inlet and increased length and friction in the outlets.

Experience at this building prepared the way for other like enterprises. Three other 2-room primary buildings have since been ventilated on the same general plan; their apparatus differs from that just described in the following particulars:

At the Red Rock Street school-house, in 1886, the chimney flues were built large enough to have 4 square feet of clear sectional area in each, after deducting the obstruction caused by the smoke-pipes, which were of fireclay, and set in the corners. No cellar was under the rear of this building, hence the flue-heating stove was set above the first-floor level, and the foul air came into the chimney just below it.


SECTION THROUGH HEATING STOVES AND FRESH AIR INLETS
FRESH AIR INLET
SMOKE PIPE
NETTING
STOVE
FIG. 2
SCALE OF FEET
SECTION THROUGH CHIMNEY ON LINE PARALLEL TO REAR WALL
PLATFORM
CIRCULAR PIPE
26"
28"
STOVE
OVAL ELBOW
32"
34"
FIG. 3
THE ENGINEERING AND BUILDING RECORD

RED ROCK STREET SCHOOL HOUSE

Experiments at the Chase Avenue building had proved that most of the air was drawn through the platform holes nearest the chimney; therefore no side platforms were built at Red Rock Street, and large openings were made through the brickwork, leading directly from the lower room into the chimney. The foul air from the upper room was carried down through the lower room to the base of the chimney by a 30-inch circular tin pipe. The bases of the jacket were somewhat improved in shape, with perhaps a slight gain in effectiveness. Instead of registers, coarse wire netting, about equal to one inch square mesh, was stretched across all outlet openings, and two wooden slides in each room shut off all the outlets when not in use. The fireclay smoke pipes in the chimney stopped on a level with the top of the brickwork, and a rectangular cap of the "Emerson" type covered the whole. The difference of temperature between the air at the floor level and that at the breathing line (3 feet above floor), ranged from two to seven degrees with outside temperatures 16° to 35° Fahr. The building is of brick, and warm. All who have to do with this school-house pronounce the air to be of exceptional purity. The task of looking after the fires, to keep the temperature of the room even, is, of course, only one of very many others imposed upon the teacher, and in practice, the temperature varies, at times, considerably from the normal of 68° Fahr., being usually too high.

At the Baltimore Street (old) school-house, in 1887, the air supplying and air removing appliances were placed in the same end of the room, following the suggestion of Warren R. Briggs, architect, who states as the result of experiments with models that this plan secures more thorough diffusion of the air. In the upper room, two small jackets were built, one on each side of the new chimney, the cold air being taken just above the projecting base of each stove. In the lower room a double jacket was built, containing two stoves, one or both of which might be fired at pleasure. Separate smoke pipes inside the chimney were dispensed with, the smoke being discharged directly into the large exhaust flues (each about 2 feet square.) No inconvenience from this arrangement was ever reported. The fullest opportunity to test the peculiar features of this building were not granted, as the Board of Aldermen, in its wisdom, saw fit to build a four-room school-house on this site the following summer. The ventilating apparatus of the old building was removed to the Jackson Street building, and worked over into a new one. Some few innovations were adopted here. For lack of space the two stoves with their jackets were set close together in one of the front corners of each room, and there was for each room only one foul air outlet into the chimney; protected by 3-inch iron gratings instead of wire netting. The smoke pipes were run straight from the stoves to the chimney, disregarding the unwritten law which says that they must run level, and parallel to the walls of the room. The fresh air inlet ducts for the lower room were connected, making a continuous pipe, nearly straight, from one side of the building to the other. For the upper room, the duct turned at right angles, and there was an opening in the front wall and another in the side wall.

In 1885 the Ingalls school-house on Essex Street was taken in hand, but the alterations were not radical enough to bring it up to a proper standard, although there was some improvement. The building is almost the exact counterpart of the Shurtleff school in South Boston, containing 14 rooms and a large hall. The old wooden outlet ducts were left in place, but each group of them was capped with a circular Emerson ventilator—rectangular ones would have been better. Eight of these were on the main portion of the roof, which was rather flat, with a large square cupola in the middle, and the other two were on a tower, in front, and were several feet above all the others. Measurements at the room outlets connecting with these two ventilating caps showed a much stronger draught in these than in the others, in high winds; in some cases even the strong draught in one of these caused a reflux in one of the others, both being connected with the same room. Several other minor improvements were made, such as substituting coarse for fine wire netting, etc. Measurements at this building showed as the result of removing a wooden frame strung with ⅝-inch wire netting from each of several foul air outlets, a gain of 25 to 30 per cent. in discharge, which was nearly in proportion to the area gained by the change. This shows how easy it it is to make air-moving appliances inoperative by neglecting a few small details. An air channel is practically only a little larger than its smallest part. Yet Mr. Perkins says that he has lately seen small outlet openings in a school room covered with two screens each—a half-inch mesh inside and a *sixteenth-inch* mesh outside—the two nettings being about one-half inch apart. If fine wire nettings must be used, the size of the openings should be greatly increased. But coarse gratings, especially if they are easily removable, are probably far better.

(TO BE CONTINUED)

C. L. HOTZE, of the firm of Adams & White, lawyers, of Cleveland, O., is said to be at work securing options for the transfer of some of the largest sewer pipe works in America to an English syndicate. Mr. Hotze's plan is to secure options on 19 sewer pipe works and five tile manufacturing companies which he has in view, and sell the companies in the London market. There is no organized syndicate that wishes to buy the works. It is believed that a combination of companies would strengthen and maintain the prices of sewer pipe and prevent future cutting.

REGULATION OF PLUMBING.

A MARYLAND act requires plumbers to get a certificate of competency from the State Board of Commissioners of Practical Plumbing before they can engage in business in the city of Baltimore. According to *Bradstreet's* the Maryland Court of Appeals lately held this act constitutional in the case of Singer *vs.* The State. The court said: "No one questions the right of every person in this country to follow any legitimate business or occupation he may see fit. This is a privilege open alike to every one. His own labor, and the right to use it as a means of livelihood, is a right as sacred and as fully protected by the law as any other personal or private right. But broad and comprehensive as this right may be, it is subject to the paramount right, inherent in every government, to impose such restraint and to provide such regulations in regard to the pursuits of life as the public welfare may require. * * * As to the common and ordinary occupations of life, little or no regulation may be necessary; but if the occupation or calling be of such a character as to require a special course of study or training or experience to qualify one to pursue such occupation or calling with safety to the public interests, no one questions the power of the Legislature to impose such restraints, and prescribe such requirements as it may deem proper for the protection of the public against the evils resulting from incapacity and ignorance; and neither section 1 of the fourteenth amendment of the Federal Constitution, nor article 23 of the Bill of Rights of the Constitution of this State, was designed to limit or restrain the exercise of this power. It is in the exercise of this power that no one is allowed to practice law or medicine, or engage in the business of a druggist, unless he shall have been found competent, and qualified in the mode and in the manner prescribed by the statute; and although the business and trade of a plumber may not require the same training and experience as some other pursuits in life, yet a certain degree of training is absolutely necessary to qualify one as a competent and skillful workman. We all know that in a large city like Baltimore, with its extensive system of drainage and sewerage, the public health largely depends upon the proper and efficient manner in which the plumbing work is executed, and this being so, the Legislature not only has the power but it is eminently wise and proper that it should provide some mode by which the qualifications of persons engaged in that business shall be determined."

BOOK NOTICES.

POOR'S MANUAL OF RAILROADS FOR 1890; By H. V. & H. W. Poor New York; Price, $6.

Poor's Railroad Manual for 1890, the introduction to which was noticed in a recent issue, has just made its appearance. It is the twenty-third annual number of that well-known work, its principal new feature being the introduction of special maps of the leading railroads of the country These maps, 51 in number, have been carefully prepared, and are of considerable interest and value, showing the lines of railroad in the territory covered, and also some of its chief topographical features. The general character of the work, as we had occasion previously to remark, has become so familiar that we need not dwell upon it here to any extent. The railroad statements are arranged in two parts, the first comprising the statements of all the steam railroads in the United States and Canada, and of the chief ones in Mexico, and the second part, or appendix, giving the statements of street railroads and private commercial railroads, State debts and liabilities, officials of steam railroads, &c.

IN 1887 the water supply of Rotterdam became so much infested with the *Crenothrix*, and with other plants and animals, that a commission of investigation was appointed, and new filters and other works built. Dr. F. Dupont and Professor Hugo de Vries studied the growths by means of laboratories arranged at the water-works, and found that the *Crenothrix Kuehniana* was the chief cause of the Rotterdam water supply difficulty. This organism, one of those known as "iron bacteria," had previously been found to be the chief difficulty in connection with the water-works troubles of Berlin in 1878. It is derived from the basins and canals of unfiltered water. Fresh water crustacea also entered the filtered water, and increased very rapidly, the *Asellus* eating the woodwork used in filters and reservoirs.

CONTRACTING NEWS DEPARTMENT.

A WEEKLY RECORD

OF SPECIAL INTEREST TO CONTRACTORS, BUILDERS AND MANUFACTURERS OF ENGINEERING AND BUILDING SUPPLIES.

CONTRACTING INTELLIGENCE

Our readers will oblige us by notes, clippings, or any information which will put us in the way of obtaining early and reliable news for our "Contracting Intelligence." *Information of importance sent to us exclusively, and not elsewhere published will be liberally paid for.*

For works for which proposals are requested see also the "Proposal Columns,' pages i-ii-191.

WATER.

For Additional Water Items see Proposal Columns.

Springfield, Ill.—The managers of the water-works propose putting down 3½ miles of 30-inch water pipe. They are now using 15-inch pipe. The work will not begin, however, for some time.

Steelton, Pa.—C. W. Traham, Secretary of the Council, writes: "The borough of Steelton has taken no steps whatever in building water-works. A company of persons, none of whom are residents of this place, has taken out a charter to build water-works here. This is all we know definitely. Whether they will ever build water-works remains to be seen. So far as we are informed this company is known as the Steelton Water Company, and has its office in Philadelphia."

Goldendale, Wash.—Town Clerk W. B. Pusley writes: "The city has been bonded in the amount of $12,500. The contract for furnishing all materials, including pump, reservoir and hydrants, has been given to John Corkish, of Portland, Ore. He is to put in the plant complete."

Louisville, Ky.—Reports say that S. J. Hobbs, W. J. Dodd, and others, have incorporated the Domestic Water Works Company to construct water-works, etc. The capital stock is $50,000.

Cannondale, Wash.—A water-works system is to be established at this place by the Cannondale Water Company at an estimated cost of $20,000. Address A. R. Cannon for particulars.

Lee, Mass.—The local water supply is to be improved.

Peru, Ill.—The committee to which was referred the proposition of the Peru Electric Light Company to put in water-works, has recommended that a franchise be granted.

Guthrie, Okla.—It is probable that steps will soon be taken towards improving the local water supply.

Menasha, Wis.—Reports say that this place is to have a system of water-works.

Vinton, Va.—Reports say that the contract for constructing the local water-works plant has been awarded to S. B. Mosby & Company, of Bedford City.

Chicopee, Mass.—The local officials will soon want proposals for 650 feet of 8-inch cast-iron pipe to connect the present water main with the Dwight Company's pumps, and also for laying the same.

Lima, O.—Reports say that there is considerable dissatisfaction over the quality of the local water supply and that steps will soon be taken to improve it.

Sioux City, Ia.—The surveys for the projected water-works plant on the Big Sioux have been completed and estimates will soon be wanted.

Cisco, Tex.—The city will soon hold an election to decide upon a proposition to issue bonds for the construction of water-works.

Brookfield, Mo.—A committee which has been investigating the water-works question has reported in favor of building a system to be under municipal control.

Arlington Heights, Tex.—A water-works system is to be established at this place by the Chamberlin Investment Company.

Decorah, Ia.—The water-works system at this place is to be considerably extended.

Perth Amboy, N. J.—At a mass meeting held here August 16, it was unanimously resolved to submit the question of establishing a system of water-works to a vote of the people at an early date. It is proposed to bring the water from Aguan Park, near Metuchen. For further information, address Mayor E R Pierce, as above. City Clerk James S. Wright writes: "The Council is taking steps towards the adoption of a public act which will authorize them to provide a supply of pure and wholesome water for the citizens."

Lebanon, Pa.—It has been decided by those in charge to take immediate steps towards improving the local water supply.

Brookville, Ind.—The people of this place are pushing a movement to establish a water-works system.

Gallatin, Mo.—Specifications, etc., are being prepared by S. T. Haynes for a system of water-works to be established at this place.

Beeville, Tex.—This place is to have a system of water-works. For particulars address Mayor A. C. Jones, as above.

Oxford, N. C.—The city will hold an election at an early date to decide upon the proposition to issue $50,000 of bonds for the construction of water-works.

Conneaut, O.—This place is to have a system of water-works. There will be eight miles of mains, 75 hydrants, two compound duplex pumping engines, two 70-horse-power steel boilers, and a stand-pipe 20 feet in diameter and 100 feet high. Water will be taken from a driven well system on the shore of Lake Erie.

Trenton, Tenn.—The city officials have finally decided, by a popular vote, to issue $20,000 in bonds for the construction of water-works.

Keithsburg, Ill.—According to numerous reports this place is to have a water-works system.

Coldwater, Mich.—The question of bonding the city to the amount of $70,000, for the construction of water-works, was voted on August 18, 1890, and carried.

Lindsay, Can.—Reports say that New York parties have made a proposition to put in water-works at this place. It is proposed to take a supply from artesian wells.

Pueblo, Col.—The Pueblo Water Company has been incorporated here by H. J. Fitch and others. The objects include the laying of pipes in Bessemer and Pueblo. Capital, $300,000.

Modesto, Cal.—At a joint meeting of the Modesto and Turlock irrigation directors, held August 9, it was decided to build a joint dam 90 feet high in the Tuolumne River, 1,800 feet above the Wheaton dam, for the use of both districts. The engineers of each district will submit plans for a masonry dam, the best plan to be accepted by the boards in joint session. The amount of water to be diverted by each district is upon the basis of the acreage of the districts.

Toledo, Ia.—The people of this place have voted to bond the town in a sufficient sum to enable establishing a water-works plant.

Fort Worth, Tex.—It is probable that the construction of the projected water-works system for this place will soon commence.

East Providence, R. I.—The matter of granting a franchise to the Riverside Water Company, to furnish water for domestic and general use, was considered at a special meeting August 18, and indefinitely postponed.

Iona, Mich.—City Clerk W. H. Hearsey writes: "This city has ordered survey plans and specifications for a reservoir of 500,000 gallons capacity. I do not know whether it will be built or not."

Gouverneur, N. Y.—L. J. Richardson, of Cortland, has received the contract for building the new water-works plant at this place at $53,000. The total estimated expense of the construction, including engineering, is $59,800. The water tower will be 30 feet in diameter and 40 feet high.

Centerville, Iowa.—Reports say that this place is to have a water-works system.

Tacoma, Wash.—The Tacoma Mill Company of this city, has decided to shortly increase its water supply, and with this end in view, the plans are being prepared for a reservoir, to hold 600,000 gallons, which the company proposes to erect. The plans are being drawn in the office of Assistant Engineer A. Rydstrom. It is proposed to so construct the reservoir that the water supply may be derived from the springs on the bluff top. The reservoir will cost in the neighborhood of $250,000.

Mobile, Ala.—Our correspondent writes: "The contract for building the water-works in Shelby Ville, Shelby Co., Ala., has been let to H. Merrigold, of Anniston, Ala. The water will be taken from Freestone Springs in neighborhood. Its system will consist of nine miles of 12, 8 and 6-inch pipe; one 2,500,000 Dean pump, and one 1,500,000 Worthington pump; stand-pipe."

Elroy, Wis.—City Clerk E. S. Willey writes: "The city will establish a system of water-works, work will not be begun, however, until early next spring. This is on account of a deficiency in the charter, which will be amended when the State Legislature convenes."

Brooklyn, N. Y.—The Aldermen have adopted the report of the Water and Drainage Committee giving City Works Commissioner Adams power to go ahead and spend $700,000 on improvements in the water supply in the portion of the city bordering on the high ground about Prospect Park.

Cairo, Ill.—Thos. W. Gannon, Superintendent of the Water-Works, has been awarded the contract for building sewers on certain streets.

Independence, Mo.—The Superintendent of the Independence Water Company writes: "We intend to change our source of supply. Instead of pumping direct from the Missouri River, we will try and get a supply from dug or driven wells, near the river. We will erect a new pumping plant; will need two duplex pumps ¾ million gallons each, with the necessary steam plant to operate them, a new stand-pipe 150 feet high by some 15 to 20 feet in diameter, about two miles of 14-inch and some three miles of 4-inch mains, with the necessary valves, etc. While we have been getting rough estimates as to the probable cost of these improvements, nothing definite will be done until after September 4, when an election will be held by stockholders for the purpose of increasing the bonded indebtedness from $60,000 to $100,000."

Palo, Mich.—It is proposed to issue bonds for the construction of a system of water-works at this place.

Iron Mountain, Mich.—The Iron Mountain Water-Works Co. has been incorporated; capital, $75,000.

Water-Works.—See our Proposal Columns for information regarding water-works and water-works furnishings at the following places: Canton, O.; Quebec, Ont.; Gainesville, Ga.; Norwalk, Conn.; New York City; Hoboken, N. J.; Algona, Iowa; Pasco, Wash.; Franklinville, N. Y.; Newport, Ky.; Allegheny, Pa.; Austin, Tex.; Madison, N. J.

SEWERAGE.

For Additional Sewerage Items see Proposal Columns

Findlay, O.—City Clerk Marion G. Foster writes: "Sewer District No. 1 has been established and the Board of Improvements has recommended the immediate construction of the same. The necessary ordinance providing for the construction will probably be passed by the Council soon. The system consists of six main sewers and about 60 sub main sewers."

Joplin, Mo.—Messrs. Rosewater & Chrysler, civil engineers, Omaha, Neb., have completed plans and submitted their report with estimates of a system of sewerage for the city of Joplin, Mo. The plans were approved and about $20,000 will be expended on work upon the system this season.

Butte, Mont.—The sum of $70,000 has been voted for additional sewers at this place.

Columbus, Ga.—The officials have decided to issue bonds for the construction of a system of sewers.

Williamsport, Pa.—Reports say that extensive improvements are to be made to the local sewerage plant.

Braintree, Mass.—Reports say that considerable sewer work is to be done at this place.

Little Falls, N. Y.—Considerable sewer work is to be done at this place. Address the Town Clerk, as above.

Batavia, N. Y.—A new system of sewerage is to be introduced at the Batavia Institution for the Blind. The State has appropriated $12,500 for it. It is expected that the swamp near the institution will be drained

Ashland, Wis.—The City Council on August 12 voted the sum of $30,000 to be used in making sewer extensions.

Kansas City, Mo—An ordinance providing for the establishment of a sewer district that will drain over 600 acres of the city lying between Eighteenth Street and Forest Avenue, Thirty-first Street and Highland, will be introduced at the next session of the Common Council. It has just been passed upon favorably by the Board of Public Works, and is now ready for the action of the two houses. The estimated cost of the main and lateral sewers in the three districts is $100,000.

Brunswick, Ga.—Important steps will soon be taken towards establishing a system of sewers at this place.

Sewers.—See our Proposal Columns for information regarding sewer construction at the following places: Danbury, Conn.; Wilmington, Del.; Cleveland, O.; Key West, Fla.; New Haven, Conn.; Vancouver, B. C.; Para, Brazil.

BRIDGES AND IRON STRUCTURES.

For Additional Bridge Items see Proposal Columns.

St. Paul, Minn.—There is a proposition to bridge the Omaha tracks at Payne Avenue with a bridge of iron in place of the present one of wood.

Lyons, Iowa.—The Lyons and Fulton Bridge Company will build a highway bridge over the Mississippi River between Lyons, Iowa, and Fulton, Ill. The structure will be 2,650 feet long from end to end of approaches, the river being crossed by one 200-foot span, three 330-foot spans, and one 360-foot channel span, all on masonry piers, the superstructure to be of steel. C. F. Loweth, of St. Paul, Minn., is the Consulting Engineer for the bridge company. Contract has recently been let to the Chicago Bridge and Iron Works, for the entire work.

Boston, Mass.—The Pittsburg Bridge Company has secured the contract for the Federal Street bridge, for $102,180.

Worcester, Mass.—It is proposed to erect a bridge over the tracks at Lincoln Square, at this place. City Engineer Allen can furnish particulars.

Knoxville, Tenn.—The Cherokee Land Company has a project on hand to open up a new tract of property, and among the other improvements necessary will be an iron bridge, on which it is proposed to expend the sum of $100,000. Gen. J. C. J. Williams, the President of the company, can furnish details.

St. Joseph, Mich.—Mayor Scott, of this town, can give information of a proposed bridge over the St. Joseph River at the foot of State street. The Cincinnati, Wabash and Michigan Railroad are interested.

Evansville, Ind.—Auditor James D. Paine writes: "All bids were rejected for constructing a wrought iron bridge over Pigeon Creek. The Commissioners will re-advertise in the near future."

Iron City, Tenn.—A scheme to place a bridge over Brush Creek is being discussed by the local officials.

Louisville, Ky.—It is proposed to construct an iron highway bridge over Kentucky Street at the expense of the city and the Louisville and Nashville Railroad Company.

Dallas, Tex.—The City Engineer has made estimates for an iron bridge across Turtle Creek on Lemon Avenue. The City Council has been asked to build a bridge across Turtle Creek at Peak Street.

Bristol, Tenn.—Bonds in the sum of $50,000 will be issued at this place for the purpose of erecting five iron bridges on numerous streets.

Tyler, Tex.—The Naches River is to be bridged at this city.

Alexandria, La.—A new railroad bridge is to be built across the Red River at this place at about 200 yards below the mouth of the Rigolette River. The structure will be about 800 feet long, and the piers will be of iron filled with concrete.

Weston, W. Va—Plans have been accepted by the County Commissioners of Suar's County for a new iron bridge, 36 feet wide and 195 feet long, across Hughes River at this place. The Commissioners will soon advertise for bids.

Augusta, Ga.—Reports say that proposals will soon be wanted by the North Augusta Land Company for the new bridge which it proposes to build over the Savannah River at this place.

Brooklyn, N. Y.—The Lewis & Fowler Girder Company, of this city, has been incorporated with the Secretary of State, to acquire, by purchase or otherwise, and to use and dispose of letters patent, licenses, etc., for and in respect of inventions relating to girder rails, etc., and to manufacture and sell these rails. The capital stock is $300,000, and the trustees are John W. Fowler and others.

Lynchburg, Va.—The City Council has ordered the construction of an iron bridge across Blackwater Creek.

St. Paul, Minn.—Reports say that the Mississippi River is to be bridged by the Great Northern Railroad, at a point below the proposed Broadway edifice, in this city.

Detroit, Mich.—The special Council Committee on Bridges will meet August 25, with the City Councilor and City Attorney, to consider the proposition of the Michigan Central Railroad Co. to share the expense of the construction of an iron bridge over their tracks on Baker Street.

Boston, Mass.—The following proposals for the Federal Street bridge draws were opened August 20 by the Engineering Department: Pittsburg Bridge Company, Pittsburg, Pa., $10,218; D. H. Andrews, Boston, Mass., $11,998. The contract was awarded to the Pittsburg Bridge Company.

Chicago, Ill.—Reports say that proposals will soon be wanted for the erection of the substructure of the Canal Street bridge over the South Branch. The estimated outlay is $25,000.

Duluth, Minn.—The contract for constructing the iron work of Howard's Pocket bridge has, it is reported, been awarded to the King Iron Bridge and Manufacturing Company, of Cleveland, O., at $27,100.

Paola, Kan.—Reports say that the County Commissioners of Miami County have advertised for proposals to build bridges at the following places: Across the Marais des Cygnes north of Osawatomie, across the Wea, east of Paola, and at Whiteford, on Bull Creek, in North Marysville.

Pittsburg, Pa.—Reports say the Fifth Street Bridge Company has been formed in this city for the purpose of erecting a bridge and viaduct from the foot of Fifth Street to Stockton Avenue.

St. Paul, Minn.—The Chicago, St. Paul, Minneapolis & Omaha will probably replace the wooden bridge over its tracks on Payne Avenue with an iron structure.

Bridges.—See our Proposal Columns for information regarding bridge construction at the following places: Marble Falls, Tex.; Rome, N. Y.; Brooklyn, N. Y.; Pineville, Ore.

NEW DEPOTS.

St. Joseph, Mich.—The Cincinnati, Wabash and Michigan Railroad will build a new depot here, also round-house and other buildings.

STREET-WORK AND PAVING.

Ashland, Wis.—The City Council has authorized the paving of numerous streets with cedar block.

New Brunswick, N. J.—Considerable important paving work is to be undertaken in this city. The City Clerk can furnish particulars.

Toronto, Can.—There is a project in this city to make improvements in paving, and also to construct several tunnels, and the entire cost of the work is estimated at $186,408. Alderman Hewitt, Chairman of the Committee on Street Paving, can furnish information.

Media, Pa.—Considerable street paving is to be done at this place.

St. Paul, Minn.—A committee from the Arlington Hills Citizens' Union recommends the paving of numerous streets

Toledo, O.—Paving contracts with fire brick have been awarded to Claflin & Miller, at $14,340.45, and Wm. McMahon with cedar blocks, at $4,762.39.

Chattanooga, Tenn.—The following bids for paving were opened by the Board of Public Works on August 14, 1890: For Market Street, Gen. P. M. B. Young bid $2.74 per square yard for sand and $3 30 for concrete; M. E. Maher, $2.69 for sand and $3 35 for concrete; Venable Bros., $2.59 for sand and $3.40 for concrete. For Carter Street, the Southern Construction Company bid $2.40 per square yard, 10 per cent. retained, or $2.34 with all money paid and a five years' guarantee given. General Young's bid was $2.25 per square yard with 10 per cent. retained. For Montgomery Avenue, Southern Construction Company bid $2.42 per square yard, and General Young, $2.30. The amount of paving to be done in all three streets covers about 38,000 square yards.

Johnson City, Tenn.—A meeting was held August 15, to consider the issuance of $50,000 worth of bonds for streets and schools.

Scranton, Pa.—Considerable paving is to be done in this city at an early day.

South Norwalk, Conn.—The sum of $10,000 has been appropriated for paving purposes at this place.

GAS AND ELECTRIC-LIGHTING.

St. John, N. B.—The St. John Electric Light Company has been organized at this place with a capital stock of $50,000, for furnishing lights to cities, towns, etc.

Laconia, N. H.—Improvements are to be made to the local electric lighting plant, at a cost of $10,000.

Morton, Pa.—The Faraday Electric Light Company will erect a plant as soon as a site can be secured. The company expects to supply Secane, Swarthmore and Moore's station.

Portland, Me.—The Orient Electric Company will establish a plant at this place. Capital stock, $100,000. Address Robie Blake, Cornish, Me.

Huntington, Ind.—The Huntington Fuel and Light Company has been incorporated here. Capital stock, $25,000. John K. Brice, Frank D. Townsend and others are interested.

Chester, S. C.—At a recent town meeting it was voted to authorize the Council to contract for a system of electric street lighting at a cost not exceeding $2,000 per annum.

Winchester, Tex.—It is proposed to establish an electric light plant at this place.

Seneca Falls, N. Y.—Immediate steps will be taken to rebuild the electric light plant at this place which was recently destroyed by fire.

McKeesport, Pa.—The Enterprise Light, Power and Heat Co., has been organized here, with a capital of $100,000, to do business at Reynoldstown. The officers are: President, J. E. White; treasurer, Thomas Reynolds.

Beloit, Wis.—The Common Council has contracted with the Beloit Electric Light Co. for thirty 2,000 candle power lights, at $75 a year per lamp, the lights to be run every night until 1 o'clock.

Hollis, L. I.—The Standard Light Co. has been incorporated for the purpose of lighting Hollis and adjoining places. A complete plant is to be established and material will be wanted for a circuit of 200 lights of 20-candle power each. For particulars address E. H. Rath, Corbin Building, New York City. The capital of the company is $500,000.

Milledgeville, Ga.—The local electric light company will double the present capacity of its incandescent system and also add the arc system.

Cohasset, Mass.—Immediate steps will be taken toward establishing an electric light plant at this place.

Eaton, O.—This place is to have electric lights, at an expenditure of $20,000.

Braintree, Mass.—An electric lighting project is being discussed here.

Sheffield, Ala.—The local electric light company is preparing to buy new electric machinery.

Washington, Ga.—A 500 light electric lighting plant is to be established at this place as soon as plans, etc., are completed.

Shelbyville, Ind.—The Indiana Water and Light Co., of this place, is consolidating its electric light and water-works plants. A new building and additional lighting apparatus will be added.

Clinton, Mo.—At a recent meeting of the Common Council it was decided to light the streets of that city with 38 arc electric lights.

Topeka, Kan.—The Johnson Fuel, Gas and Construction Co., has been incorporated here with a capital stock of $200,000. The directors are C. P. Baker, T. D. Cook and others, all of Topeka.

Wellsville, N. Y.—An electric lighting plant is to be established at this place.

Centreville, Iowa.—An electric light plant is to be established at this place.

Canisteo, N. Y.—This place is to have electric lights. For particulars, address Messrs. Bailey & Davis, as above.

Monillton, Ark.—A franchise has been granted to W. J. Stowers and others for establishing, etc., an electric light plant.

Mount Pleasant, Mich.—An electric lighting company has been incorporated here, and a plant is to be established at once. The capital stock is $10,000.

Oil City, Pa.—The city officials will soon want proposals for electric lighting.

Waynesboro, Ga.—The Waynesboro Electric Light Company has been organized here with a capital stock of $7,500. Directors, A. G. Whitehead, P. L. Corker and others.

San Francisco, Cal.—The California Gas, Light and Fuel Company has filed articles of incorporation. Directors, H. B. Smith, Jr., of Alameda, and others. Capital stock, $10,000,000.

Electric Railways.—New electric railways are to be built and improvements are to be made to those already established at the following places: Winnepeg, Man.; Waco, Tex.; Owasso, Mich.; Rochester, N. Y.; Newark, N. J.; Portland, Ore.; Salem, Mass.; Braintree, Mass, Memphis, Tenn.; Paterson, N. J.; Knoxville, Tenn.; Norfolk, Va.; Hastings, Neb.; Beatrice, Neb.

RAILROADS, CANALS, ETC.

Springfield, Ill.—The Citizens' Street Railway Co., of which Charles F. Herman is secretary, will spend $150,000 or more in an electric plant, and the road will be run by electricity.

Marquette, Mich.—The Marquette and Presque Isle City Railway Company has been incorporated, capital $25,000.

Holland, Mich.—The Holland South Shore Railway Company has been incorporated; capital $60,000.

INDUSTRIAL.

Aberdeen, S. D.—At a special election held here it was decided to issue city warrants to the amount of $50,000, to aid in the construction of a railroad from Oakes to Aberdeen and Pierre.

San Francisco, Cal.—The San Francisco Gas Light Company will build a wharf (for the reception of coal cargoes) at the foot of Second Street. M. E. Manson, C. E., can give particulars.

Coatesville, Pa.—Huston & Co. contemplate erecting a steel plant at this place.

MISCELLANEOUS.

Springfield, Ill—C. W. Shinn, architect, has completed plans for a boiler shop, to cost about $35,000. A. L. Ide and E. A. Wilson are interested. Plans will also be made for a furniture factory, in which the same parties are interested.

NEW CORPORATIONS.

Madison, Wis.—The Wisconsin Bee Line and West Superior Railroad Co. has been incorporated. The object of the company is to construct a line from Milwaukee to West Superior, a distance of 360 miles. The capital stock is $3,000,000. The incorporators are C. D. Smith, F. M. Fox, R. O. Bigford, and others.

BIDS OPENED.

Fairbury, Neb.—The contract for building the Jefferson County Court House was awarded August 12 to J. C. Holland, of Topeka, at $52,000. The building is to be of stone and is 90 by 106 feet.

Sherbrook, N. Dak.—The following bids for furnishing 26,000 common or slop bricks were received by L. C. Goplemd, Auditor, August 12: W. P. Alsip, Grand Forks, N. Dak., $235; W. I Warrey, N. Dak., $11 per M., or $286.

Milledgeville, Ga.—T. O. Brown, of Augusta, Ga., has been awarded the contract for the erection of the Girls' Normal Industrial School, at $38,000. Messrs. MacMurphy & Story, of Augusta, are the architects.

Boston, Mass.—The following proposals for the construction of sections 8 and 9, Metropolitan Sewerage System (East Boston), and Sections C and D (Brighton), all in this city, were opened by the Board of Metropolitan Sewerage Commissioners, August 13:

Section 8—Main Sewer—East Boston.

Bidders.	Items and Estimated Quantities.														Total.
	a	d	e	f	g	h	k	o	p	q	r	s	t	u	
	Earth Excavation and Refilling 9 ft. diam. sewer. 4,100 lin. ft.	Rock Excavation. 50 cubic yards.	Brick Masonry, American. 1,650 cubic yards.	Brick Masonry, Portland, 150 cubic yds.	Concrete Masonry, American. 4,350 cubic yds.	Concrete Masonry, Portland. 575 cubic yards.	Spruce Lumber in Place. 120 M feet, B. M.	6" underdrain in place. 300 lin. ft.	8" underdrain in place. 500 lin. ft.	10" underdrain in place. 1,600 lin. ft.	12" underdrain in place. 1,700 lin. ft.	Spruce piles driven. 500 lin. ft.	Cobblestone paving. 25 sq. yds.	Earth excavation and refilling outside of trench. 500 cu yds.	
R. A. Malone & Son,	$10 00	$5 00	$12.00	$13 50	$5.50	$6.50	$30.00	$0.50	$0.60	$0.70	$0.80	$0.20	$1.00	$0.80	
Philadelphia	41,000.00	250.00	19,800 00	2,025.00	23,925.00	3,737.50	3,600.00	150.00	300.00	1,120.00	1,360.00	100.00	25.00	400.00	$96,792.50
Metropolitan Construction Co.,	8.25	5.00	6.86	8.78	5.65	7.57	35.00	0.20	0.25	0 40	0.50	0.15	0.30	1.50	
Boston	33,825.00	250.00	11,310.00	1,317.00	24,577.50	4,352.75	4,200.00	60.00	125.00	640.00	850.00	75.00	7.50	750.00	82,348.75
O P. Roberts,	9.20	2.00	6.75	7.90	5.00	6.35	25.00	0.25	0 35	0.45	0.60	0.20	0.50	0.60	
Cambridge	37,720.00	100.00	11,137.50	1,185.00	21,750.00	3,651.25	3,000 00	75.00	175.00	720.00	1,020.00	100.00	12.50	300.00	80,946.25
Charles Linehan,	8.00	1.00	6.00	7.25	4.00	4.50	24.00	0.50	0.60	0.75	1.00	0.15	1.00	0.75	
Cambridge	32,800.00	50.00	9,900.00	1,087.50	17,400.00	2,587.50	2,880.00	150.00	300.00	1,200.00	1,700.00	75.00	25.00	375.00	70,530.00
National Construction Co.,	7.35	1 00	6.05	7 15	4.35	6.00	23.00	0.25	0.35	0.50	0.65	0.15	0.75	1.00	
Boston	30,135.00	50.00	9,982.50	1,072.50	18,922.50	3,450.00	2,76[illegible].00	75.00	175.00	800 00	1,105.00	75.00	18.75	500.00	69,121.25

VICKSBURG, MISS.—The contract for roofing, plumbing and gas fitting of the new Natchez Hotel has been sublet to H. B. Bruser, of this city, at $80,000.

INDIAN ORCHARD, MASS.—The contract for the brickwork on the additional plant for Chapman Valve Manufacturing Company, Jason Giles, General Manager, has been awarded to D J Curtis, of Springfield, at $8,000.

ELLIS ISLAND, N. Y.—Frank Rinschler, of Stapleton, August 20, received the contract for building the masonry and making the foundation for the main immigration station on Ellis Island. His bid was $13,747. The contract for making the cribwork, with the exception of the breakwater, was awarded to Warren Rosevelt, of New York City, for $37,000.

SPRINGFIELD, MASS.—The following proposals for the erection of the Pynchon School has been received by the city property committee: J. S. Sanderson, $30,845; J. B. Walls, $30,500; Jerry Shea, $29,335; L. H. Scott, $28,877; L. Strong, of Chicopee, $27,641; Patrick Benston, $27,625. The contract has not yet been awarded.

CAMDEN, N. J.—The Board of Education has awarded the contract for the new schoolhouse on Newton Avenue to City Assessor John Corbett, at $19,281.79. The lowest bid was that of Charlton H. Sayre, $18,127, but it was informal. The contract for building an extension to Mt. Vernon school was also awarded to Corbett, at $5,598 63.

SECTION 9—MAIN SEWER—EAST BOSTON.

BIDDERS.	ITEMS AND ESTIMATED QUANTITIES.														Total.
	a	d	e	f	g	h	k	o	p	q	r	s	t	u	
	Earth excavation and refilling, 9 feet diameter sewer. 3,700 lineal feet.	Rock excavation. 50 cubic yards.	Brick masonry, American. 2,000 cu. yds.	Brick masonry, Portland. 110 cu. yds.	Concrete masonry, American. 3,500 cu. yds.	Concrete masonry, Portland. 450 cu. yds.	Spruce lumber in place 125 ft. M. B. M.	6" underdrain in place. 500 lin. ft.	8" underdrain in place. 700 lin. ft.	10" underdrain in place 1,000 lin. ft.	12" underdrain in place 1,500 lin. ft.	Spruce piles driven. 500 lin. ft.	Cobblestone paving. 25 sq. yds.	Earth excavation and refilling outside of trench 500 cu. yds.	
National Construction Company,	$6.35	$1.00	$6.15	$7.15	$4 35	$6.00	$26.00	$0.30	$0 40	$0.50	$0.65	$0.15	$0 75	$1.00	
Boston	$23,495.00	50.00	12,300 00	786.50	15,225.00	2.700.00	3,250.00	150.00	280.00	500.00	975.00	75.00	18.75	500.00	$60,305.25
Charles Linehan,	7.75	3.00	6.00	7.25	4.25	5.25	24.00	0 50	0.60	0.75	1.00	0.15	1.00	0.75	
Cambridge	28,675.00	150 00	12,000.00	797.50	14.875.00	2,362.50	3,000.00	250.00	420.00	750.00	1,500.00	75 00	25 00	375.00	65,255.00
O. P. Roberts,	10.20	3.50	6.95	8.10	5.00	6 35	25 00	0.25	0.35	0.45	0.60	0.20	0 50	0.60	
Cambridge	37.740.00	175.00	13,900.00	891.00	17,500.00	2,857.50	3,125.00	125.00	245.00	450.00	900.00	100.00	12.50	300.00	78,321.00
R. A. Malone & Son,	12.00	5.00	12.00	13.50	5.50	6.50	30 00	0.50	0.60	0.70	0.80	0.20	1.00	0.80	
Philadelphia	40.400.00	250.00	24,000.00	1,485.00	19,250.00	2,925.00	3,750.00	250.00	420.00	700.00	1,200.00	100.00	25.00	400 00	99,155.00

BROOKLYN, N. Y.—The following proposals for furnishing and setting up at the County Almshouse four boilers were opened by the Charity Commissioners August 20: Ch. Cunningham, Brooklyn, N. Y., $8,870; Blake & Williams, New York City, $7,533; Donegan & Swift, New York City, $6,694; Peter J. Donahan & Sons, Brooklyn, N. Y., $6.230; Consolidated Iron Company, Hoboken, N. J., $8,250; Henry Voght & Bro. Manufacturing Company, Brooklyn, $7.300. The lowest bidder received the contract.

GOVERNMENT WORK.

WASHINGTON, D. C.—The following proposals for the work named were opened on the given dates by the Supervising Architect of the Treasury Department:

Vicksburg, Miss.—Iron vault doors for the United States Court House and Post Office at this place; opened August 20. Bidders: National Safe and Lock Company, Cleveland, O., $739.80; Farrell & Co., Philadelphia, Pa., $921; L. L. Leach & Son, Chicago, Ill., $1,183; Barnes Safe and Lock Company, Pittsburg, Pa., $621; Hall's Safe and Lock Company, Cincinnati, O., $726; John J. Milligan, Vicksburg, Miss., $900.

Wilmington, N. C.—Approaches to the United States Post Office and Custom House at this place; opened August 6. Bidders: P. Sinchan & Sons, Raleigh, N. C., per specifications, $16,360.80; using artificial stone for sidewalks, $10,842.05; Thomas E. Wallace, Wilmington, N. C., artificial stone, $12,222; National Paving Company, Philadelphia, Pa., artificial stone, $13,940; Martin Hendricks, Washington, D. C., per specifications, $14,359.34; artificial stone, $11,859.34; J. P. Laurence, Wilmington, N. C., specifications, two bids, $13,614 and $11,500; artificial stone, $12,000 and $11,000.

SECTION C—MAIN SEWER—BRIGHTON, BOSTON.

BIDDERS	ITEMS AND ESTIMATED QUANTITIES.														Total.
	a	d	e	f	g	h	k	o	p	q	r	s	t	u	
	Earth Excavation and refill. 4 ft. 10 in. diam. sewer. 5,800 lin. ft.	Rock excavation. 50 cubic yards.	Brick masonry, American. 1,400 cubic yds.	Brick masonry, Portland. 100 cubic yards.	Concrete masonry, American. 2,300 cubic yards.	Concrete masonry, Portland. 150 cubic yards.	Spruce lumber in place. 100 M. Ft. B. M.	6" underdrain in place. 700 lineal feet.	8" underdrain in place. 1,100 lineal feet.	10" underdrain in place. 1,600 lineal feet.	12" underdrain in place. 2,400 lineal feet.	Spruce piles driven. 13,000 lineal feet.	Cobblestone paving. 25 square yards.	Earth excavation and refilling outside of trench. 500 cubic yards.	
John Cavanach & Co.,	$8.90	$3	$6.75	$7.75	$6 75	$7 50	$28	$0.45	$0.55	$0 65	$0.70	$0.18	$2.00	$8.90	
Boston	51.620.00	150	9,450.00	775.00	15.525.00	1,125.00	2,800	315.00	605.00	1,040.00	1,680.00	2,340.00	50.00	4,450.00	$91,925.00
Aaron A. Hall,	6.85	5	7.00	9.45	4.57	5.38	30	.40	.50	.60	.80	.30	2.25	.80	
Dorchester	39.730.00	250	9,800.00	945 00	10,511.00	807.00	3,000	280.00	550.00	960.00	1,920.00	3,900.00	56.25	400.00	73,109.25
National Construction Company,	5.90	1	7.25	8.00	4.65	5.75	27	.25	35	50	.65	.13	.75	1.00	
Boston	34,220 00	50	10,150.00	800.00	10,695.00	862.50	2,700	175.00	385.00	800.00	1,560.00	1,690.00	18 75	500.00	64,606.25

PHILADELPHIA, PA.—The following bids for repairs to the United States iron pier, in Delaware Bay, near Lewes, Del., were received by C. W. Raymond, Major of Engineers, U. S. A., August 15: Wm. H. Virden, Lewes, Del., $6,514; The Alvin R. Morrisson Co., Wilmington, Del, $5,937.

PROPOSALS.

(Continued from page ii.)

BUILDINGS, Pittsburg, Pa.—Proposals are wanted until August 30, for the erection of five brick factory buildings for the Standard Underground Cable Company. Address Frank I. Cooper, architect, Room 24, Allegheny County Court House, as above.

WATER-WORKS, Franklinville, N. Y.—Proposals are wanted until September 4, for the construction of a complete system of water-works at this place. Address Alfred Spring, Secretary of the Board of Water Commissioners, as above.

SEWER FOUNDATIONS, New Haven, Conn.—Proposals are wanted until September 3, for constructing pile and timber foundations for about, 3,200 feet of sewer. Address A. B. Hill, City Engineer, as above.

WATER-WORKS, Algona, Iowa.—Proposals are wanted until September 1, for the construction of a complete system of water-works at this place. Address W. B. Quaitor, City Clerk, as above.

PAVING, Brooklyn, N. Y.—Proposals are wanted until August 27, for paving numerous streets. Address John P. Adams, Commissioner of City Works, as above.

WATER-WORKS, Gaffney City, S. C.—Proposals are wanted, no date specified for the construction of a system of water-works. Address F. G. Stacy, as above.

SECTION D—MAIN SEWER—BRIGHTON, BOSTON.

BIDDERS.	ITEMS AND ESTIMATED QUANTITIES.														Total.
	a	d	e	f	g	h	k	o	p	q	r	s	t	u	
	Earth excavation and refilling, 4 ft. 10 in. diameter sewer, 5,400 lin. ft.	Rock excavation, 50 cu yds.	Brick masonry, American, 1,500 cu. yds.	Brick masonry, Portland, 100 cu. yards.	Concrete masonry, American, 2,250 cu. yds.	Concrete masonry, Portland, 150 cu. yds.	Spruce lumber in place, 70 M. ft. B M.	6" underdrain in place 500 lin. ft.	8" underdrain in place 1,100 lin. ft.	10" underdrain in place 1,600 lin ft.	12" underdrain in place 2,200 lin. ft.	Spruce piles driven 1,500 lin. ft.	Cobblestone paving 25 sq. yds.	Earth excavation and refilling outside of trench, 500 cu. yds.	
Aaron A. Hall,	$6.85	$5.00	$7.00	$9.50	$4.57	$5.38	$30.00	$0 40	$0.50	$0.60	$0.80	$0.30	$2.25	$0.80	
Dorchester	36,990.00	250.00	10,500.00	950.00	10,282.50	807.00	2,100.00	200.00	550.00	960.00	1,760.00	450.00	56 25	400.00	$66,255.75
Charles Linehan,	5.40	1.00	6.00	7.25	4.00	4.50	24.00	0.50	0.60	0.75	1.00	0.15	1.00	0.75	
Cambridge	29,160.00	50.00	9,000.00	725.00	9,000.00	675 00	1,680.00	250.00	660.00	1,200.00	2,200.00	225.00	25.00	375.00	55,225.00
National Construction Company,	4.75	1.00	6.75	7.75	4.45	5.50	24.00	0.30	0.35	0.45	0.65	0.15	0.75	1.00	
Boston	25,650 00	50.00	10,125.00	775.00	10,012.50	825.00	1,680.00	150.00	385.00	720.00	1,430.00	225.00	18.75	500.00	52,546.25

PROPOSALS.

AUGUST 20, 1890.

SEALED PROPOSALS WILL BE RECEIVED at the office of the Supervising Architect, Treasury Department, Washington, D. C., on or before 2 o'clock P. M., on the 19th day of September, 1890, for all the **LABOR AND MATERIALS** required in the erection and completion of the U. S. Post Office building at WATERTOWN, N. Y. (heating apparatus not included), in accordance with the drawings and specification, copies of which may be had on application at this office or the office of the Superintendent at Watertown N. Y. Each bid must be accompanied by a certified check for $500. The Department will reject all bids received after the time herein stated for the opening of the same; also, bids which do not comply strictly with all the requirements of this invitation. Proposals must be inclosed in an envelope, sealed and marked, "Proposal for the Erection and Completion (except heating apparatus) of the U. S. Post Office Building at Watertown, N. Y.," and addressed to JAS. H. WINDRIM, Supervising Architect. 13

AUGUST 21, 1890.

SEALED PROPOSALS WILL BE RECEIVED at the office of the Supervising Architect, Treasury Department, Washington, D. C., on or before 2 o'clock P. M., on the 8th day of September, 1890, for all the labor and material required for the **EXCAVATION, CONCRETE FOUNDATIONS, STONE AND BRICK WOR** of the basement and area walls of the United States Post Office, Court House, etc., at TROY, N. Y., in accordance with the drawings and specification, copies of which may be had at this office or the office of the Superintendent, at Troy, N. Y. Each bid must be accompanied by a certified check for $500. The Department will reject all bids received after the time herein stated for the opening of the same; also, bids which do not comply strictly with all the requirements of this invitation. Proposals must be inclosed in an envelope, sealed and marked, "Proposal for the Excavation, Concrete Foundation, Stone and Brick Masonry for the Basement and Area Walls of the Post-Office, Court House, etc., at Troy, N. Y., and addressed to JAS. H. WINDRIM, Supervising Architect. 13

BRIDGE, Clifton Forge, Va—Proposals are wanted, no date specified, for the erection of a bridge over Smith Creek. Address the Clifton Forge Company, as above.

CHURCH, Atlanta, Ga.—Proposals are wanted until September 10, for the erection of a church at this place. Address A. D. Adair, as above.

ARMORY, Jamestown, N. Y.—Proposals are wanted until September 10. for the erection of an armory building at this place. Address Hon. I. G. Perry, Commissioner, Capitol, Albany, N. Y.

BUILDINGS, Albany, N. Y.—Proposals are wanted until September 1, for the erection of certain buildings, to include plumbing, etc., at Mattewan, N. Y. Address I. G. Perry, Commissioner, Capitol, as above.

BRICK, Boston, Mass.—Proposals are wanted until September 1, for furnishing 2,000,000 or more hard brick. Address Howard A. Carson, Chief Engineer, Metropolitan Sewerage Commissioners, as above.

PIPE AND CASTINGS, Norwalk, Conn.—Proposals are wanted until August 26, for furnishing, etc., 575 tons of 16-inch cast-iron water pipe, together with such special castings as may be necessary. Address A. H. Camp, Clerk of the Water Company, as above.

BRIDGE, Bastrop, Tex.—Proposals are wanted until September 1, for the erection of an iron bridge over Wilbarger Creek, near Elgin. Address the Commissioners' Court of Bastrop County, as above.

BRIDGE, New Gretna, N. J.—Proposals are wanted until September 15. for the erection of an iron bridge over the Mullica River. Address Charles A. Mathis, Chairman Board of Chosen Freeholders, as above.

POSITIONS WANTED.

TOO LATE FOR CLASSIFICATION.

WANTED.—A FIRST-CLASS PLUMBER OF ten years' experience desires a steady position. Address P. O., care this office.

POSITIONS VACANT.

WANTED.—FOR PERMANENT POSITION, good salary, two first-class draughtsman for detail bridge and structural iron workshop drawings. None but the very best men wanted. Apply by letter, giving references and experience. MILLIKEN BROS., 55 Liberty Street, New York.

Building Intelligence.

NEW YORK.

S w cor 160th st and Amsterdam av, br flat; cost, $15,000; o, Wright, Gillie & Bro; a, H Fouchaux.

9 Vestry st, br warehouse; cost, $45,000; o, F Leggett; a, W H Smith.

S w cor 10th av and 81st st, 3 br flats; cost, $105,000 all; o, P Dempsey; a, E L Angell.

Sedgwick av, cor Academy st, br home; cost, $200,000; o, Webb Academy; a, O B Jennings.

S e cor 16th st and 6th av, br office bldg; $250,000; o, Greenwood Savings Bank; a, R W Gibson.

N w cor Willis av and 135th st, br flats; cost, $30,000; o, G D Ross; a, J C Burne.

BUILDING INTELLIGENCE.

NEW YORK.—Continued.

N s 135th st, 81 w Willis av, 2 br flats; cost, $40,000 all; o and a, same as above.

W s Willis av, 25 n 135th st, 3 br flats; cost, $60,000 all; o and a, same as above.

N w cor 84th st and Madison av, br dwell; cost, $125,000; o, R B Lynch; a, J H Duncan.

39–41 W 27th st, br hotel; cost, $75,000; o, E S Renwick and others; a, Renwick, Aspinwall & Russell.

528 Canal st, br store; cost, $13,000; o, M S Herman; a, F Baylies.

507 W 54th st, br ten; cost, $14,000; o, G Anthon; a, J W Cole.

S s 175th st, 150 w Franklin av, fr dwell; cost, $22,000; o, Mary Seiford; a, J J Vreeland.

S s 97th st, 140 w Amsterdam av, br stable; cost, $15,000; o, M Guggenheimer; a, R N Anderson.

S s 87th st, 150 e 10th av, 12 br dwells; cost, $192,000 all; o, D W James; a, J G Prague.

E s 10th av, 15th to 16th sts, br factory; cost, $600,000; o, N Y Biscuit Co; a, Romeyn & Stevens.

147 Stanton st, br flats; cost, $20,000; o, Lomi & Parker; a, C Rentz.

248–252 W 43d st, 3 br flats; cost, $55,500 all; o, A Moore; a, G Kaister.

Broome st, s w cor Goerck st, 2 br flats; cost, $20,000 each; o, Bernhard Rosenstock; a, W C Frohme.

36 Forsyth st, br and stone flat; cost, $18,000; o, Loomis & Parker; a, C Rentz.

57 Mott st, br flat and store; cost, $15,000; o, Isaac Marks; a, F Wandel.

120 Willett st, br and stone flat; cost, $18,000; o, Fay & Stacom; a, C Rentz.

Wooster st, e s, 120 s Houston st, br warehouse; cost, $60,000; o, Patrick H McManus; a, J A Webster.

Broadway, n e cor 18th st, br, stone and terra cotta office bldg; cast, $200,000; o, Ewen McIntyre; a, R H Robertson.

213 E 21st st, br and terra cotta flat; cost, $18,000; o, Eliza Weber; a, Weber & Drosser.

N s 22d st, 188 e 7th av, 2 stone-front flats; cost, $70,000; o, John Jordan, et al. a, J W Cole.

N s 74th st, 225 w 1st av, rear, br flat; cost, $17,000; o, Philip Braender; a, W Graul.

N s 80th st, 149.9 e 5th av, br and stone dwell; cost, $70,000; o, Samuel C Boehm; a, F A Minuth.

Madison av, s w cor 107th st, 4 br and stone flats; cost, $100,000; o, Hugh Brady; a, E Weirs.

N s 137th st, 100 e Lincoln av, br factory; cost, $15,000; o, John H Droge; a, M V B Ferdon.

ALTERATIONS—NEW YORK.

855 5th av, extension; cost, $8,500; o, Madame F DeBarrios; a, E S Hess & Co; m, Jones & Co; c, W Hamilton.

170–172 Greenwich st, br shop; cost, $20,000; o, New York Steam Co; a, not given.

S s 61st st, 200 e 9th av, br flat; cost, $10,000; o, Leid & Lennon; a, Buchman & Deisler.

4 W 54th st, br dwell; cost, $9,000; o, J D Rockfeller; a, H O Wren.

126–128 E 59th st, br hospital; cost, $12,000; o, Orthopædic Hospital; a, C C Haight.

44 E 57th st, br dwell; cost, $8,000; o, S A Valentine; a, Carrie & Hastings.

BROOKLYN.

N e cor Bedford av and Hayward st, br dwell; cost, $12,500; o, Mrs Margaret Mulvihill; a, H A Billard.

E s Bedford av, 22 n Hayward st, br dwell; cost, $10,000; o and a, as above.

S s Cornelia st, 300 e Bushwick av, 5 fr dwells; cost, $22,500 all; o, R Dreyer; a, C F Naughton.

E s Harvard av, 86 s Herkimer av, fr church; cost, $12,000; o, St John's A M E Church; a, C A Povie.

N s Jefferson av, 480 E Bushwick av, 4 fr dwells; cost, $12,000 all; o and a, R B Miller.

N s Hancock st, 273 w Tompkins av, br dwell; cost, $12,000; o, W Reynolds; a, I D Reynolds.

S s Moffat, 150 w Bushwick av, br dwell; cost, $13,000; o, Evangelical Home Society; a, Th Engelhardt.

BUILDING INTELLIGENCE.

BROOKLYN.—Continued.

Oakland st, n e cor Greene st, 4 fr (br filled) stores and tens; cost, $4,000 each; o, James Kelly; a, F Weber; c, J A and W H Port, m, C C Gately.

S s S 3d st, 100 w Hooper st, 2 br tens; cost, $6,000 each; o and b, J W Lamb & Son; a, A W Lamb.

S s N 1st st, 75 Wythe av, 1 br storehouse and stable; cost, $8,000; o, Thomas W Kiley; a, W H Gaylor.

BETHLEHEM, PA.—Wall and Mable, 5 br and terra cotta dwells; cost, $14,000; o, G H Myers; a, A W Leh; b, no contract let.

BOSTON, MASS.—Knapp st, br mercantile, alteration and extension, cost, $53,000; o, Cobb, Bates & Serxa; a, Hartwell & Richardson; b, McNeill Bros.

Ruthven st near Elm Hill av, fr dwell; cost, $12,000; o, M P W Jones; a, J W Beals; b, Ourish & Rich.

Harbor View st, fr dwell; cost, $7,000; o and b, Hugh H Smith; a, E N Boyden.

Clinton st and N Market st, fr rebuild (fire); cost, $40,000; o, Clinton Market Corps; b, J J Shaw.

43 Central wharf, internal alteration; cost; $6,000; o, J D Williams, Treas; b, S S Goodwin.

436 Meridian st, fr dwell; cost, $7,500; o, S M Stevens; a, I S Eastman; b, Hatt & Rogers.

Cambridge st near Dustin st, fr dwell; cost, $7,000; o, Henry P Kennedy; a, T L Smith; b, James Muldoon.

Conant st and Bumstead lane, fr dwells; cost, $7,500; o, Thos Toohey; a and b, J H Pierce.

BRADDOCK, PA.—A church, to cost, $15,000, is to be erected at this place. Address the pastor of the Disciple Congregational Church, as above.

CAIRO, ILL.—The building of a new City Hall is proposed, as one is badly needed in Cairo.

CHAMBERSBURG, PA.—A hospital bldg is to be erected at this place by the Children's Aid Society. Address Dr J S Hull, as above.

CHICAGO, ILL.—Winter nr 50th, br flats; cost, $35,000; o, Jno S Thomas.

Packers av and 46th, beef house; cost, $30,000; o, T E Wells & Co; b, William O'Brien.

2469 n s Paulina, br dwell; cost, $8,000; o, R J Gannell.

4938–40 Drexel boul, br dwell; cost, $65,000; o, Dr J A M'Gill; a, H Ives Cobb; b, Angus & Girdele.

4119 Vincennes av, br flats; cost, $8,000; o, F N Nelligan; a, W W Myers.

5121–23 Kimbark av, br dwell; cost, $8,000; o, C C Conover; a, N Sprague.

538 46th, br flats; cost, $8,000; o and b, Z F Ringer; a, N H Smith.

4823–29 Drexel boul, br dwell; cost, $75,000; o, Albert Wisner.

170–72 92d, br store and flats; cost, $10,000; o, Hermann Derwedden; a, T Tretholm; b, Daegling & Co.

3300 Wallace, br flats; cost, $11,000; o, Jno Hackett; a and b, C Kerbach.

927 w Adams, br dwell; cost, $8,000; o, Jas McGraw.

1113–15 Lawndale av, br dwell; cost, $13,000; o, Bonney Bros; b, F C Porter.

3836 Wabash av, br flats; cost, $8,000; o, Geo E Core; a, R G Pentecost; b, T A Beckett.

351 Webster, br store and flats; cost, $8,000; o, Frank L Shellenberg.

1430–38 W Congress, br flats; cost, $30,000; o, Elizabeth Cooley.

3646 Michigan av, br dwell; cost, $16,000; o, M Gimbel; a, O W Marble; b, O Anderson & Co.

504–10 Armitage av, br store and flats; cost, $8,000; o and b, Aug Wentel; E Clark.

3803 Vincennes av, br addn; cost, $11,000; o, J R Crocker; b, Williams & Stacy.

1291–1301 Taylor, addn to factory; cost, $20,000; o, Jas A Piper; b, Mortimer & Barr.

BUILDING INTELLIGENCE.

CHICAGO, ILL.—2713 Indiana av, br flats; cost, $12,000; o and a, Jas A Tham; b, A Collender.

Cor Washington boul and Peoria, St Mary's Mission House, adjoining Cathedral; cost, $15,000; o, Episcopal Bishop of Chicago; a, Treat & Foltz.

La Salle and Adams, 2 additional stories to office bldg; cost, $125,000; o, Home Insurance Co; a, W L B Jenney.

951 Ogden av, br flats; cost, $12,000; o, P Bretchmer; a, A J Pott.

Edison Park, lodge bldg; cost, $9,000; a, F Ahlschlager.

Hoyne and La Moyne av, br dwell; cost, $20,000; a, H T Kley.

W Harrison, west of Oakley av, br flats; cost, $12,000; o, Thos Gault; a, W L Carroll.

Michigan av near 12th, 8-story apartment house; cost, $100;000; o, E O Russell; a, Fred Baumann and J K Cady.

2332–48 State, br store and flats; cost, $40,000; o, Jonathan Clark; a, Howe & Shelton.

Lake Shore Drive, st and br dwell; cost, $25,000; o, Hiram N Smyth; a, as above.

Cor Dearborn av and Erie st, 2-story addition to Mentone flats; cost, some $40,000; a, L G Hallberg.

Oakenwald av near 45th st, br dwells; cost, $45,000; o, R F Keith; a, as above.

Park av and Hoyne, br and st dwell; cost, $26,000; o, J J McGrath; a, as above.

1201–23 N Western av, br flats; cost, $160,000; o, Geo L Marchie; a, Perley Hale; b, Wm Zullsdorf.

1027 W 19th st, br flats; cost, 810,000; o and b, Frank Kneaba; a, Anton Charvat.

3312 Indiana av, br dwells; cost, $8,000; o, Hy Heflor; a, Furst & Rudolph; b, A Minor.

225 S Morgan st, br flats; cost, $8,000; o, J L Brown.

123–25 LaSalle av, br office bldg; cost, $60,000; o, Watson estate; a, Bowman & Cody; b, Barney & Rodatz.

9–18 Huron st, br factory; cost, $90,000; o, Jose Tilt; a, M P Bell; b, same as above.

160 bldgs costing less than $7,000 each.

COLUMBUS, O.—State st, br and stone church; cost, $25,000; W H Slade, trustee. 10 dwells; cost, $27,000.

DECATUR, ILL.—Henry F Starbuck, architect, Chicago, Ill., has completed plans for 2 churches, one a Presbyterian, to cost $75,000, and the other an Episcopal, to cost $30,000. R G Young has been awarded contract for the construction. The plumbing has not yet been contracted for.

R L Dickinson, architect, has completed plans for a residence for J S C Cussins, of the same place.

DENVER, COL.—S 5th st, bet 12th and 13th avs, br brewery; cost, $100,000; o, J P Dostal; a, Hiershuer & Hiershuer.

McCollough Addition, br dwell; cost, $8,000; o, Thomas Furgeson.

McCollough Hill Addition, stone dwell; cost, $10,000; o, William Geddes.

McCollough Hill Addition, stone dwell; cost, S10,000; o, David Seerie.

DETROIT, MICH.—Cor Chene st and R R, 4 story br mfy bldg; cost, $40,000; o, Detroit Radiator Co; a, Scott, Kamper & Scott.

Cor Cass and Middle sts, 4 story br hotel, cost, $15,000; o, Wm B Perkins; a, Donaldson & Meier.

Jefferson av, bet Dubois & Chene sts, 2½ story br and s res; cost, $14,000; o, Michael Martz; a, Gordon W Lloyd.

S e cor Michigan av and 4th st, block of 4 4-story br stores; cost, $12,000; o, Thos Kennedy; a, A C Varney & Co.

Junction av, 2½ story br and s res; cost, $7,000; o, Chas Jenkins; a, Spier & Rohns.

1134–6 3d av, 2 story br and s res and barn; cost, $7,500; o and a, H W Holcomb.

Cor Canfield and McDougall avs, br and s church; cost, $30,000; o, St Elizabeth R C Soc'y; a, Donaldson & Meirer.

ERIE, PA.—A seminary, to cost $40,000, is to be erected at this place. Address Rev. Father Thomas A. Carey, as above.

BUILDING INTELLIGENCE.

GREENSBURG, PA.—The Committee on Public Buildings and Grounds has reported favorably a bill appropriating $50,000 for a public building at this place.

HOLYOKE, MASS.—Plymouth st, 16 tens, br block; o, Le Clair & Labourin; a, G B P Alderman.

HYDE PARK, ILL.—Maher & Corwin, architects, of Chicago, will make plans for a $100,000 hotel for A F Shuman. Steam heat and electricity will be used.

McKEESPORT, PA.—A brewery, to cost $100,000, is to be erected at this plac.

MERIDEN, CONN.—Crown st, apart house, 2 families, 24 rooms; cost, $8,000; o, John Ives; a, H M Jones; b, not let.

MINNEAPOLIS, MINN.—2714–22 N Wash av, br flats; cost, $30,000; o, J Hanson.

MONTCLAIR, N. J.—Frame dwell; cost, $7,500; o, I Lymore Crane; a, George W Delenha; b, Wm H Dewitt; m, George Booth.

NATCHEZ, MISS.—Hotel; cost, $85,000; a, McDonald Bros; b, M T Lewman & Co.

NEW HAVEN, CONN.—East st, near Greene, br storehouse; cost, $30,000; o, L Candee & Co; b, Smith, Sperry & Treat.

Congress av, near West st, fr dwell; cost, $8,000; o, Fritz Leah; b, Bohen.

Park st, near Chapel st, br dwell; cost, $8,000; o, Elizabeth Thompson; b, John Leonard.

Goffe st, near Webster st, br dwell; cost, $7,500; o and b, H F Warner.

Silver st, br freight house; cost, $15,000; o, Housatonic Railroad Co.

OAKLAND, CAL.—The Board of Public Works has instructed Architect Matthews to draw up the plans and specifications for a new $18,000 engine house.

PITTSBURG, PA.—It is reported that the Order of American Mechanics will erect a new building on Penn ave, at a cost of $100,000.

RED BANK, N. J.—Articles of incorporation have been filed by Edward F. Stokes, proprietor of the Hoffman House in New York, and others, as a company to erect a hotel at Red Bank. The capital stock subscribed is $750,000.

SELLERSVILLE, PA.—The Sellersville Improvement Company will erect eight dwellings at this place.

SHORT HILLS, N. J.—A casino, to cost $20,000, is to be erected at this place. Address the Postmaster.

ST. LOUIS, MO.—Bell av and Whittier st, br dwell; cost, $7,000; o, Mrs L W Green; b, T J Kelly.

Waverly pl and Geyer av, br dwell; cost, $7,500; o, A Herthel; b, A Wieden.

Cambria and Congress sts, br dwell; cost, $7,000; o, H Dorste; b, F Mueller.

Olive st and Newstead av, br dwell; cost, $7,500; o, Sam T Bleyer; b, J H Keefe.

ST. PAUL, MINN.—Iglehart near Prior, 4 2-story fr dwell; cost, $20,000.

Lowell near Mackubin, addn to school; cost, $25,000; o, Board of Education.

WHEELING, W. VA.—15th st, county jail of br, s and iron; cost, $70,000; o, County; a, M Giesy; b, Murray Bros.

Market st, br, fr and slate market-house; cost, $7,000; o, City; a, E Franzheim; b, not given.

WORCESTER, MASS.—Jackson st, br ten block; cost, $12,000; o, J A Colvin; a, Barker & Nourse; b, W Cheney.

YORK, PA.—27 East Market st, Trust, Real Estate and Deposit Co; cost, $25,000; o, Trust, Real Estate and Deposit Co; a, J A Dempwolf; b, contract not let.

BUILDINGS.—There is not over $7,000 in value to report at the following places: Geneva, N. Y.; Harrisburg, Pa.; Charleston, S. C.; Springfield, O.; Ogdensburg, N. Y.; Wilkesbarre, Pa.; Dennison, O.; Saginaw, Mich.; Dayton, O.; Waco, Tex.; Canton, O.; Clinton; Iowa; Pasadena, Cal.; Topeka, Kan.; Galveston, Tex.

THE ENGINEERING & BUILDING RECORD

AND

THE SANITARY ENGINEER.

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THE INTERNATIONAL NAVIGATION CONGRESS AND ITS RECOMMENDATIONS.

AT the Manchester meeting of the International Navigation Congress, which was attended by official delegates from nearly all of the European states and was opened by Sir Michael Hicks-Beach, the President of the Board of Trade, the following recommendations, briefly stated, were agreed to by the delegates, after much discussion, as representing the chief results at which they had arrived.

The construction and maintenance of waterways should be the object of earnest attention from the State, as they form a valuable means for transportation at low cost. To secure this, uniform dimensions of locks are necessary. The co-existence of waterways and railroads is desirable, because the one is complementary to the other, and, from a broad point of view, the industrial and commercial development which will result from perfecting both must, in the end, profit each. The great value of waterways and the fact that they are feeders of, and supplementary to, the railroads justifies the State in assisting their construction and maintenance, so as to encourage through traffic at low rates.

The interdependence of the two methods of transportation has possibly never been thoroughly recognized by any of our railroad managers, except the late Dean Richmond, who, when President of the New York Central Railroad, refused to countenance a raid on the Erie Canal, saying he had rather increase its depth and usefulness, pointing out that the best paying railroads of the country were parallel to the natural or artificial navigable water courses. On the contrary, the testimony of Messrs. Fink, Blanchard and others, showing the effect of water-borne freight in reducing railroad freights, the combined Erie Canal and Lake traffic influencing freight rates to the Gulf, has appealed strongly to those interested in railroad securities, and they, with the aid of bankers, who never handle the money expended in the improvement of our rivers and harbors, have developed an immense amount of newspaper and other hostility to our River and Harbor bills.

In Europe, and more particularly in England, where railroads are neither so well nor cheaply managed as here, and the freight rates are much higher—two to two and a half times higher in England—the demand for the aid of cheaper water rates is more general than here, and, as our readers know, the improvement of rivers and the construction of large canals progresses faster and on a more satisfactory basis than here. One reason for this is that the plan of improvement, when once adopted, is provided for, so that the works can be carried out to the best advantage and at the minimum cost, instead of by the method of yearly appropriations, which, being at the mercy of every objecting demagogue, and liable to be withheld at any time, or even withdrawn for a series of years, requires appropriations covering the cost of a new plant for prosecuting the work possibly on an average of once in three or four years all over the country. This is due, in part, to the fact that a new contract is let to expend each appropriation instead of treating each work as a whole.

In addition to the economic questions involved in a discussion of navigable waterways, a great deal of discussion was given to the technical side. One feature in the management of the meeting may be heartily commended to the consideration of the American Society of Civil Engineers. All the papers were printed and furnished to the delegates, so that they were taken as read, and the time of the congress was devoted to an intelligent discussion of their contents.

A GENERAL SUBWAY FOR NEW YORK.

PROBABLY no other matter has more prominently brought the much-discussed need of a general subway beneath the streets of New York to the attention of the public than the recent controversy between the New York Steam Company and Commissioner of Public Works Gilroy.

After a war of words and almost endless correspondence, however, the hatchet has been buried and the work of the company which has called forth so much unfavorable comment will go on as before. New connections will be made as required and old defects will be patched up as formerly, and there is no reason to expect a cessation of periodical, if not almost continual, street excavating.

It is not the Steam Company alone, however, that is responsible for all the street annoyances inflicted upon the New York public in years past. Every corporation having underground pipes or conduits of any kind has been instrumental in contributing more or less to the discomforts, and will necessarily continue to be so until a rational method of accommodating underground conduits has been adopted. It is only a question of time when the general subway, long urged by THE ENGINEERING AND BUILDING RECORD, and designed to give room to all such conduits, will become an even more pressing necessity than it has already shown itself to be. It is only a subway of this kind which will enable inspection and repair of old, and the laying of new, subterranean pipes, without constantly tearing up pavements and damaging one set of conduits while attempting to add to or overhaul another one.

With the idea once firmly impressed, as it must become, that such a subway is unavoidable in the end and that the cost and difficulties of construction are only being multiplied with the lapse of time, there ought to be no hesitation in getting the work under way. Prompt action now would save large additional sums which would have to be expended a few years hence.

THE BRICK BOYCOTT.

THE brick boycott which was recently declared at New York, Brooklyn and Jersey City is, in one respect at least, unique, and its outcome will be of general interest. Briefly stated, the history of the boycott is that the Board of Walking Delegates recently demanded of four firms of brickmakers at Verplanck Point, on the Hudson, that they should discharge all their non-union workmen and employ only union men. On the refusal of the firms a boycott of their brick was ordered, and no union bricklayers or other union workman in New York City dare now touch their brick, and no dealer dare handle it for fear of being boycotted himself.

The interesting part of the matter, however, is that the New York and New Jersey Brick

Manufacturers' Association, of which the four boycotted firms are members, have, in retaliation adopted the union workingmen's tactics, and since August 22 have stopped all shipments of brick to the New York market, and threaten that they will not resume them until the boycott on the Verplanck Point manufacturers is removed. As in the case of the recent New York Central Railroad strike, the question of wages is not under consideration at all. It is a question of business principle—a question whether manufacturers have a right to employ what kind of labor best pleases them, or whether they must submit to the dictations of that irrational and irresponsible species, known as walking delegates, sometimes, by courtesy, classed as workingmen. In reality the question never has come up for discussion among men of sufficient intelligence to distinguish between what is obviously right and what is just as clearly wrong. It is the indisputable right of everyone to employ any workman who is willing to work for him, no matter whether he be member of a labor union or not, and it is time that labor union enthusiasts clearly understood this.

Under the present circumstances the action of the brick manufacturers, while it must unfortunately bring suffering to many more or less intimately connected with the building trades, is entirely justifiable. It will give labor unions an opportunity to find out that sympathetic strikes can be made to work both ways, and that the gentle, persuasive measures of their own making can be used very effectively by manufacturers, their erstwhile victims.

MECHANICAL MINE VENTILATION.

In reviewing recent improvements in the mechanical engineering of coal mines before the British Institution of Mechanical Engineers, Mr. Emerson Bainbridge recently pointed out that the elements of danger, waste and inconvenience in furnace ventilation for mines have caused an almost general adoption of mechanical ventilators.

The considerations to be aimed at in selecting a mechanical ventilator are as follows: First cost of fan, engine and foundation, future cost of maintenance, economy of fuel and stores, useful effect of fan. The fans now chiefly used in England are the Guibal fan, Walker's improved Guibal fan, Cockson's, Schiele's, Capell's, Waddell's, and Lupton's fans. The Guibal fan is that most largely adopted, and is so well known that it needs no description. In Walker's improved Guibal fan the chief variation in the style is the increased strength, designed with the view of obtaining the same results with a small diameter of fan; and the air, instead of being admitted as in the Guibal fan, on one side only, is admitted on both sides. The Guibal movable shutter is replaced by an anti-vibrating shutter, which is very effective in its action. The tendency recently has been to adopt fast-running fans, which, however, are most suitable where limited quantities of air are required. Four years ago Mr. Bainbridge adopted this principle at the Woodthorpe Colliery, near Sheffield, by applying an 8-foot Cockson fan, driven direct without gear by one of Willans and Robinson's direct-acting engines, which runs very quietly at a speed of 280 revolutions per minute. At this speed the fan gives about 58,000 cubic feet of air per minute, with 3 inches water gauge. The engine since it was started has run about 500 million revolutions, and has cost a very small amount for repairs. The actual economy in the useful effect of a fan depends upon the cost of fuel; but bearing in mind that the useful effect is found to vary from about 15 per cent. to 70 per cent., the matter is of importance; and in the ordinary carrying on of a colliery the quantity of fuel used in driving a fan engine, which practically never stops working, may be said to be one-fourth of the entire fuel used. A simple contrivance in connection with ventilating machines has been adopted by Mr. Bainbridge at the Nunnery Colliery. A new engine-house which is now being completed will be ventilated by taking a pipe from the roof, and passing it into the fan chamber; the air leaving the house will pass up through two ventilators placed in the roof, and thence to the fan.

The break of a 46-inch water main in Philadelphia on the 25th inst. caused considerable damage to several houses along the line.

SLATE PRODUCTION IN THE UNITED STATES.

According to the slate census bulletin, just issued from the Division of Mines and Mining, under the charge of Dr. David T. Day, the total value of all slate produced in the United States in 1889 is $3,444,863. Of this amount $2,775,271 is the value of 828,990 squares of roofing slate, and $669,592 is the value of slate for all other purposes besides roofing. As compared with the statements of the Tenth Census report of 1880 on stone, the roofing slate product of 1889 is nearly twice as great in number of squares and in value. The total value of all slate produced in 1889 is more than twice as great as that considered in the Tenth Census. According to "Mineral Resources of the United States, 1888," the total number of squares of roofing slate produced in that year is 662,400, valued at $2,053,440.

Twelve States at present produce slate. A line drawn on the map from Piscataquis County, Me., to Polk County, Ga., and approximately following the coast outline, passes through all the important slate producing localities. According to amount and value of product, the most important States are, in the order named. Pennsylvania, Vermont, Maine, New York, Maryland and Virginia. In the remaining six States productive operations are of limited extent, and in the case of Arkansas, California and Utah of very recent date. The 12 States referred to do not include all those in which merchantable slate is known to exist, since discoveries promising good results for the future have been made in a number of other States, among which may be specially mentioned Tennessee, where operations of production are beginning.

The Bangor region, which is entirely within Northampton County, Pa., is the most important. This region includes quarries at Bangor, East Bangor, and Mount Bethel, Pa. The character of the slate produced at Mount Bethel is similar to that of the Northampton Hard Vein region. Included in the Lehigh region, besides Lehigh County, Pa., are a few quarries in Berks and Carbon Counties, and a small number in Northampton County, on the opposite side of the Lehigh River.

The Pen Argyle region embraces quarries at Pen Argyl and Wind Gap.

The Northampton Hard Vein region is specially distinguished on account of the extreme hardness of the slate, as compared with that produced in other regions of the State. This region includes the following localities: Chapman's Quarries, Belfast, Edelman, Seemsville, and Treichlers, all in Northampton County.

Five of the nine quarries included in the Peach Bottom region are in Hartford County, Md., the remaining four being in York County, Pa.

The Vermont and New York region includes an extensive slate formation occupying a part of the old Champlain Valley lying between the western base of the Green Mountains of Vermont, and the southern trend of the Adirondacks, in New York. The area in which slate is actually produced at present is confined to a narrow strip in Washington County, N. Y., and a somewhat wider one lying next to it in Rutland County, Vt. It extends from Castleton, Vt., on the north, to Salem, N. Y., on the south, a distance of 35 or 40 miles, and has a maximum width of six miles, but the average is not more than a mile and a half. With the exception of red slate, the production of which is at present limited to Washington County, N. Y., the general character of the slate in Vermont and New York is the same. It happens, however, that red slate is produced only in Washington County, N.Y., this being the only locality in the country producing this variety of slate.

The slate quarrymen of the country, and to a considerable extent the firms operating the quarries, are either Welsh or of Welsh descent, many of them having learned the methods of quarrying slate in the celebrated quarries of Wales. The quarries are operated on an average of about 220 days in the year. The idle days are the result of rainy weather and holidays. The first day of every month is regarded as a holiday by the Welsh quarrymen, and no work is ever done by them on Saturday afternoons.

The average wages for the entire country paid to foremen or overseers is $2 48 per day; for quarrymen and millmen, $1.56; for mechanics, $1.64; for laborers, $1.27, and for boys, $0.76. The highest wages are paid in California, while those paid in the most important regions naturally approximate more closely the figures above given as the averages. The following figures represent the average daily wages paid in Pennsylvania. Foremen, $2.25; quarrymen, $1.88; mechanics, $1.54; laborers, $1.40, and boys, $0.73. In the Vermont and New York region foremen receive an average of $2.65; quarrymen and millmen, $1.77; mechanics, $1.97; laborers, $1.51, and boys, $0.89. The statistics were gathered by Dr. William C. Day, special agent in charge of stone.

A BIG CALIFORNIAN FLUME.

According to the *United States Miller* a flume of exceptional dimensions has just been completed for supplying water to the city of San Diego, Cal., and also for irrigation purposes. The whole flume, 45 miles in length, has been constructed on a uniform grade of .75 feet per mile, the water being carried over 315 trestles of varying heights and through many tunnels and numerous cuts. No fills have been allowed, as with embankments there is always a risk of landslips, trestles being used in every case where these would have been necessary. The whole length is lined with redwood, which is said to be everlasting. The water is drawn from an artificial lake of 900 acres formed by the Cuyamaca dam, which is 720 feet long and 35 feet high. From here it is led along a natural flume to a diverting dam, where another lake is formed. This dam is 400 feet long by 35 feet high, and from this point the flume proper begins. Some of the longest trestles are: The Sweetwater Pass, 1,264 feet long and 81 feet high; Sweetwater Pass, No. 2, 720 feet long and 25 feet high; Sycamore Creek, 720 feet long and 35 feet high; Connor Creek, 688 feet long and 34 feet high; Knob Creek, 600 feet long and 55 feet high; Cut off, 640 feet long and 48 feet high; Los Coches, 1,664 feet long and 70 feet high; Sand Creek, 600 feet long and 58 feet high: South Fork, 420 feet long and 86 feet high; Quail Canon, 560 feet long and 68 feet high; Monte Tunnel, 438 feet long and 60 feet high; Chocolate, 450 feet long and 63 feet high; and over 300 smaller ones. The most important tunnels are: Lankersheim, 1,900 feet in length; Los Coches, 313 feet; El Monte, 290 feet; Cape Horn, 700 feet; South Fork, 200 feet; Anderton, 270 feet; and Sand Creek, 430 feet. These are through solid rock of granite or slate 6 feet square, cemented and arched overhead, supports being placed wherever the rock is soft or has any indications of falling. The flume is 6 feet wide and 4 feet deep, and its capacity when flowing full is said to be 65,000,000 gallons daily.

PERSONAL.

Dr. John S. Billings, Surgeon U. S. A., arrived from Europe on the steamship Majestic on August 27, and has gone to his home in Washington, D. C.

City Engineer Voigt, of Detroit, Mich., took leave of that office on the 20th inst. Mr. Ludden, his successor, has entered upon his duties. Mr. Voigt has made no business arrangements for the future.

Major George W. McNulty has accepted the position of Engineer of Construction on the Broadway Cable Road, of New York City, whose plant has been designed by A. D. Whitton, Chief Engineer of the Philadelphia Traction Company. Mr. Whitton also designed the North and West Side Cable systems of Chicago.

OBITUARY.

Orlando W. Atkinson, of the firm of Johnson & Co., iron founders, at Burlington, N. J., died on the 25th inst.

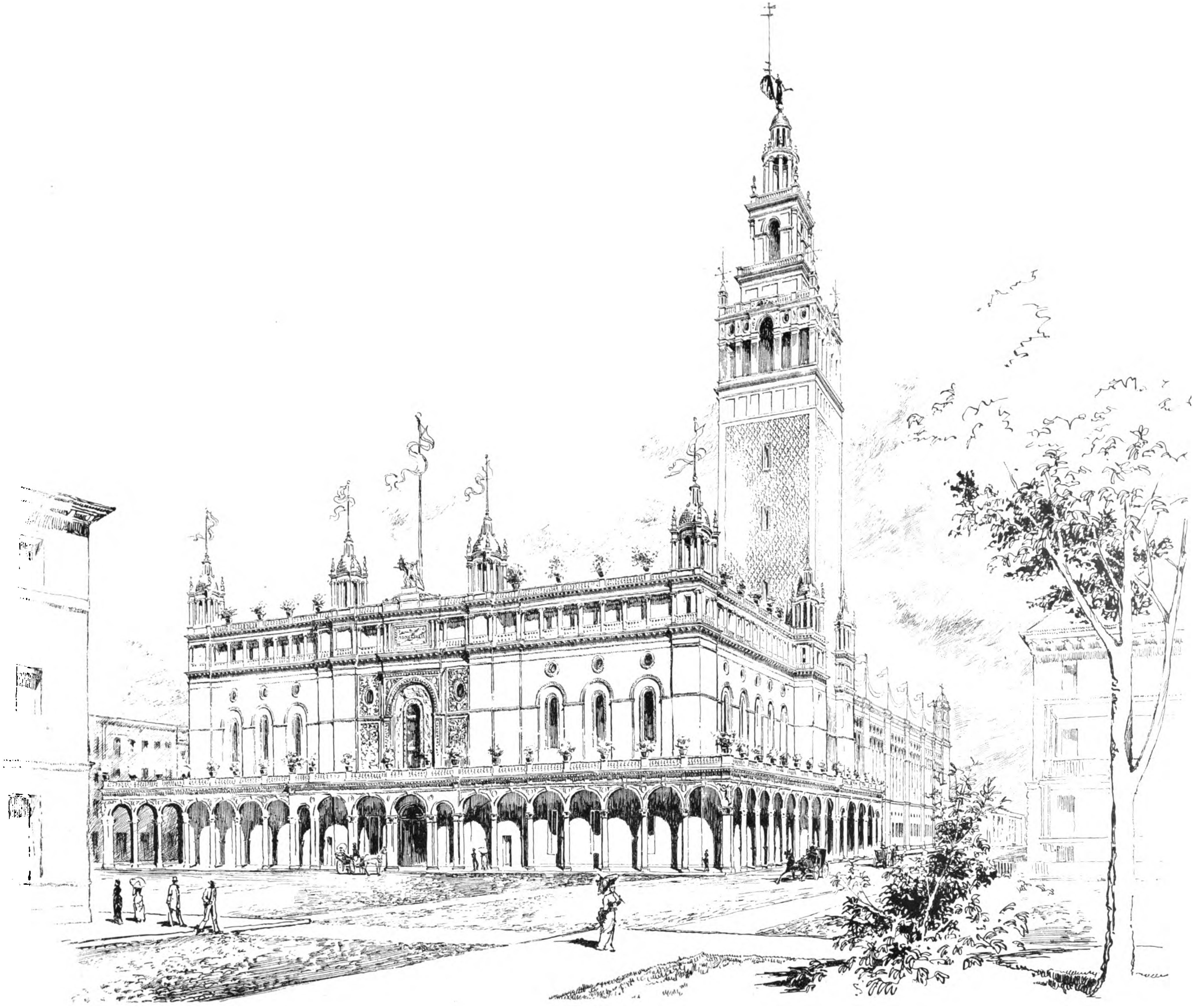
Walter Howe, a member of the Aqueduct Commission of New York City, was drowned while bathing at Newport, R. I., on the 22d inst.

Col. Victor E. Piolett died at his home in Wysox, Bradford Co., Penn., August 26, aged seventy-eight. He had held many positions of trust. He was Superintendent of the North Branch Canal and Superintendent of Construction of the Philadelphia and New York Railroad from 1867 to 1872.

OUR ARCHITECTURAL ILLUSTRATIONS.

HOUSE AT WABAN, MASS.,
H. LANGFORD WARREN, ARCHITECT, BOSTON, MASS.

THE MADISON SQUARE GARDEN, NEW YORK.
MCKIM, MEAD & WHITE, ARCHITECTS, NEW YORK.



THE ENGINEERING AND BUILDING RECORD ILLUSTRATED SERIES.

THE MADISON SQUARE GARDEN, NEW YORK.

McKIM, MEAD & WHITE, ARCHITECTS, NEW YORK.

ENGINEERING SOCIETIES.

THE fall meeting of the New England Water-Works Association will consist of an excursion of members, with ladies, to the White Mountains, in accordance with the programme which appears below.

PROGRAMME.

Saturday, September 13.—Leave Boston, Eastern Railroad station, 9.30 A. M., special cars; lunch at Wolfeboro Junction; arrive at Crawford's 3.25 P. M.; Crawford House.

Sunday, September 14.—At Crawford House. During the stay ride up Mount Willard.

Monday, September 15.—Leave the Crawford House 9.15 A. M. for the Profile House; arrive at 10.30 A. M.; carriage ride to the Flume in the afternoon.

Tuesday, September 16.—Leave the Profile House 9.20 A. M.; stage to North Woodstock, through cars to Boston, arrive at 5.00 P. M. stopping 50 minutes for dinner at Plymouth at the Pemigewassett House.

Any members of the party desiring to take a trip to Mount Washington can do so on Monday and join the party at the Profile House during the afternoon. Tickets to the Summit and return $3 each. Tickets $22 25, including railroad fare, Boston to Crawford's and Profile, stage Profile House to North Woodstock, rail to Boston; carriage ride up Mount Willard, Profile House to the Flume and return, lunch at Wolfeboro Junction, dinner at the Pemigewassett House; board from Saturday P. M. until Monday morning at the Crawford House, from Monday morning until Tuesday morning at the Profile House and services of the conductor. All the details of the excursion will be under the management of Messrs. Raymond & Whitcomb, 296 Washington Street, Boston, Mass., and all tickets must be obtained of them by members of the association on or before September 10. The return tickets will be good until October 1, 1890. Members who do not desire to purchase the round trip tickets can have rooms reserved for them at the Crawford and Profile Houses on application to Messrs. Raymond & Whitcomb. In such cases the hotel rate will be $3 per day. Should a withdrawal be necessitated, after the ticket has been paid for, the money will be refunded.

Further information may be obtained from Albert F. Noyes, West Newton, Mass.; R. C. P. Coggeshall, Secretary, New Bedford, Mass.; Dexter Brackett, 221 Federal Street, Boston, Mass.

THE fifth annual excursion of the Boston Society of Civil Engineers will occur on September 13–16, 1890, and will consist of a trip of members and friends, with ladies, to the White Mountains. The programme outlined is the same as that given above, sent out by the New England Water-Works Association, which will participate in the excursion.

HOUSE AT WABAN, MASS.—H. LANGFORD WARREN, ARCHITECT, BOSTON, MASS.

CREOSOTING OF WOOD.

THE practice of the Eastern Railway Company, of France, in creosoting sleepers is described in a recent issue of *Revue Generale des Chemins de Fer*. Sleepers as delivered are stacked and seasoned in the open air. They are then adzed and bored by a special machine, loaded on trucks, and run into a drying oven, where they remain 24 hours or more. After drying at a temperature of about 176° Fahr., they are run into a metal cylinder 6 feet 3 inches in diameter and 36 feet long, which is hermetically closed. The air is then exhausted, and a partial vacuum is maintained for about half an hour. Communication is then opened with reservoirs of dead oil, which is allowed to flow in at a temperature of 176° Fahr., under pressure. When the oil ceases to flow under moderate pressure, it is forced in by a pump up to a pressure of 83 pounds per square inch, and this pressure is maintained for an hour or an hour and a quarter. Communication with the oil reservoirs is then opened again, and the excess of oil not absorbed by the timber flows back into the reservoir. The cylinders hold 168 sleepers each. The quantity of oil absorbed is measured by determining the difference in volume of the oil before and after operation. The wood used is principally oak and beech. The oak sleepers absorb from 2.4 to 2.7 quarts per cubic foot; beech sleepers from 8.7 to 10 quarts per cubic foot. The whole operation takes about four hours. This method of treatment has been practiced by the company since 1865, with, it is stated, very good results. After fifteen years of service the sleepers taken out have been 15 per cent. for creosoted oak and 50 per cent. for creosoted beech.

COMPETITION FOR PEDESTAL DESIGN FOR THE ROBERT E. LEE STATUE.

THE committee in charge of the Annual Competition for the Clark Medals submits to the draughtsmen of the United States the following problem:

It is required to design for the equestrian statue of Gen. Robert E. Lee, recently erected at Richmond, Va., a pedestal which shall be unlike the one upon which the statue is now set. The design shall comprise the pedestal and the approaches and surroundings of the monument, and no limitation as to the cost or material or dimensions of the pedestal and its accessories are imposed by the committee.

The site of the monument for the purposes of this competition shall be immediately outside of the entrance to a public park, and at the end of a broad boulevard, on each side of which are tall and elegant buildings, apartment houses, hotels, etc.

Drawings shall be rendered on two sheets, one containing such ground plans, elevations and sections as may be required to illustrate fully the intention of the designer, and the other a perspective drawn to any scale and rendered in any manner desired by the individual competitors. The size of the sheets shall be 16x23 inches, and they are not to be rolled for the purposes of shipment.

Drawings will be received until, and not later than noon of the first day of November at the office of the Chairman of the Committee, room 1600, Auditorium Tower, Chicago.

An excellent illustration of the statue for which the pedestal is to be designed can be found in the supplement to *Harper's Weekly* of March 29, 1890.

D. Adler, Chairman.
Henry Ives Cobb,
N. Clifford Ricker,
Lorado Taft,
Samuel A. Treat,
Committee.

WORK was begun recently on the new viaduct from the heights at One Hundred and Fifty-fifth Street and St. Nicholas Avenue to Seventh Avenue at Macomb's Dam Bridge, New York. The viaduct will be of iron, and it will be 1,500 feet long. The roadway will be 60 feet wide with footways on each side. It will cost $600,000.

THE SHEFFIELD, ENGLAND, WATER-WORKS.

According to a paper on the Sheffield, England, water-works, recently presented to the British Institution of Mechanical Engineers, by Edward M. Eaton, Chief Engineer of the works, the town is supplied with water by gravitation from the elevated moorlands lying to the west and northwest, the gathering grounds forming part of the western slope of the backbone of England. The rainfall has been continuously gauged for the last fifty-four years, and averages rather more than 40 inches in depth per annum. Of this it has been ascertained from actual experience that during a period of three consecutive dry years nearly 20 inches can be collected, stored, and distributed. The system of reservoirs may be divided into the high-level and the low-level, the distinction having reference, not to absolute height above the sea, but to the means available for conveying the water from the storage reservoirs into the various surface reservoirs near the town.

The high-level reservoirs are situated at Redmires, about six miles in a direct line from the center of the town. They consist of three reservoirs—the Upper, Middle and Lower Redmires—with the Oaken Clough dam and catch-water. They receive the flow from 2,108 acres of drainage area, and have a total storage capacity of 670,000,000 gallons, the gathering ground comprising the upper part of the valley of the river Rivelin. The water from the high-level reservoirs is conveyed down a water course, open for the greater part of its length, but covered in at the lower end, into the Hadfield or Crookes service reservoir having a capacity of more than 21,000,000 gallons, whence the supply is taken for the higher parts of the town.

The low-level system comprises two reservoirs upon the River Rivelin, and four reservoirs in the adjoining valley of the river Loxley, these being the Strines, Dale Dike, Agden and Damflask Reservoirs. There is also upon the river Rivelin a small reservoir called the depositing pond. The total capacity of the low-level system of storage reservoirs is more than 3,000 million gallons. The water collected in Strines, Dale Dike and Agden Reservoirs is conveyed through a tunnel, passing under the high ridge which divides the Loxley from the Rivelin watershed; and uniting at the depositing pond with the water from the Rivelin Reservoirs, passes through a conduit and tunnel to the service reservoirs at Crookesmoor, lying immediately west of the town. In the valley of the river Ewden, lying immediately north of the Loxley Valley, the corporation of Sheffield has power to construct two other reservoirs,—namely, the Broomhead and Moorhall Reservoirs, for receiving the flow from a drainage area of 6,496 acres; but these works have not yet been commenced.

The total drainage area of the works is 15,703 acres. The total available water during three consecutive dry years is 19,460,000 gallons per day, of which an average of 9,113,472 gallons per day has to be sent down the streams as compensation water, leaving 10,346,528 gallons per day for the supply of the town and district. It will thus be seen that nearly one-half of the available supply of water has to be sent down the rivers for the benefit of the millowners and other riparian proprietors.

After leaving the storage reservoirs and being received into service reservoirs at Crookesmoor, the water is distributed throughout the town and district of supply by means of main pipes from 24 inches to 5 inches in diameter, laid in zones. The service pipes are mainly 4 inches in diameter, 3-inch pipes being laid in short streets and courts. The total length of the distributing pipes is nearly 300 miles. The total daily quantity of water distributed is about 6½ million gallons, of which exactly one-third is for trade and manufacturing purposes, or for supplies in bulk to local authorities distributing water themselves. When water was first supplied to Sheffield under constant pressure in 1869, the daily consumption was 40 gallons per head of the population supplied, of which only about 2¾ gallons per head was for trade purposes. Now, and for many years past, the quantity consumed without restriction or limitation, for all purposes other than meter supplies, has averaged not more than about 13 gallons per head per day; this happy result is due to the rigorous rejection, so far as practicable, of fittings and apparatus of an inferior character, combined with unceasing vigilance in suppressing all unnecessary waste of water.

At each of the surface reservoirs a self-recording gauge is fixed for the purpose of measuring the water supplied to the town. These recorders have been in use since 1878, and the result of their working has been to disclose several facts relating to the supply of water, of a character very interesting to all engaged in the practical management of water-works. So far as Sheffield is concerned, the least draught upon the reservoirs is between 3 and 4 o'clock in the morning, the maximum draught being between 11 and 12 noon; while the fact of the stoppage of work for dinner between 12 and 1 o'clock is strikingly manifested. In proportioning pipes for town supply, although the average daily flow through the pipes may be taken at 100, yet provision must be made for passing 50 per cent. in excess of this quantity.

The water supplied to Sheffield may be taken as a fair type of the excessively soft upland waters supplied to many of the large towns in the north of England. The hardness varies at different periods of the year, rarely falling below two degrees of Dr. Clarke's scale, and seldom exceeding three degrees. The water pressure in different parts of the town varies between 150 feet and 250 feet, or up to 300 feet head. In some spots, however, the pressure rises to 400 feet, but this is considered a dangerous pressure, and with it lead pipes last a very short time Sheffield water is used for power purposes, the motors being coupled direct to the mains, and the exhaust is measured to ascertain the consumption.

THE RADFORD, VA., WATER-WORKS.

Concerning the water supply of Radford, Va., the Radford *Enterprise* gives the following particulars:

> After a careful investigation of all the springs and streams in the vicinity and after analyses had been made of three different sources of supply by Professor Henry Leffman, Analytical Chemist of Philadelphia, it was decided to adopt Connelly's branch as the source. The analysis of Dr. Leffman shows that the waters of this stream are of high organic purity and that it is admirably adapted for use in steam boilers and for general manufacturing purposes.
>
> The pumping station has been located upon this stream, at a point where several springs of undoubted purity can be utilized as well as the waters of the stream.
>
> A subsiding reservoir, with a capacity of 1,000,000 gallons is now nearly completed in the meadow adjoining the stream and engine and boiler house. Full detail arrangements have been made so that the stream, during freshets, will pass the subsiding reservoir without entering it.
>
> The springs referred to will be conducted to this subsiding reservoir, and a supply of water which shall be always clear is fully anticipated.
>
> A substantial and ornamental engine and boiler house of ample proportions is being erected on the bank of the subsiding reservoir. This house is adapted to the convenient accommodation of two 1,000,000 gallon engines and three boilers, each of full capacity to alone operate either engine at its full capacity.
>
> A pump well and inlet chamber, with screens, blow-out and other appliances, have been provided.
>
> The pumping machinery at first to be introduced will consist of a million gallon, compound, duplex, direct acting, condensing pumping engine with duplicate boiler capacity, made after specifications by the hydraulic engineer by the Holly Manufacturing Company, of Lockport, N Y.
>
> The pumping main and the principal distribution main will be 12 inches in diameter, and the general system of distribution pipes will be of ample size, and the whole work will be proportioned for a fire pressure 125 pounds per square inch.
>
> On the top of a commanding ridge between the pumping station and the principal portion of the town, a stand-pipe will be erected which will be 25 feet in diameter and 50 feet high, with an ornamental roof some 30 feet in height. The foot of the stand-pipe will be about 200 feet above the level of the water in the stream.
>
> It is intended to ultimately use this stand-pipe for the supply of dwellings, etc., upon the higher levels of the city and to supplement it by a large reservoir to supply the lower levels when the consumption of water demands it.
>
> The whole Radford water-works have been proportioned to provide an ample fire and domestic service and the engineer has not been limited in any expenditure which he has recommended.
>
> With legitimate economy in the use of water, Connelly's branch will supply the ordinary wants of 10,000 persons and will afford them full fire protection. The works have been so proportioned that two good fire streams can be obtained from each fire hydrant without the intervention of a fire engine.
>
> The works were designed and are being executed by Mr. Howard Murphy, civil and hydraulic engineer, of Philadelphia, who engaged Mr. T. Roney Williamson, architect, of Philadelphia, to furnish him with the ornamental work on the engine house and stand-pipe.

The St. Clair River Tunnel between Port Huron, Mich., and Larnia, Ont., was practically completed on August 25. It is probably the greatest river tunnel in the world, being 11 feet longer than the Brooklyn Bridge.

PARIS PAVEMENTS.

According to the *Zeitschrift für Transportwesen*, there will be more attention paid to the granite and macadam pavements in Paris during the coming year than has been the case for some time. Property holders in the suburbs have complained that more than a just amount of the appropriations for streets is spent in laying wooden and asphalt pavements in the heart of the city. The authorities have accordingly resolved to repair or renew all the outlying streets.

The chief improvement in the granite pavements is the concrete bed that is now used as a foundation for the blocks wherever the traffic is of great volume. The new pavements are prepared in the following manner: The old blocks and the underlying sand are removed, and the ground then brought to the proper grade and heavily rolled. On this surface a concrete layer of about 8 inches is placed, and the whole covered with 3 to 3 5 inches of sand. On this sand are laid the rectangular blocks at right angles to the center of the street. Between the rails of the tramways and for 1.5 feet on either side the joints are filled with cement. The entire upper surface is then covered with sand, sprinkled with water and rammed by hand. More sand is now scattered over the surface, and after two or three days the street is opened to traffic. Several layers of sand are scattered over the pavement during the first few weeks of its use.

When broad streets are being repaired in this manner it is usual to close but one side of the street at a time, thus allowing a limited traffic to be carried on. The pavements are not popular on account of their noise, and will be restricted to the suburbs.

Macadam pavement is restricted to streets where few vehicles pass and to drives in the public parks, such as the Bois du Bologne. In repairing such roads of late years it has been customary in some places to mix old asphalt fragments with the broken stone. The results, as regards wearing qualities, show little improvement over the unmixed stone. The great advantage of the process lies in the fact that such a pavement keeps remarkably clean during dry weather and does not become so muddy as the true macadam style during rainy seasons. In the middle of summer, however, an unpleasant odor is given out, and the surface has a dirty black color.

THE CINCINNATI MANUAL TRAINING SCHOOL.

The Technical School, of Cincinnati, O., is a manual training school, started in 1886 by Col. W. L Robinson, one of Cincinnati's public spirited citizens. In 1888 the Commercial Club of that city, recognizing the value of the movement, came to his aid, and now there exists a well-equipped institution with complete carpenter, blacksmith and machine shops.

During the past winter the third and fourth classes built a 5x12 inch slide valve engine which is now driving the shop machinery. During next winter it is proposed to build another engine, a duplicate of the above. Pupils are to make sketches by direct measurement from this engine, preparing from them a set of working drawings from which they themselves are to work in the shops. Some of the details will be made in lots of three or four, a selection to be made at the end of the year for use in the complete engine. By this method of work good practical instruction can be given in machine drawing, and a series of shop exercises developed which, in themselves, have a useful purpose.

All students, in the regular course, work two hours a day for the entire first year in the carpenter shop, the same amount of time the second year in the blacksmith shop, and the same the third year in the machine shop. Special attention is given to drawing, both free-hand and mechanical. Sketching in perspective and simple projection is encouraged. In addition to manual training, studies are followed similar to those in the best high schools, except that Latin and Greek are omitted. There is a three years' course in arithmetic, algebra, geometry, trigonometry, chemistry and physics. Daily practice is given in writing and speaking English correctly.

Last year the school had 120 pupils; this season many more are expected. The work is intended for boys between the ages of 14 and 17. There are nine teachers besides a director, Mr. J. B. Stanwood, who has special supervision of the work.

Owing to the brick boycott there has been an advance in the price of bricks from $4.95 to $7.45 per thousand.

SLAG CEMENT.

In a recent article on slag cements *Le Génie Civil* states that these cements are made by finely grinding blast furnace slag and mixing it with a suitable proportion of fat lime. The grinding has to be very fine, because as the cement is made by a simple mixture it is necessary that the surface on which the two constituents, the lime and the slag, react on each other should be as large as possible if proper chemical combination is to ensue. The density of slag cements is much less than that of Portland, weighing bulk for bulk, but from .8 to .88 times as much. In general, this cement also sets somewhat more slowly than Portland, but when hardened, has, in many cases, a greater strength, particularly at early dates after setting. In some experiments still unfinished, the following results were attained with a slag cement from the Department of Isère:

Age....	1 week.	1 month.	3 months.
Breaking load, pounds per sq. in..	473.5	568.8	678.3

These figures are higher than any attained in the tests made on Portland cements for the new Croton Aqueduct. Experiments have also been made with slag cement mortar mixed with, and allowed to harden in, sea water, and gave the following results; the mortar consisted of six parts by weight of cement to ten of sand:

Age.	Breaking Weight.		Pounds per Square Inch.		
8 days	252.0	319.9	275.1	273.0	2°5.8
28 "	375.4	327.0	327.0	248.4	341.2

The main objection to slag cement seems to be that if it is allowed to harden in dry air its strength is very materially reduced, and it is then liable to crack. In the town of Villefranche-sur-Soane (Rhône) it has been largely used for paving footpaths, some 4,800 square yards having been laid there with the most satisfactory results.

On Saturday, August 23, the remains of Captain John Ericsson were transferred, with imposing ceremonies, from the Marble Cemetery, New York, to the U. S. cruiser Baltimore, to be taken to Sweden for final interment.

THE MADISON SQUARE GARDEN.

PART I.—GENERAL DESCRIPTION AND PERSPECTIVE; FRONT AND SIDE ELEVATIONS; LONGITUDINAL AND TRANSVERSE GENERAL SECTIONS. GENERAL PLAN AND PLAN OF ROOF GARDEN.

The Madison Square Garden, just completed on the site of the old garden, adjacent to the north east corner of Madison Square, New York, occupies an area about 200x425 feet square, and will be one of the most extensive amusement buildings in this country. It is owned by a stock company, for whom it was designed, and the construction was superintended by McKim, Meade & White, architects, New York. D. H. King, of New York, is the principal construction contractor. The total estimated cost is about a million and a half dollars.

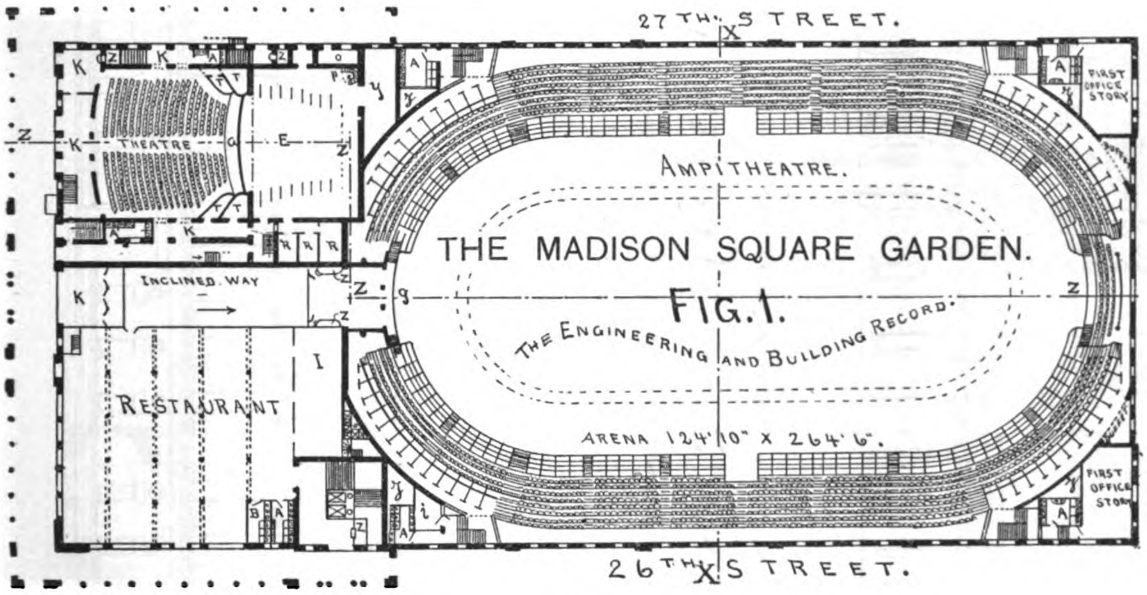
The side and curtain walls are of brick, resting on continuous massive brick foundation walls, 28 inches thick, and from 10 to 30 feet deep, which, in turn, rest on continuous Portland cement concrete footings, from 4 to 8 feet wide, and about 3 to 6 feet deep. The outside walls are 40 feet high above the level of the street to roof, and the tower is 38 feet square at the ground, and 325 feet high to the top of the figure. The partition walls are of hollow brick. The roof trusses, floor beams and columns are of wrought iron and steel, the roof of tar and gravel, and most of the doors of iron, the construction throughout being designed to be fire-proof.

At the first floor level are the amphitheater arena, the theater and a restaurant. Below the amphitheater is stabling for nearly 400 horses. Above the restaurant are concert halls and ball rooms, and the roof. Both theater and restaurant are designed for open-air gardens.

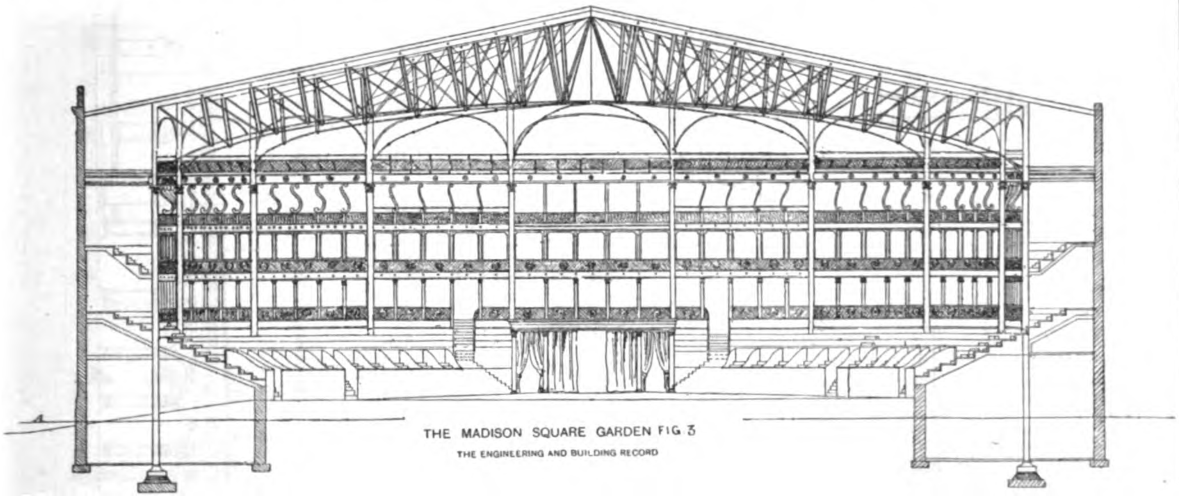
Figure 1 is the general first-floor plan. K K, etc., are lobbies; A A, etc., men's toilet rooms; B B, etc., women's toilet rooms; Z Z, ticket offices; Q, manager's office; T T, boxes; *p*, stair well; E, stage; *y*, scene room; *z*, light shaft; R R, dressing rooms; I, pantry; *j*, cloak room. Figure 2 is a section at Z Z Z Z of Fig. 1, and Fig. 3 is a section at X X of Fig. 1.

Figure 4 is an elevation from Madison Avenue, and Fig. 5 is an elevation from Twenty-sixth Street. The Twenty-seventh Street and Fourth Avenue elevations are similar to Figs. 4 and 5, respectively, except that they do not show the tower on the same arrangement of small domes. A general perspective is given on a separate page. Figure 6 shows a plan of the roof garden, and section of the roof buildings; *t*, is the pitched roof over the stage; A, men's toilet room; *u*, store room; *v*, kitchen; L, freight elevator; S S, etc., sinks; M, concert hall elevator; N, roof garden elevator; *x*, sliding skylight over theatre auditorium, movable to position indicated by dotted lines; *r*, promenade; *b*, open court of roof garden; *w*, stairs from gallery.

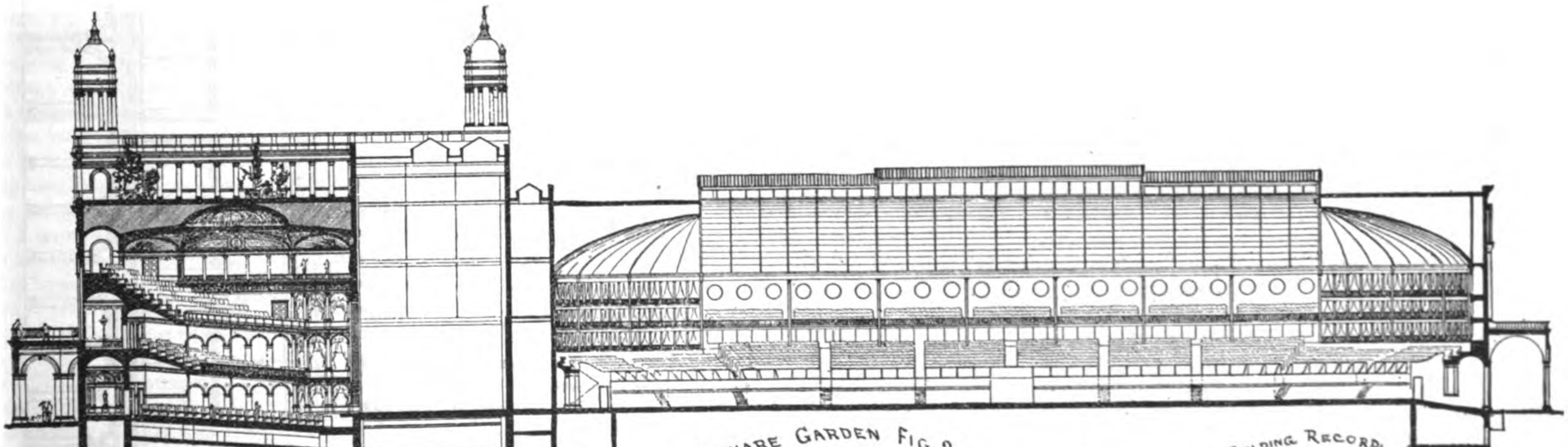
(To be continued.)



THE MADISON SQUARE GARDEN. FIG. 1. THE ENGINEERING AND BUILDING RECORD.

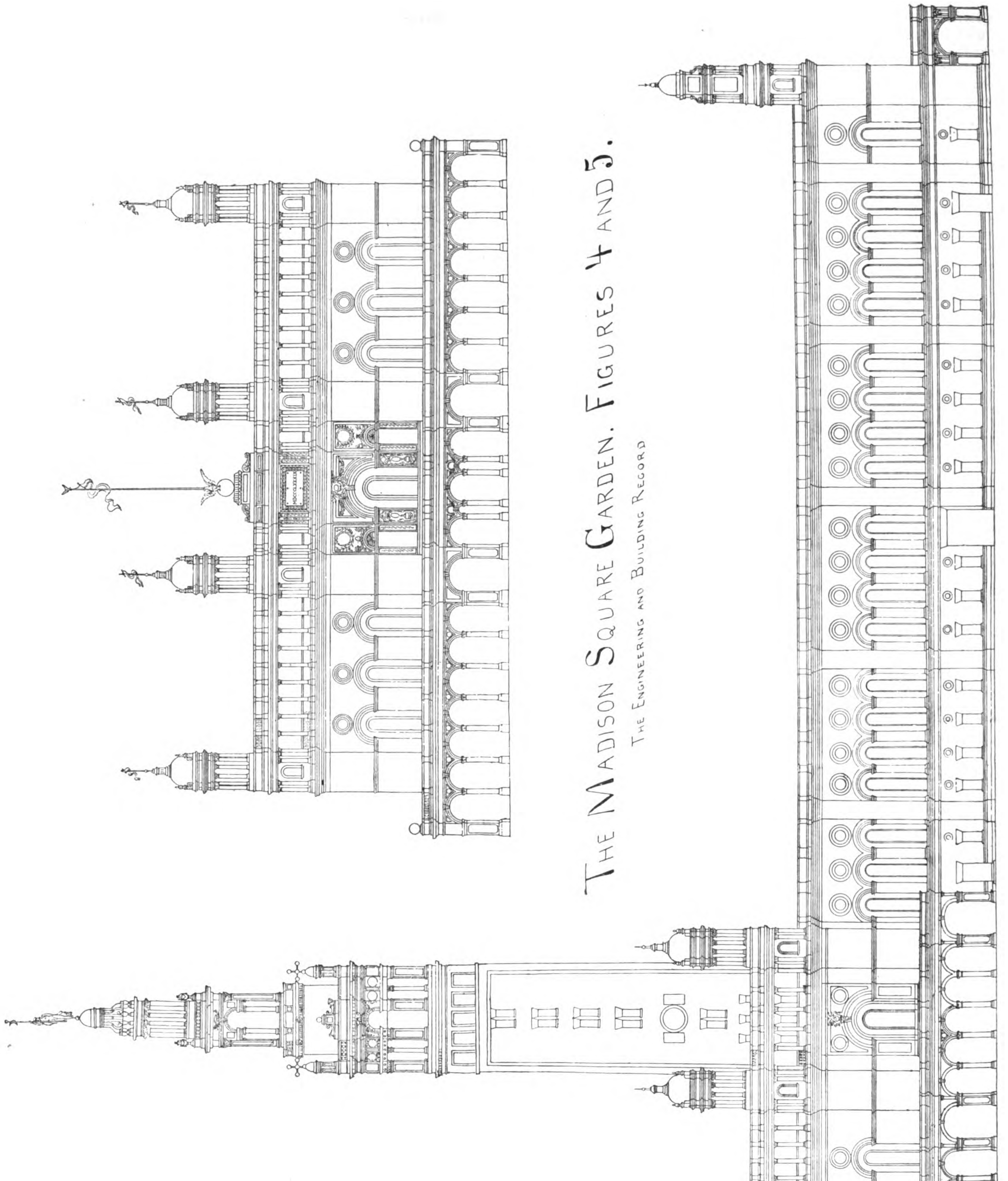


THE MADISON SQUARE GARDEN FIG 3
THE ENGINEERING AND BUILDING RECORD



THE MADISON SQUARE GARDEN FIG. 2. THE ENGINEERING AND BUILDING RECORD.

The Supreme Court of New Jersey, at its November term, will be called upon to decide whether the Plainfield Water Company has a legal existence. An application for a writ of *certiorari* has been made to Supreme Court Judge Magie by Israel Lewis, of North Plainfield, who claims in his application that the charter under which the company is operating is null and void, it having been obtained under a law which is alleged to be unconstitutional.



The Madison Square Garden. Figures 4 and 5.

The Engineering and Building Record

WIND PRESSURE.

AN article discussing records of exceptionally heavy wind pressures recently appeared in *Engineering*, in which it was contended that the very high records published from some observatories, and notably from Bidston, Liverpool, are unworthy of credence. The anemometers at this observatory have shown indications referable to a wind pressure of 80 and 90 pounds per square foot, which if actually exerted in a storm would have razed the observatory buildings to their foundations. Before 1883, several extraordinarily high anemometer records were made at Greenwich; but in that year the Astronomer Royal repudiated such high pressures, the mere substitution of a connecting chain for a wire in the mechanism of an anemograph having effected a startling reduction in the recorded pressure, although observation of light winds showed that the change was an improvement in the way of increasing the sensitiveness of the instrument. The intelligence of tornadoes that reaches us from time to time shows that, in some localities and on some occasions, wind pressures amounting to sufficient to overturn railway cars, destroy buildings, and uproot growing trees, may be met with. It is certain, however, that the more violent these storms are, the more restricted is their range. They may cut a clear strip across a town or tract of country, leaving everything bordering their path intact. No gasholder or other large and light erection would stand for an instant before such a force as a narrow tornado can exert; but seeing how local these atmospheric disturbances are, even in their native homes, engineers treat them according to the advice given in 1881 by Mr. Hawksley, when he told the British Association that no provision for withstanding the effects of whirlwinds could with propriety be introduced into calculations of the strength of structures intended to have a commercial value. Nobody will ever know what an anemometer would say respecting the pressure exerted by a typical narrow tornado in full career, because any instrument of the kind set up in the pathway of such a storm would be swept away with all its attachments.

SHRINKAGE OF FILLING ON SALT MEADOWS.

SOME interesting data in regard to the so-called "shrinkage" of filling on a salt meadow is given by Walter C. Berg, Principal Assistant Engineer of the Lehigh Valley Railroad Company, and has been furnished to this journal by Francis Collingwood, C. E.

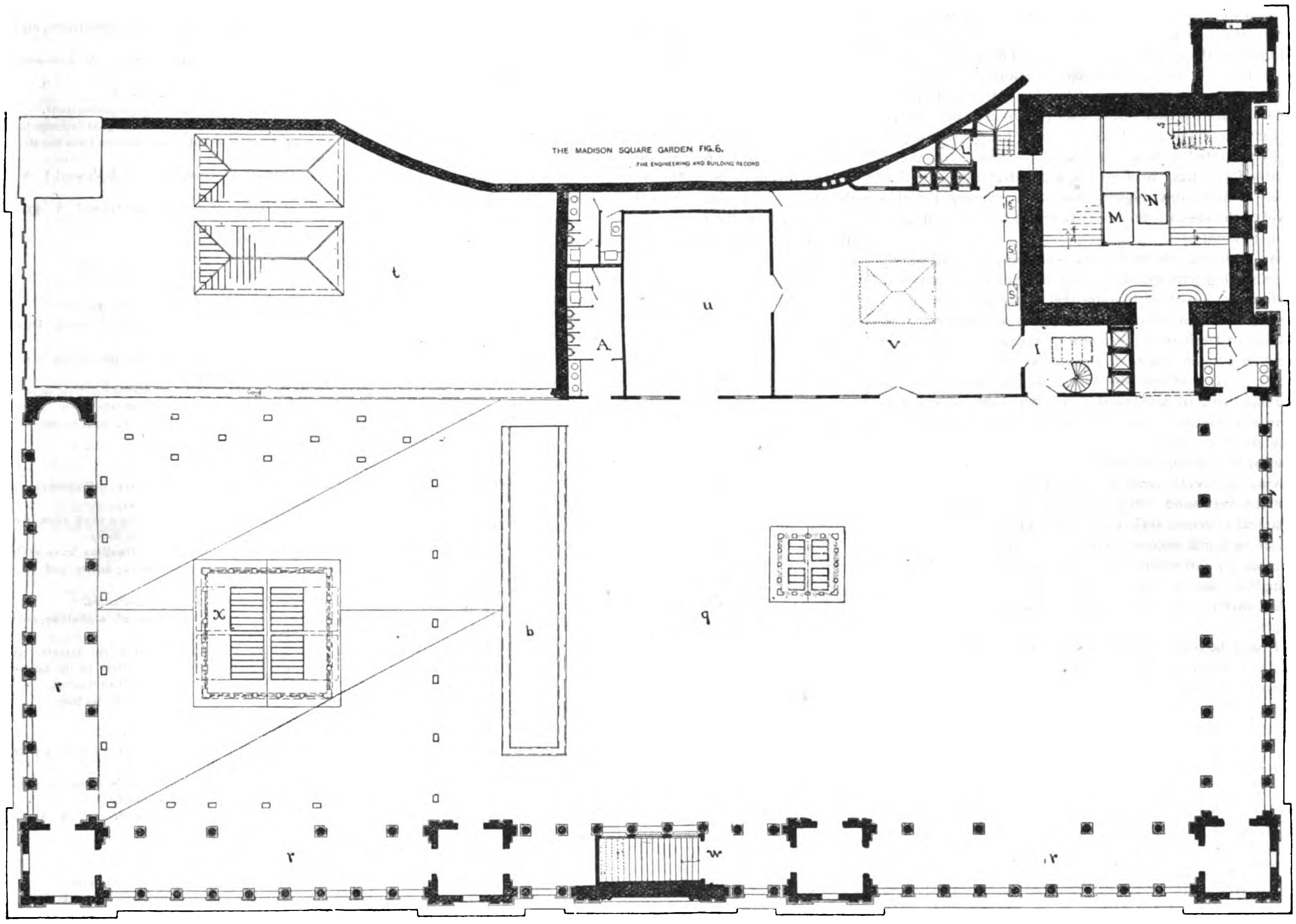
The fill was on the east approach incline of the J. C. N. & W. Ry. to the P. R. R. Bridge at Newark, N. J. It formed, when completed a double track embankment 1,200 feet long, 14 feet above the surface of the meadow at one end and five feet at the other and having a gradient of 0.75 per cent. The surface of the meadow was about at high water level in Newark Bay and for a depth of 8 feet the soil was soft mud below which was quicksand. The track for the dump cars was first laid on a small crib of old ties and was raised from time to time as the work progressed until the proper elevation was reached.

New York City "street dirt" was at first used exclusively (shipped on cars from Jersey City from February to May, 1890), but it was afterwards covered by about 6 inches of solid earth. The material is quite compact, although considerable additional shrinkage is expected to take place when the double track is laid and put in use. The surface of the meadow on each side was not visibly disturbed by the weight of the embankment.

Up to May 28 there had been placed in the embankment, by car measurement, 20,551.2 cubic yards of "street dirt" and 1,303.9 cubic yards of earth, a total of 21,855.1 cubic yards. The total yardage by cross sections taken on that date was 15,586.7 cubic yards, showing a total shrinkage of fill of 6,268.4 cubic yards, or 28.7 per cent. of the whole amount of the material delivered. If this shrinkage be divided by the total yardage found by cross section it will give 42.1 per cent. which is the ratio in which the yardage of the completed fill must be increased in order to find the amount of material required to make it.

In a subsequent letter Mr. Berg says: "The use of the word 'shrinkage' is a misnomer in this case. * * * It is mostly compression of the peaty material underneath the fill. Relative to the proportion of the shrinkage of the street dirt proper, I am not able to say anything direct as we have had no actual observations. The percentage given under the term of 'shrinkage' should really be 'percentage showing the increase of actual volume regained over the theoretical section above the meadow level to make the fill of the kind shown under the conditions as given.' In other words, this information would give data as to how much to add to the theoretical cross sections to get at about the true volume required in making fills on salt meadow bottoms. * * * The salt meadow at this point is really very shallow and that accounts for there being no mud wave action on each side of the fill, that is, any action perceptible to the eye, as levels were not taken."

SEATLESS safety valves are said to have been brought out in England more than 30 years ago.


THE MADISON SQUARE GARDEN FIG. 6.
THE ENGINEERING AND BUILDING RECORD
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THE PHILADELPHIA WATER SUPPLY AND THE PHILADELPHIA AND READING R. R.

A SPECIAL injunction was granted on the 16th inst., in a bill in equity filed by the City of Philadelphia against the Schuylkill Navigation Company and the Philadelphia and Reading Railroad Company, restraining the defendants from interfering with the use of the water of the Schuylkill by the city and its inhabitants for domestic and other purposes, and from lowering the water in the pool to a point which will interfere with the use of it by the plaintiff.

The complaint stated that the agents of the defendants have, since daylight of the 16th inst., opened the locks, emptying the pools at the Flat Rock Dam, and had announced their intention of keeping the locks open until the water shall be lowered five feet below the comb of the dam. In three hours afterward the pool was lowered 18 inches, and the pumping at the Roxborough Station would have to be stopped. The section served with Schuylkill water includes Falls of Schuylkill, Manayunk, Roxborough, Germantown, Chestnut Hill and Mt. Airy.

THE ACTION OF QUICKSANDS.

THE peculiar property of quicksands in swallowing up bodies which may happen to come upon them is well known. In a paper on the subject, recently presented to the British Institution of Civil Engineers, Mr. Wilfrid Airy pointed out that articles great and small, which would be perfectly well able to float in water, are unable to do so in a quicksand, although it is of greater specific gravity than water, and are gradually drawn down. Vessels which have been stranded on quicksands by a falling tide have been unable to float off when the tide has again risen, and after being swamped have settled down deeply into the sand; and, in the descriptive accounts of such accidents, it is often stated that there appeared to be something mysterious in the way the vessels disappeared.

When a vessel or other body floats in water, it floats by virtue of the vertical components of the water-pressures around it. If, for instance, the body be a rectangular box floating with its sides vertical, then the box floats solely by reason of the water pressure on its bottom; and, if its bottom were protected in any way from the action of the water, the box would not float. This is precisely what happens in the case of a quicksand. The mingled mass of water, silt and sand which constitutes a quicksand forms a semi-fluid which is not capable of transmitting the full hydraulic pressure of the water. When, therefore, a vessel comes upon such a quicksand her bottom is partially protected from the action of the water, and she is unable for a time to float up, even after the water has risen considerably higher than the ordinary flotation level of the vessel. Sooner or later she will float up if she be not swamped.

A quicksand may be defined as a mass consisting chiefly of sand; but partially also of silt or argillaceous matter so intimately mixed with water that it forms a semi-fluid, having all the properties of a fluid, but in a minor degree. The most familiar instance of a quicksand is that of the sand on a beach, where it is kept alive and mixed up with water, soil, and organic matter by the action of land springs rising from below it; this often forms a very dangerous quicksand. But the admixture with water may be due to other causes. In general, the tendency of silty sand is to sink together and form a firm, compact body, having apparently none of the properties of a quicksand; but this very sand, when its surface is disturbed by mechanical violence, such as the force of the waves, will, to a certain depth, become a quicksand. The grains of sand become so intimately mixed up with the water that the mingled mass of sand, silt and water, becomes a semi-fluid covering the solid body of the sand to a certain depth.

It will be readily seen that the extent to which a mass of sand is capable of becoming a quicksand will depend upon the fineness of the sand, and the extent to which it is mixed with silt or argillaceous matter. If the sand be sharp and clean, no matter whether it be coarse or fine, it has very little of the nature of a quicksand; but if it be in a fine state of division, and be mixed with silt, etc., the particles will be readily held in suspension by the water, and it may form a deep quicksand. If a vessel be left upon such a quicksand by the falling tide it will sink considerably into it, and the sand will form a very complete and sufficient seal round the bottom; and on the subsequent rise of the tide the vessel will not float when the water has reached the ordinary flotation level, but a considerable time will elapse before the water can communicate sufficient of its pressure through the seal of sand to float up the vessel; and in the meantime the water will have risen considerably higher than the ordinary flotation level of the vessel.

In order to verify these conclusions, and to obtain some reliable measurement of the effect of such quicksands, Mr. Airy made experiments in the following manner: A trough was prepared containing several inches in depth of the sand to be experimented upon, with water above it; and the surface of this sand was worked up by hand so as to become "quick" to a small depth. A rectangular water-tight box, 12 inches long by 8 inches broad, was then floated in the water, and was forced down upon the sand with its sides vertical, and sunk into it to the depth of one-half inch. When released from the pressure by which it had been forced down, it remained sunk, and was held down by a great force, due mainly to the atmospheric pressure, while at the same time its bottom was protected from the action of the still greater external pressures by the seal of the sand. The time was then observed which elapsed before the external pressures were able to break through the seal of sand sufficiently to float the box.

Many experiments were made with different kinds of sand, both fine and coarse, with the general result that clean and sharp sands had few of the properties of a quicksand. But the case was different with sands which, although apparently clean, contained an admixture of clayey matter. When the box was forced down upon such sands it felt quite free as if floating, and could be moved about laterally with great ease; but it offered very great resistance to a vertical pull. The experiments all showed that there exists in fine sand, with a slight admixture of clayey matter, a capacity for becoming "quick," and holding vessels to a degree which, in combination with other causes, may act powerfully in bringing about some of the terrible and unexplained shipwrecks that so frequently occur on sand banks. If in any case it should be thought advisable to make provision for freeing ships from sand banks which they might be liable to run upon, the plan to be pursued is tolerably clear. All that is wanted is to assist the external water in breaking through the seal of the sand round the bottom, and in re-establishing the full hydraulic pressure. This could be done by forcing water with pumps through holes in the ship's bottom, and would probably soon have the desired effect.

STREET CLEANING PARTICULARS.

BEARING further on the subject of street cleaning, referred to in our issues of August 9 and 16, the following additional particulars concerning the removal of dead animals, offal, etc., from the streets of New York are interesting. The sections given are from the "New York City Consolidation Act of 1882."

SECTION 566. The Board of Health shall have full and exclusive power and authority over the removal of night soil, and in the removal of dead animals, offal, night soil, blood, bones, tainted or impure meats, and other refuse matter from said city. It is hereby charged with the duty of causing the removal of the same daily, or as often as may be necessary, and of keeping the said city clean from all matter or nuisance of a similar kind.

SEC. 567. The Board of Health is authorized to make contracts with any responsible person or persons for the removal of said offal, dead animals, night soil and other refuse matter from the city of New York, and to require and receive security in such form and amount as the said Board may approve, for the faithful performance by the person or persons aforesaid, to whom such contracts may by the said Board be, in its discretion, awarded, of all and every of the provisions of such contracts on his or their part.

SEC. 741. It shall be lawful for the Commissioner of Street Cleaning to cause to be dumped, or authorize to be dumped, snow and ice from the ends, or near the ends, of any piers, into the waters of the East and North or Hudson Rivers. But no dead animals, carrion, street sweepings, garbage, or any putrid, offensive, decaying, or refuse vegetable or animal matter shall be deposited in violation of sections 749 and 750.

SEC. 750. It shall not be lawful for any person or persons to sail, navigate or move, or to aid, direct or assist in sailing, navigating or moving, or to be employed upon or to accompany any boat or vessel containing any such animals or material as is named in the preceding section, through or upon the waters of that part of New York Bay, known as the Narrows, and lying between Forts Wadsworth and Hamilton, or any part of said bay south of said Narrows, with the intent or for the purpose of throwing or casting such animal or material, or any portion thereof, into the ocean or sea, or in any portion of the waters mentioned in the preceding section, without a permit, in writing, first obtained therefor from the inspector appointed or to be appointed under chapter 604 of the laws of 1875, and the amendments thereof, who shall have the power of granting such permits from time to time as he shall deem proper, and which shall not be inconsistent with the last preceding section, and having such regard to the course and condition of the then existing winds and tides as in his judgment shall best tend to prevent the subsequent return or deposit of any such contents of said boat or vessel within the waters of this State, if cast upon the waters beyond the jurisdiction thereof.

SEC. 752. It shall not be lawful for any person or persons to sail, navigate, or move, or to aid, direct, or assist in sailing, navigating, or moving, or to be employed upon or to accompany any boat or vessel engaged in the transportation of any dead animal, carrion, offal, or any putrid, offensive refuse, decaying or decayed vegetable or animal matter, or any garbage or sweepings taken from the streets of any city, upon the waters referred to in the last section but one, unless the same be propelled or moved by steam power; and it shall not be lawful for any steam vessel to tow or carry any of the articles mentioned in this section unless its name be plainly painted on each side.

SEC. 753. Any person offending against the provisions of sections 750 and 752 shall be deemed guilty of a misdemeanor, and liable to imprisonment for a term of not less than six months and to a fine of not less than $500, in the discretion of the court, for each and every offense, and may be arrested by the authorities of either of the counties of New York, Kings, Queens, Westchester, or Richmond. The courts in said counties respectively shall have power and jurisdiction to try said offenders, whether the offense be committed within their respective counties or not. Out of any moneys received for fines, such sum or sums shall be allowed and paid for the expenses and disbursements attending the arrest, as the court or magistrate may deem reasonable or proper.

We have also received the appended tables, giving data, for Brooklyn, N. Y., and Boston, Mass.:

BROOKLYN, N. Y

1. What is the population? A. 852,000.

2. How many houses, stores and dwellings? A. Number of stores and dwellings, 101,683; buildings other than dwellings, 7,951; total, 109,634.

3. How often are ashes removed? A. Once a week.

4. How often is garbage removed? A. Tri-weekly during May, June, July, August, September and October; semi-weekly during November, December, January, February, March and April

5. How many miles of paved streets? A. 366.911 miles.

6. With what are they paved? A. Belgian, cobble, granite and asphalt. Granite blocks, 55,303 miles; Belgian blocks, 22,410 miles; concrete asphalt, 8,822 miles; cobbles, 280,378.

7. How often are they cleaned? A. Where most traffic, nightly; others, three times a week.

8. What is the average width of main streets? A. main avenues, 70 feet; main streets, 60 feet.

9. Are your streets underdrained? A. Sewers.

10. How many sewer catch basins? A. 5,500 (estimated).

11. How often are they cleaned? A. Twice a year (average).

12, What provision for removal of dead animals from the streets A. Removed by contractor.

13. Is the above work done by contract or by day's work? A. By contract for term of five years.

14 What is the annual cost of cleaning the streets? A. $340,000 (estimated).

15. Removing ashes? A. $140,000.

16. Removing garbage? A. $95,000.

17. Cleaning catch basins? A. $16,000 (estimated).

18. Removal of dead animals? A. $800.

19. For the supervision of all above work? A $32 000.

20 What is the final disposition of the street dirt? A. Dumped at sea, in part, and part in low lots.

21. Ashes? A. Dumped at sea, in part, and part in low lots.

22. Garbage? A. By boat to sea.

23. Dead animals? A. Removed to rendering establishment.

24. Are streets swept by machinery, or hand labor? A. Both.

25. What kind of hand brooms are used? A. Bass brooms.

BOSTON, MASS.

1. What is the population? A. 450,000.

2. How many houses and stores? A. 3,214. Dwellings? A. 49,716. Apartment houses and hotels? A. 445.

3. How often are ashes removed? A. Once a week from dwellings; stores, twice a week; markets and hotels, daily.

4. How often is garbage removed? A. Dwelling houses, three times a week, in summer usually twice a week; hotels and restaurants, daily.

5. How many miles of paved streets? A. 404 miles.

6. With what are they paved? A. Blocks 26, asphalt 27, cobbles 8,. macadam 172, gravel 159

7. How often are they cleaned? A. Principal streets, daily; others, two and three times a week; the gutters to the macadam streets in outlying districts are cleaned once in two months.

8. What the average width of main streets? A. 40 feet.

9 Are your streets underdrained? A. Yes.

10. How many sewer catch basins? A. 6,000.

11. How often are they cleaned? A. From 1 to 12 times a year, as often as necessary after heavy rains.

12. What provision for removal of dead animals from the streets? A. By a rendering company at no expense to city.

13. What is the annual cost of cleaning the streets? A. $150,000.

14. Removing ashes? A. $200,000.

15. Removing garbage? A. $130,000.

16. Cleaning catch basins? A. $25,000.

17. Removal of dead animals? A. No expense to city.

18. What is the final disposition of the street dirt? A. Used for filling vacant lots, wharf property and sent to sea.

19. Ashes? A. Same as street dirt.

20. Garbage? A. Sold to farmers from adjoining towns

21. Dead animals? A. To the rendering company.

22. Are streets swept by machinery or hand labor? A. Both

23. What kind of hand brooms are used? A. Made of birch brush. The machines used are made by the Abbot-Downing Company, of Concord, N. H.

THE St. Louis Master Plumbers' Association vigorously protest the report that they contemplated withdrawing from the National Association. In a recently issued circular they say: "We want it distinctly understood that there are no secessionists in our association. * * * The St. Louis Master Plumbers' Association occupies the same relation to the National Association that the State of Missouri occupies to the General Government. We are a part and parcel of the National Association."

IT is said that the famous Kinzua viaduct, on the N. Y., L. E. & W. R. R., will be replaced by a heavier structure. The viaduct for years has been one of the remarkable bridges of the world.

COLD WATER WITHOUT ICE.

THE following method of obtaining a constant supply of cool water at all times is described by the *Railroad and Engineering Journal*, as being in general use in Hanover, York County, Pa.

The town, says the *Journal*, is closely built up and without any system of drainage, so that the water from the wells is unfit to drink. Some years ago these reasons led to the introduction into the town of a supply of very excellent water from a large spring about three miles distant. This water is brought through iron pipes, and when it reaches the consumer in summer is warm, while the water in the wells is cool. For this reason many of the inhabitants drink the well water, and, as a consequence, typhoid fever is a prevalent disease in that community. In order to obtain pure cool water, not impregnated with lime, some of the inhabitants of the place have adopted a plan which is so simple and gives such excellent results that it is worthy of general adoption wherever there is a water supply other than wells or springs. The plan is as follows: A cylindrical galvanized sheet iron tank, 12 inches in diameter and 4 feet or 5 feet long, is placed in the bottom of a well. This tank is then connected by a galvanized iron pipe with the water supply pipes, and another pipe is carried from the tank to the surface of the ground, or to any convenient point for drawing water, and has a cock at the upper end. The tank is consequently always filled with water from the water supply, and being in the bottom of the well, the water is cooled off and acquires the temperature of the well; so that that which is drawn from the tank is as cool as well water, and is without any of the impurities with which the latter is contaminated. The water drawn from the tank in one of the wells in the place named had a temperature of 56 degrees when the thermometer in the atmosphere above stood at 76 degrees.

This method gives an abundant supply of cool water during the whole summer, and can be adopted in all cities, towns or in the country. If a well is available it can be used; if not, by simply digging a hole in the ground, deep enough so as not to be affected by the surface temperature, and burying the tank, it will answer equally well. This hole might be dug in a cellar or outside the building. If the water has any impurities in suspension, such as mud, the tank should be made accessible, so that it can be cleaned occasionally.

TAPPING THE ERIE CANAL.

THE boatmen on the Erie Canal, at Lockport, N. Y., are complaining vigorously of the practice of tapping the canal at that point and at several other places. The interests involved are on the one hand the commerce of the Erie Canal, and on the other certain big manufacturing concerns which supply virtually the vitality to the Lock City. These factories are said to borrow their power from the Erie Canal.

Scarcely a year has passed since this tapping of State water began that boat owners have not complained of its serious interference with canal navigation. The great volume of water rushing into the tunnels created a sort of whirlpool and boats once drawn into the vortex could not be released until the gates in the tunnels were shut down. This year the complaints are renewed with added energy. Boatmen seem universally to agree that the trouble is worse than ever before. They are not satisfied with claiming that the situation is serious but they assert that it is positively dangerous. The chief cause for complaint seems to be a new tunnel which taps the canal above the locks and supplies the power for a "pulp" manufactory, as it is called by the boatmen.

THE PENNSYLVANIA RAILROAD COMPANY'S WATER-WORKS AT HARRISON, N. J.

THE extensive water plant on which the Pennsylvania Railroad Company has been at work in Harrison, N. J., for the purpose of securing for railroad uses a water supply for the Hudson County section of the road is completed, and will soon be ready for use. A system of wells sunk just north of the Illingworth Steel Works, three miles of water mains alongside the railway tracks, a large reservoir at Marion, and boilers and pumps at the Harrison end of the line, constitute the new water plant. The pump will bring up 400 gallons of water per minute, and it is calculated that the works can furnish the road with a quarter of a million gallons of water daily.

ADHESIVE STRENGTH OF SULPHUR, LEAD AND PORTLAND CEMENT FOR ANCHORING BOLTS.

UNDER the above head a correspondent of the Troy *Polytechnic* says that during a recent experience in constructing foundations for an elevated railway, solid rock was encountered so near the surface as to necessitate anchoring the foundation bolts in it. Some more durable and economic means of accomplishing this than by the use of sulphur or lead was desired, and Portland cement was suggested as being suitable.

A careful investigation failed to find any record showing the adhesive strength of cement in pounds per square inch, when used this way; hence it was decided to make such experimental tests as would give reasonably positive information on this point. For this purpose 14 holes were drilled in a ledge of solid limestone, 7 of them being 1⅜ inches in diameter and 7 of them 1⅝ inches in diameter, all being 3½ feet deep. Seven ¾-inch and seven 1-inch bolts were prepared, with thread and nut on one end and plain at the other end, but ragged for a length of 3½ feet from the blank end.

Four were anchored with sulphur, 4 with lead and 6 with cement mixed neat. Half of each were ¾ inch and half 1-inch bolts, and all of them were allowed to stand till the cement was two weeks old. At the expiration of this time a lever of sufficient power was rigged and all the bolts were pulled with the following results:

Sulphur—3 bolts out of four developed their full strength, 16,000 and 31,000 pounds. One 1-inch bolt failed by drawing out under 12,000 pounds.

Lead—3 bolts out of 4 developed their full strength, as above; one 1-inch bolt pulled out under 13,000 pounds.

Cement—5 of the bolts out of 6 broke without pulling out; one 1-inch bolt began to yield in the cement at 26,000 pounds, but sustained the load a few seconds before it broke.

Whilst this experiment demonstrated the superiority of cement both as to strength and ease of application, yet it did not give the strength per square inch of area. To determine this, four specimens of limestone were prepared, each 10 inches wide, 18 inches long and 12 inches thick, two of them having 1¾-inch holes, and two of them 2¾-inch holes drilled in them. Into the small holes 1-inch bolts were cemented, one of them being perfectly plain round iron, and the other having a thread cut on the portion which was imbedded in the cement. Into the 2¾-inch holes were cemented 2 inch bolts similarly treated, and the four specimens were allowed to stand 13 days before completing the experiment. At the end of this time they were put into a standard testing machine and pulled. The plain 1-inch bolt began to yield at 20,000 pounds, and the threaded one at 21,000 pounds. The 2-inch plain bolt began to yield at 34,000 pounds, and the threaded one at 32,000 pounds, the strain in all cases being very slowly applied. The pump was then run at a greater speed, and the stones holding the 2-inch bolts split at 67 pounds in the case of the smooth one, and at 50,000 pounds in the case of the threaded one.

It is thus seen that cement is more reliable, stronger and easier of application than either lead or sulphur, and that its resistance is from 400 to 500 pounds per square inch of surface exposed. The cement used throughout the experiment was an English Portland cement.

THE scheme of Commissioner Hans S. Beattie, of the New York Street-Cleaning Department, to clean some of the streets by aid of a fire engine and the flushing process, has met with the opposition of the Department of Public Works. Horace Loomis, engineer in charge of sewers, has reported to the Commissioner of Public Works that Mr. Beattie's flushing process is washing a considerable part of the dirt of the streets into the sewers and choking them up.

PUBLICATIONS RECEIVED.

REPORT of PROCEEDINGS OF THE TENTH ANNUAL MEETING OF THE AMERICAN WATER-WORKS ASSOCIATION, CHICAGO, ILL.; May 20-22, 1890.

TENTH ANNUAL REPORT OF THE STATE BOARD OF HEALTH OF NEW YORK.

REPORT OF THE FIFTH ANNUAL MEETING OF THE ILLINOIS SOCIETY OF ENGINEERS AND SURVEYORS. Held at Peoria, Ill., January 29-31, 1890.

MANUAL FOR THE USE OF BOARDS OF HEALTH OF MASSACHUSETTS. Prepared by direction of the State Board of Health.

ANNUAL REPORT OF BUREAU OF HEALTH, PITTSBURG, 1889.

Correspondence.

Communications giving information or opinions on matters of general interest to the engineer, the architect, the contractor, or the municipal officer, will be welcomed in this column. Fairness will suggest that when communications are sent simultaneously to this and other journals we should be informed of it at the time. Anonymous letters will not be noticed.

TUNNELING THE NARROWS.

BROOKLYN, August 18, 1890.

To the Editor of THE ENGINEERING AND BUILDING RECORD·

DEAR SIR: The project of tunneling the Narrows for railroad purposes, which Mr. Winans is said to favor, is not exactly a new one. It was first proposed, I believe, by one of the ablest of our engineers about ten years ago. He designed by its use and the construction of another tunnel to the main land near Hell Gate, to furnish new territory on Long Island for the storage and distribution of freight, and to give a direct and convenient all-rail route to the upper portion of New York City and to New England.

Perhaps the time is not yet ripe for the construction of this Narrows tunnel. It would, however, be unwise at any time to underestimate or exaggerate the difficulties of the problem.

The newspaper reports say that the material to be penetrated will be a soft soap-stone, easily worked and strong enough to resist the strain, and that the top of the tunnel will be 35 feet beneath the bottom of the Narrows. The character of the material predicted for in this location will, I fear, astonish some of the geologists.

The New York tower foundation of the East River bridge was excavated through sand and gravel to bed rock at a depth of about 100 feet. The recent borings for the Quaker Bridge Dam show the same or similar material to the rock bottom of a valley about 120 feet below the present level of the Hudson River. It is believed that something in the nature of a rock-bounded cañon exists below the present Hudson River valley of a depth not less than 100 feet below present tide level, and that this extends far out beyond Sandy Hook, the high grounds of the Palisades, Staten Island and the Navesink forming its western boundary. The bed of this prehistoric valley is probably rock of the earliest formation or trap. The valley has probably been filled up to present height of bottom with compacted gravel and boulders similar to the material on Long Island. It would not, therefore, be surprising if a tunnel built anywhere between 30 and 130 feet below tide level ran almost entirely in the last named material. There should, however, be nothing essentially prohibitory in this if true.

We must learn from cases of this kind and those similar to the projected Harlem Tunnels, where excessive depth is so important an item to avoid, to construct tunnels whose tops may be exposed, if necessary, above the river bottom. This is certainly not impossible, and I venture to say that when the occasion demands, will be found quite practicable.

O. F. NICHOLS.

THE NICARAGUA CANAL.

BY advices from San Francisco, information comes of the purchase by the Nicaragua Canal Construction Company of the plant of the American Contract and Dredging Company at Colon, formerly used on the works of the Panama Canal. The purchase includes seven dredges, fifteen lighters, several tugboats, and the machine shops, with all their machinery, tools and supplies of every kind complete. The entire plant is now being rapidly put in order for removal to San Juan del Norte, (Greytown,) and some of the dredges and tugs are already on their way there. Chief Engineer Menocal has arrived at San Juan del Norte to attend their coming.

These dredges are to be used in harbor dredging and in excavating the first ten miles of the canal, from its mouth to the first lock.

THE New York Board of Health Inspectors have found the water of all the public baths more or less filled with noxious particles, except at the Battery, while the bottom of nearly all contained unhealthy deposits. Dr. Edson will advise the reconstruction of the bath-houses and their removal to the ends of the different piers, where the water is purer and not liable to become stagnant.

Questions and Answers.

All questions relating to building construction, paving, sewerage, water supply, or kindred subjects, will be welcomed in this column provided they relate to matters of general interest and are not such as should properly be referred to a consulting engineer. Answers will be carefully prepared and a proof of both question and answer mailed to the inquirer as early as proper consideration will permit. They will be published for the benefit of other readers as soon as convenient. The full name and address should be given, not necessarily for publication, but as a guarantee of good faith, and to facilitate further correspondence in case the question is not sufficiently explicit.

Inquiries of the Editor, in order to secure prompt attention, should *not be written on the same piece of paper as a communication* to the *Publishing Department*. Letters renewing subscriptions are sent to a clerk in the publishing office, and matter for the Editor, if in the same enclosure, is likely to be overlooked unless it is on a separate piece of paper, so that it may be promptly sent to the Editor.

ALGAE GROWTHS IN WELLS.

J. D. Thomas, President and Manager of the Paris, Tex., Water Company, writes: "We get our water supply from a system of dug wells and tunnels. We have a large open well 80 feet in diameter and 35 feet deep. In this well we have had considerable trouble and annoyance, in the spring and early summer, from an algae or vegetable growth, which gives out a disagreeable odor and taste. We have also a smaller and deeper well from which we propose to pump the water into the big well, letting it fall over the top and creating considerable agitation. Now the question is, will this agitation of the water in the big well improve it, or will it only make it worse?"

[It is doubtful whether the plan of pumping from the smaller into the larger well will make any noticeable difference, either one way or the other. Roofing over the well so as to exclude all sunlight may prevent the algae growth, as shown by experience in several somewhat similar cases. There is, according to Mr. F. F. Forbes, Superintendent of the Brookline, Mass., Water-Works, a class of plants, however, which thrive as well in complete darkness as in sunlight, but such plants are not able to make their own food, and are, hence, wholly dependent on food made by other plants. Water which contains vegetable solutions in sufficient quantity with certain organic matters might, therefore, develop an extensive growth even in total darkness.

We would be glad to hear from any of our readers concerning Mr. Thomas' inquiry.]

THOSE DANGEROUS TRUSSES.

Mr. Fredrick J. Amweg, C. E., of the firm of R. C. Ballinger & Co., Philadelphia, Pa., contractors for Herrmann's Theatre, at Brooklyn, N. Y., to which extended reference has been made in the last two issues of The Engineering and Building Record, writes:

"Relative to the communication entitled, 'Dangerous Trusses,' I beg to say that the trusses in question have never been either approved or condemned by me. We are the contractors for the building in which these trusses were supposed to be used, and Mr. J. D. Allen, of Philadelphia, is the architect, to whom we looked for all information concerning the construction of said building.

"We were not employed as the architects of this work, and therefore assumed no responsibility belonging to the present incumbent.

"We, of course, look to Mr. Allen in his capacity to make all matters satisfactory, and when done so, we are ready to go on with the work."

STEEL RAIL MAKERS IN ALABAMA.

William G. Smith, C. E., of Waterbury, Conn., writes: "Will you kindly send me the addresses of the concerns who make steel rails at Anniston and Birmingham, Ala.? I have not the facilities for finding out here. I am the engineer for a Southern electric road, and want prices from some of the Southern manufacturers."

[There are no rolling mills in Alabama which can properly be classed as steel rail mills. The Birmingham Rolling Mill Company, and the Alabama Rolling Mill Company, of Birmingham, the only works which could be put under that head, turn out only small T rails and tram rails. Possibly these would answer our correspondent's requirements.]

The horse-power transmitted by hemp ropes can be found by multiplying the square of their circumference in inches by their speed in feet per minute, and dividing by 4,000. For cotton ropes 25 per cent. should be added to the result.

Notes and Queries

on Domestic Engineering.

Communications relating to the practical details of plumbing, heating, lighting and ventilation will be welcomed in this column. The writer's true name and address must always be given, but an assumed name may be used for publication if preferred.

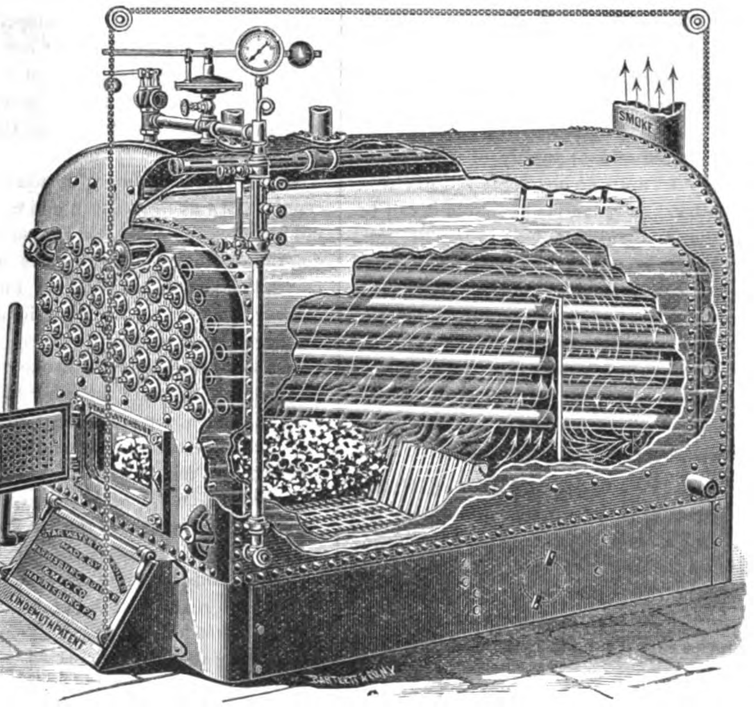
APPORTIONMENT OF COSTS FOR STEAM.

Latting & Bailey, plumbers, of Memphis, Tenn., write: "Please decide the following question: A and B have two 50 horse-power boilers coupled together. A's boiler has a six horse power engine to run and 1,500 square feet of radiating surface to heat; B's boiler has a large elevator pump to run, also a boiler feed pump and heats 2,800 square feet of surface. A's boiler has only two and three-quarter hours to run out of the twenty-four, say three hours. B's boiler is to run twenty-four hours. Please determine the percentage of fuel each party should pay for."

[The percentage of fuel to be paid for by each in this case depends altogether upon the amount of steam used by each, and this cannot be determined from the meager particulars given. Just how much steam the six horse-power engine and the elevator and feed pumps consume ought to be determined by measurements by a competent consulting engineer.

The matter should not be left to guesswork, which, in such instances, frequently goes very wide of the mark.

As regards the radiator consumption, it may be pointed out that a radiator will condense from ⅙ to ⅜ of a pound of steam per square foot of surface per hour, varying with the nature of the surface and the kind and position of the pipes.



THE STAR WATER TUBE BOILER.

With low-pressure steam, ⅓ of a pound of steam per square foot of surface per hour is not too great an estimate for the man who has to sell the steam. Accordingly, the 1,500 square feet of radiating surface supplied by A's boiler would condense about 500 pounds of steam into water in an hour, and the 2,800 square feet supplied by B's boiler would condense about 933 pounds per hour. Allowing 9 pounds of steam as the evaporative power of one pound of coal, A's boiler would use, for the radiator supply alone, about 55½ pounds of coal per hour, and B's boiler about 103 pounds per hour.]

AN IRISH CHANNEL TUNNEL.

A proposal is being entertained of having a tunnel between Ireland and Scotland, and for this three routes have been suggested—the first from Donaghadee to Portpatrick, the second from Cushendall to Mull of Cantyre, and the third from Whitehead to Portpatrick. Of these, says *Industries*, the last seems the most reasonable; but even it would require very careful consideration, for the Irish Channel is much more difficult to tunnel than the English Channel, the depth of the water in some cases exceeding 900 feet, so that the tunnel would require to be 1,000 feet below the surface of the water at mid-channel. Besides, the rock is hard and very different, as regards facility of working, from the Dover chalk.

Novelties.

Devices are described under this head purely and strictly as news; because believed to be new and calculated to interest readers.

In no case is pay accepted, directly or indirectly, for publishing a novelty notice.

As the subjects are selected for their supposed novelty and interest merely, it will, of course, be understood that the selection does not imply indorsement.

THE STAR BOILER.

The annexed cut shows the new Star water-tube boiler just brought out by the Harrisburg Boiler and Manufacturing Company, of Harrisburg, Pa.

It is designed to heat all classes of large buildings requiring 1,000 square feet of radiating surface or more, and is adapted to both steam and hot water heating. It is also claimed to recommend itself for power purposes. H. H. Lindemuth is the inventor.

The boiler is listed in 16 sizes, of which Nos. 1, 2, 3, 4, 6, 8, 10 and 12 are stock sizes, while the remaining sizes will be built to order. The capacities range from 1,000 square feet of radiating surface to 6,000 for steam, and to 1,250 for hot water heating, and from 10 to 75 horse-power for power purposes. The best shell steel is used in the construction of the boiler, together with flanged steel heads, though iron will be used where specially desired.

The general character of the design is apparent in the illustration, and requires but little description. A special feature is found in the entire absence of brick setting, the boiler being furnished with an independent cast-iron base on which it rests. The grate is of a new shaking pattern. The boiler is surrounded by a water space which measures 2 inches at the sides, and 3 inches at the ends. Great stress is laid by the builders on the relatively large amount of fire-box surface. The fire-box is deep and large and can be made of various lengths, for wood burning, for example, if desired. It is claimed to hold sufficient fuel to maintain a fire for a period of from 8 to 12 hours without requiring attention.

There is claimed, also, to be ample room for good combustion of the gases before they strike the tubes and enter into an upper chamber, not well shown in the cut, impinging there against the crown sheet. Instead of placing the smoke exit in the top of boiler, as was originally done, it is now placed in the rear of the boiler below the tubes.

Experiments recently conducted on the Paris, Lyons and Mediterranean Railroad, France, show that with boilers having tubes averaging 14¾ feet in length there is a total evaporation, in a given time, about 5 per cent. greater than with boilers having tubes 16½ feet long.

Flexible boiler stays are in extensive use on Indian railroads, and give good results.

DOMESTIC PLUMBING & HEATING & LIGHTING & VENTILATION ENGINEERING

PLUMBING IN TEN NEW HOUSES.

In a block of four-story houses just finished on East Seventy-fifth Street, New York City, the water supply for the upper stories of each house is pumped or rises through the 1½-inch pipe A, Fig. 1, and ball-cock B into the copper-lined wooden tank T, that is about 4 feet square. This tank is built to fit a special alcove, and is elevated conveniently for accessibility over the framework of 2 by 4-inch timber joists C C, etc. It rests directly on 2 by 4-inch sills D D D, laid across the lead lined safe E.

The pipe A has a branch R, which takes water from the bottom of the tank, and supplies the lower stories of the house through the filling pipe A. G is a stop cock for controlling the supply, and O is a check valve closing against an upward pressure and preventing the overflow of the tank from the pipe R. F is a special branch to the top floor fixtures only, whose supply is thus made separate to insure some draught from the tank and consequent change of its contents, even though the city pressure is sufficient to always keep the tank full and supply the branches from the pipe A without drawing through the branch R. H is a tell-tale to the cellar sink. I is the safe waste also discharging into the cellar sink (Fig.). M is a 1½-inch overflow pipe discharging into an adjacent slop-sink N.

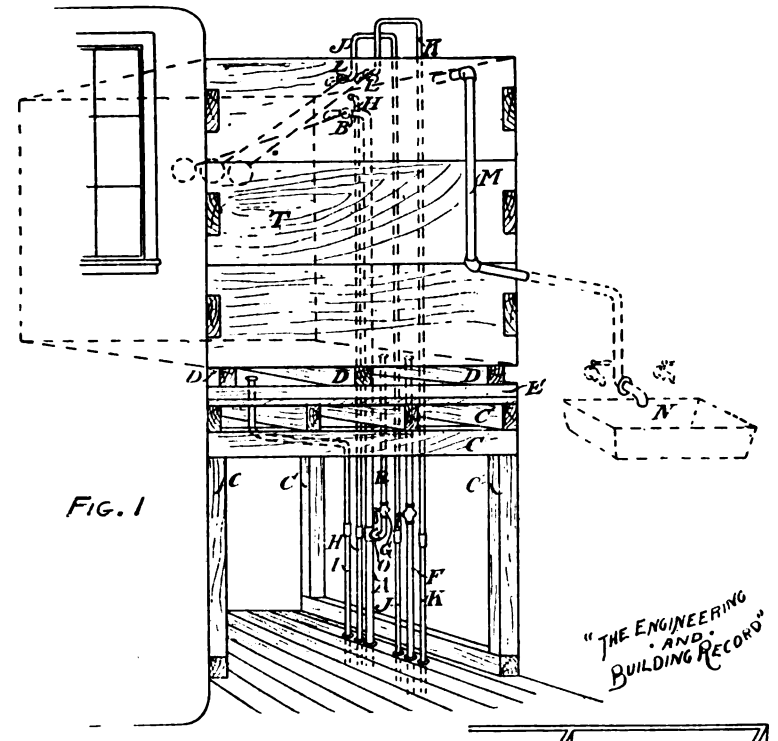


FIG. 1

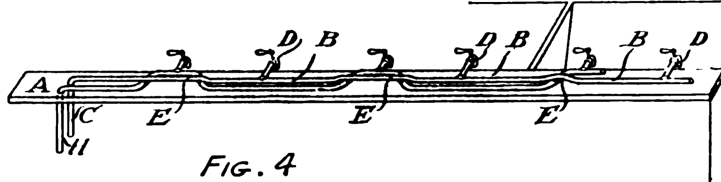


FIG. 4

PLUMBING IN A 75 ST. RESIDENCE, N. Y.

J and K are vent pipes from the kitchen boilers. Each of them terminates in a ball-cock L to prevent the escape of city water through them if the street pressure should be great enough to rise above the tank.

Figure 2 shows the double boiler arrangement in the kitchens. The outside boiler is supplied through a pipe A, with water under street pressure, and delivers hot water through a pipe B. The inside boiler is supplied through a pipe C with water under tank pressure, and delivers hot water through the pipe D. E and F are hot-water return circulation pipes, K and L are circulation pipes to the water-back, and M and N are sediment pipes for emptying the boilers. O O O are gate valves controlling the tank and hot water supplies. P and P are corresponding valves to give a symmetrical appearance to the work, but having their gates removed so that they do not obstruct the pipes or cause any danger of bursting the boilers by being accidentally left closed. The tank pipe C is connected with the street supply pipe A by the branch S, which has a check valve Q. If the tank supply fails the valve Q will open under street pressure and the inside boiler will be filled from the pipe A, but if the street pressure is cut off the valve closes downwards and prevents the escape of tank water.

The pipes are of galvanized iron, and are supported from the ceiling by special brass hangers G G, etc., which, as shown in the detail, are made in two pieces and bolted together. The upper part H is drilled and countersunk to receive the 3-inch wood screw I that can pierce the ceiling J at any point without defacing it, and is driven into a cleat K, between two floor joists L, or directly into the joists if it comes in the proper position.

Figure 3 shows the cellar sink receiving the discharge of all drip pipes throughout the house. F F F are safe wastes, G is cold water supply, H is from the refrigerator, I is a tank tell-tale, and J is sediment pipe from the kitchen boilers. All of these pipes terminate with flap valves.

A is a pipe frame supporting the sink. B is the house sewer which is carried along the cellar wall on hooks C about 10 feet apart. Holes are drilled in the stone wall and the hooks secured in them by firmly driven wooden plugs D alongside.

Horizontal pieces of gas pipe E are leaded into the wall and alternate with the hooks.

Figure 4 shows the arrangement of hot and cold water pipes H and C on the horizontal board A at the laundry tubs. The lateral branch of H is all flat on the board as are the depressed portions B B B of the pipe C. There are three summits E E E where pipe C crosses over H, and these are drained through cocks D D D. This arrangement was devised to bring all the cocks in one straight line, support both pipes on the same shelf A, and avoid making traps that could not be drained by the cocks.

This plumbing was done by Paul S. Bolger, of New York, and George H. Budlong, also of New York, was the architect of the houses.

The works of the first cable tramway in Paris, which runs from Belleville to the Place de la Republique, have been completed. The system employed is that so largely adopted in the United States.

INTERNAL GAS FITTINGS.

In a paper on internal gas fittings, read at the recent annual meeting of the North British Association of Gas Managers, Mr. R. Robertson said that architects are much to blame for existing defects in such work.

He drew attention to the circumstance that all that a gas-fitter receives from an architect, when a new house is being erected, is a specification stating the number of feet of the different sizes of pipes required. No details, or plan, or declivities are given, and the mode of laying is left entirely to the gas-fitter himself. If he has taken a job at a cheap rate, he will endeavor to use as little pipe as possible, without giving much thought about the gas supply.

Corporations and water companies having control of the water supply lay down laws and regulations as to the quality of material to be used in the water fittings inside buildings. The pipes must be of certain sizes and weights, and the cranes or taps or other fittings must be subjected to a standard pressure, and be stamped accordingly. Mr. Robertson holds that similar regulations should apply to gas-fittings, and that all gas-taps and joints should be subjected to a like examination.

Pipes used for gas-fittings are, according to Mr. Robertson, of three kinds—viz., malleable iron, composition, and block tin. The first material is the best for mills and factories where steam power is used, as from its hardness, it is not liable to be cut or break at the fastenings in consequence of the vibration caused by the working of the machinery. Of this sort of pipe, the galvanized is superior to the other, as no rust collects inside, as is sure to do in the ordinary kind; and in course of time obstruct the gas supply.

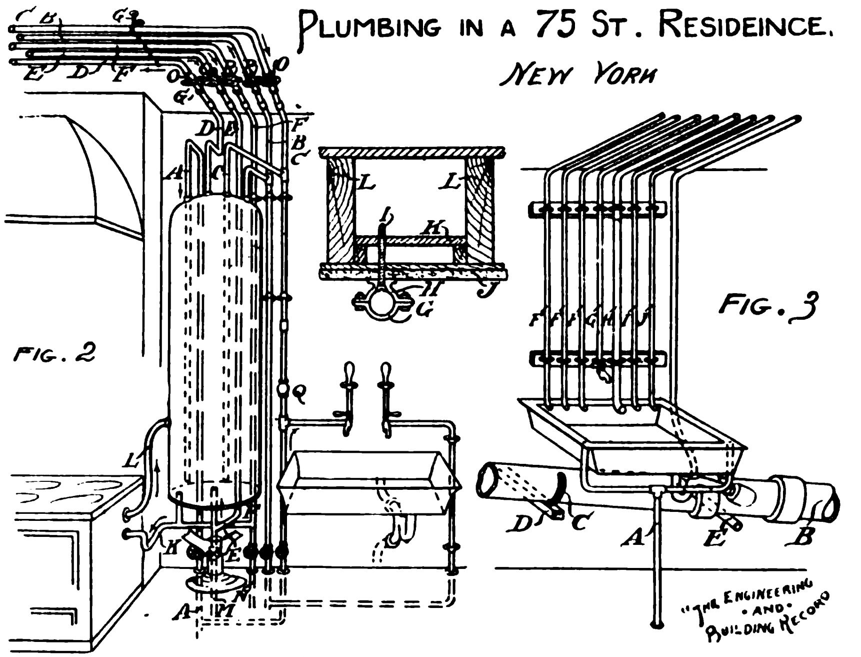


FIG. 2

FIG. 3

PLUMBING IN A 75 ST. RESIDEINCE. NEW YORK

The second kind of piping is composition, of which there are two classes—tinned and untinned. The tinned is a good article for ordinary use, and is extensively employed in country buildings. The use of the untinned kind Mr. Robertson condemns as altogether unsuitable for gas-fitting purposes. It is too easily bent, and is thus always ready to "bag;" while from the softness of its nature it gathers moisture easily, and produces that disagreeable jumping of the lights often seen.

The third class of pipes are of block tin; and these the author considers by far the best that can be used. It is hard, easily laid, rarely gathers moisture, and altogether makes a tidy piece of work. This material is often objected to as being more expensive than the others; but when weight for weight is compared, it will be found that the difference is not so great as supposed, because two yards of block tin pipe weigh nearly the same as one yard of the other. Mr. Robertson strongly recommends the use of this class of piping in preference to all others; and advises that it should be fitted up wherever possible.

One of the oldest houses in America is said to be the stone mansion on the Staats farm, about four miles below the village of Greenbush, N. Y., on the river bank. The building was erected of bluestone and brick in 1650, and at present is occupied by Lawrence and Philip Staats, and is in a splendid state of preservation.

HEATING AND VENTILATING SCHOOL-HOUSES.

(Continued from page 188.)

At the Sanborn school-house, in 1888, a more thorough work was undertaken. A minimum supply of 60,000 cubic feet per hour for each of the eight school-rooms, containing upwards of 50 scholars, was taken as a standard.

A "Clogston" heating boiler was put in, with about 3,000 linear feet of 1¼-inch steam pipe, in addition to the boiler and "direct" heating plant already there. A sheet iron air chamber, in shape resembling a triangle, was put in at each corner of the basement, each chamber drawing its air supply from two windows on two different walls of the building, each opening being covered with a coarse and strong wire grating, and provided with doors and a valve. Two upright sheet iron ducts rose from each of these corner air chambers, each duct containing a coil of 320 linear feet of 1¼-inch steam pipe. These coils, shown in Fig. 4, were each made of two sets of branch tees, one set "feed" and one "return," connected by upright and horizontal pipes and elbows, outside pipes long and inside pipes short, several "nests" of pipe, in fact one fitting inside another; the uprights from each branch tee being alternately short and long in order that the horizontal pipes might offer little obstructive area to the upward air current. For a lower room the coil was compact and the duct large in cross-section, for the vertical space was only about 7 feet, but for an upper room the coil was about 10 feet long, with the pipes fewer and further apart. The duct for an upper room ran up through the lower room and was boxed in. All ducts ran up full size, each to a point about 6 feet above its school-room floor and were open at the top.

For removing the foul air rectangular sheet-iron ducts, each 2 feet square, were used, each starting at the floor level of the room served by it in the cloak-room, and running up as straight as possible to the attic. Each duct had in it a large opening for the school-room and a small one for the cloak-room, the combined sectional area of these two openings being somewhat greater than that of the duct itself, the openings being coarsely grated, as usual. These ducts ran up in pairs from the second floor to the attic, and were there joined into one large pipe, 4 by 8 feet, ending in a rectangular Emerson cap of the same size provided with a damper. The opening from the rooms and the inlet ducts were also provided with dampers or doors, and from 45 to 70 linear feet of 1¼-inch steam pipe was placed in each outlet duct to move the air.

The Blossom Street school house, an eight-room wooden building, was fitted up in almost the same way. Both buildings have passed through one mild winter and half of another with fairly good results, the air supply being found by a few measurements to be up to the standard previously fixed and the air being pronounced good. It has been found troublesome, however, in the mild weather to keep the rooms from getting too hot.

The new building on Baltimore Street, built in 1888, has been overhauled in 1889, according to local custom, and its "indirect" steam-heating apparatus greatly increased in capacity. Its imperfect working during the previous winter was partly explained when, in taking off the louvred cupola to make room for an Emerson cap, the foul-air flues were found half covered with boards left in by careless workmen the previous summer.

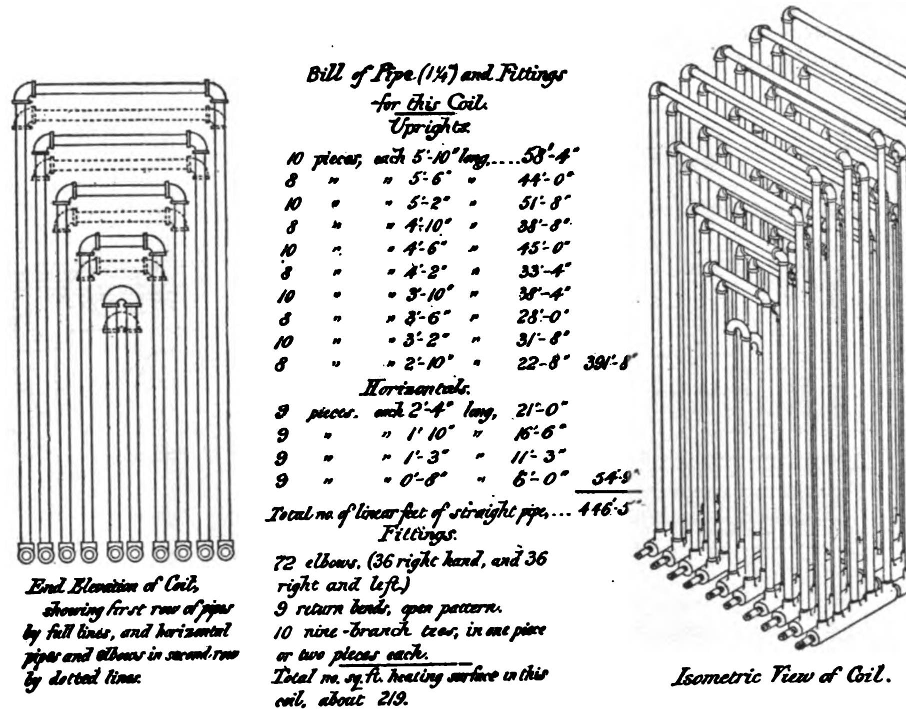
As to the cost of the primary school apparatus and its maintenance, Mr. Perkins quotes from the paper on the ventilation of school-rooms heated by stoves, by Dr. J. G. Pinkham, in the Massachusetts State Board of Health Report for 1887.

"*Expense of the System.*—This includes the cost of construction and of maintenance. The cost of the improvements at the Red Rock Street School-house was $567.77; of those at the Baltimore Street School house, $554.56. At the Chase Avenue School-house $418.16 was originally expended, but subsequent changes considerably increased the cost. Quite a large part of the first cost came from the necessary tearing down and building up again. It is notoriously expensive to make changes in completed buildings. The school-house mechanic, who has had a general oversight of the work of making these improvements, estimates that if put in during the process of construction the apparatus in a two-room building would not cost more than $350; in a one-room building, $225. The change could be probably made in an old one-room building for $350. When the arrangements form part of the original plan of a school-house, they are likely to be much more satisfactory than when added afterwards.

"The cost of maintenance involves an increased outlay for janitor service and for fuel. In country districts, where the fires are cared for by voluntary service of teacher and pupils, the former item is not to be reckoned. In Lynn an allowance of 50 cents per week for each additional stove is made during the season when the fires are in operation. This amounts to something near $40 per year for each building of two rooms.

"From our experience thus far it is difficult to form an exact estimate of the increased cost of fuel. The coal and wood are supplied to the city on contract, the bins being filled up when necessary. It is certain the consumption of fuel increases somewhat in proportion to the amount of fresh air supplied. At the Chase Avenue school-house, as near as can be ascertained, from five to six tons more of coal have been burned each year since the ventilating apparatus was put in than before. It would be not far from the truth if we should reckon the increased cost of fuel for the building at $30 per year, or $15 for each room. This added to the increased outlay for janitor service makes $35 per room—surely not an extravagant sum to pay for anything so necessary to health as pure air."

(To be continued.)



End Elevation of Coil, showing first row of pipes by full lines, and horizontal pipes and elbows in second row by dotted lines.

Bill of Pipe (1¼") and Fittings for this Coil.

Uprights.

10	pieces, each	5'-10"	long....	58'-4"	
8	" "	5'-6"	"	44'-0"	
10	" "	5'-2"	"	51'-8"	
8	" "	4'-10"	"	38'-8"	
10	" "	4'-6"	"	45'-0"	
8	" "	4'-2"	"	33'-4"	
10	" "	3'-10"	"	38'-4"	
8	" "	3'-6"	"	28'-0"	
10	" "	3'-2"	"	31'-8"	
8	" "	2'-10"	"	22-8"	391'-8"

Horizontals.

9	pieces, each	2'-4"	long,	21'-0"	
9	" "	1'-10"	"	16'-6"	
9	" "	1'-3"	"	11'-3"	
9	" "	0'-8"	"	6'-0"	54'-9"

Total no. of linear feet of straight pipe.... 446'-5"

Fittings.

72 elbows. (36 right hand, and 36 right and left.)
9 return bends, open pattern.
10 nine-branch tees, in one piece or two pieces each.
Total no. sq. ft. heating surface in this coil, about 219.

Isometric View of Coil.

FIG. 4 COILS FOR WARMING FRESH AIR

ANNUAL REPORTS.

Wichita Municipal Reports; for the fiscal year ending March 31, 1890.

The pamphlet contains, besides the report of the City Engineer, H. H. Jackman, the Mayor's message, the City Clerk's report, and the reports of the treasurer, fire marshal, city physician, and street commissioner. The city engineer gives an interesting outline of the work of his department, accompanied by a number of extensive tables. Considerable time and attention has been given to the introduction of a concise system of records of work done by the department. These records include a complete record of all information relative to the sewer, with list of locations of all house connections, etc., records of curbing and guttering, giving location, cost, contractor, date built, etc.; records of permanent and wooden sidewalks, with location, costs, etc.; records of sewer estimates, paving estimates, and all other contract work; paving records showing at a glance the amount, location and kind of work done, the contractor, cost, etc.; records of cement tests, covering all well known brands of cement, and including upwards of 1,000 briquettes, copies of all plats of additions lying within the limits of the sewer district, made from the original plats on file in the office of the Recorder of Deeds; plans and specifications for all work done and under contract, filed for ready reference, together with much other information of interest of a general nature.

BRICK PAVING.

Brick paving work is described as follows in a recent issue of the *Clay Worker*:

The street is brought to the grade required, which is but little crowning—probably four inches on a street fifty feet in width. The street is then rolled with a 6-ton cast roller. Then a layer of sand is spread four inches thick, on which a layer of good common, hard brick is laid flat, but lengthwise with the street, and tamped down solidly with a heavy tamp, leaving an even surface. A 2-inch layer of sand is then spread, care being taken to fill the interstices of the flat layer of brick, after which a course of what are called in the market "black hards," are set on edge cross-wise of the street, breaking joints the same as in building; these are tamped down solidly, leaving the surface as even as possible.

Over the surface a layer of sand is spread of sufficient thickness to fill all the spaces left in laying by the common travel of the street, and the surface is again rolled several times with the cast roller. Both layers of brick are set as close as possible by hand so as to leave the smallest space only. The bricks used for the top course are very hard, but are made from common yellow clay. The bricks are burned in down draught kilns until they are vitrified. A brick that is not vitrified through as solidly as it is possible to make it when taken from the kilns is the exception. As an evidence of their character it is sufficient to say that in delivering on the streets the bricks are pitched from the wagon by hand into piles and there is seldom a broken brick. The bricks have a bright black glaze. The average cost of the pavement is estimated at $1.50 per square yard, which includes grading, curbing, etc.

TRADE PUBLICATIONS.

RADIATORS.

The Standard Radiator Company, 12-32 Porter Street, Buffalo, N. Y., is sending out an attractive little pamphlet devoted to direct and indirect hot-water and steam radiators. Illustrations, price-lists and sizes are given of various styles.

THE GORTON HOUSE-HEATING BOILERS.

A new catalogue, dated 1890-91, has been issued by the Gorton & Lidgerwood Company, 96 Liberty Street, New York. While devoted in the main to the Gorton steam and hot-water boilers, which are illustrated and described at length, it contains interesting chapters on modern methods of house heating, comparing hot air with hot water and steam systems, indirect and direct radiation, etc. Sample sets of plans and specifications also are given for direct and indirect steam systems. Illustrations of automatic water feeders and various styles of radiators occupy the concluding pages.

PAVEMENTS.

In a recently issued pamphlet the New England Paving Company, 19 Pearl Street, Boston, Mass., treats, in an interesting manner, of American bituminous rock, and asphalt pavements. A brief history is given of the material, the methods of handling are outlined and general directions offered for laying the pavements.

MAINTENANCE OF MAIN ROADS*

Manual Labor.—In purely rural portions of the main road one man will be required on each three miles, all the year round; one man on each two miles of road partly urban and partly rural; and one man on each mile and a half of road quite urban. In the neighborhood of plaster pits and collieries of course this would have to be varied. Each laborer should be supplied by the foreman with a sheet, stating the work he is to do each day, such sheet to be produced when required to be initialed by a member of the Council, by the surveyor or foreman (chief), and would take all orders and directions from the foremen.

Foremen.—The best of the existing road-men in the parishes could be engaged for this work. They should have about 12 miles of ordinary road to superintend, varying, of course, very much with the present state of the road and traffic of the future, but should live in the center of their length. Doubtless, more foremen and laborers will be required at first than later; but take a road 30 miles in length, as the work became less and the road in better condition the worst foremen and laborers could be discharged and the district of the others extended.

Each foreman should supply himself with a sheet, stating the work he is engaged upon. Such sheet to be produced when required to be initialed by a member of the Council, by the surveyor or chief foreman. The foremen should keep the time sheets of themselves and men under them; be accountable for all tools, and for the condition of their road-length; receive and check all material, entering same in their account book; take all necessary orders from the chief foreman of the district, and see the whole of the work was properly carried out, working themselves. They should have no power to discharge or engage any workmen without first reporting the matter to the chief foreman. They shall keep all tool, team and materials accounts of their divisions.

Chief Foremen.—Three chief foremen will be required for an area of about 320 miles of roads. Their duties should be to superintend the entire road management direct from the County Surveyor. They should have no power to discharge or engage any foreman without first reporting the matter to the County Surveyor, but should have full power over the day laborers. They should take all moneys from the County Surveyor for paying the foremen and roadmen fortnightly, and pay them direct, entering same in a book provided for the purpose, and get a receipt from the men on the labor sheet, to balance with the foremen's account. They should set out and direct all work for manual labor. They should check and superintend the delivery of all material under the material contracts. They should arrange and order, on check forms, all horse labor that may be required under the team labor contracts, and see the same is properly employed and entered in the road foreman's book. They should collect all accounts that might be owing by the Council for road maintenance. They should, under no pretence whatever, order any new tools, materials, or special work, unless the order is signed by the County Surveyor; in cases to avert an accident, or to save expense, alone excepted. They should walk the district under their charge, as far as practicable, and carefully take and keep notes of work required to be done. They should assist the County Surveyor in every way, in estimating for material, team, and manual labor and any other work.

Where main roads are repaired by contract under any highway or urban authority, they should walk over same, not interfering in any way with the management, but reporting any matter that should require reporting to the County Surveyor. They should initial the sheets of the foreman and day laborers of the Council, when passing at any time other than when paying the wages, collecting such sheets when paid, and returning the sheets and the duplicate pay-book of the foreman to the County Surveyor. They should work the same hours as the workmen, and do their utmost to skillfully manage and check all extravagance on the roads, filling up any spare time in doing any necessary road work. Should any foreman be temporarily laid up, the chief foreman should take his place in every way until fresh arrangements can be made. They should keep an order, tool account, material, team, and general expenditure book; also a careful diary of their day's doings, and should every year, or as often as necessary, take stock and furnish the County Surveyor with a return of stock and tools in their district.

The steam roller should be under the full direction and charge of the chief foreman, and he should pay special attention to the economical working of same.

The chief foreman and the foremen should be provided by the Council with overalls and oilskins, so that they may be on the roads during wet weather, and be able to deal at once with any matters that may only show the work necessary in such weather.

Tools.—Every foreman should be furnished with the following tools for the use of the men under him and himself:

4 shovels.
3 spades.
6 brushes.
3 wheelbarrows.
3 pickaxes.
2 hooks.
2 sledges.
4 small hammers.
4 rakes.
4 road lines.
4 scrapers.

The tools should be repaired by contract on a schedule; each blacksmith should tender every three years, or as often as might be required; and before any tools are repaired the foreman should give a written order to the smith and preserve a duplicate himself.

Team Labor and Materials.—All team labor and materials should be let by tender and contract. No material should be received unless previously invoiced, with 24 hours' notice, the total weight of each truck to be sent and the railway weight to exactly correspond, for the latter would be taken as correct. If the material be delivered by road, it should be weighed (if possible at a public weighing machine) and the exact weight of the material sent, with the carter's signature attached. All weight checks should be delivered to the road foreman at time of unloading either by the railway company, contractors for material, or the carters, on proper forms.

Accounts.—Accounts of all kinds should be sent to the County Surveyor direct, as soon as the work or contract is complete, and no account would under any circumstances be passed, unless accompanied by the necessary order for the work being carried out. Accounts for tools should be sent to the County Surveyor, at least one month before the meeting of the County Council.

County Surveyor.—He would take the direct management of all the roads, now under the various parish management, setting out all work to the chief foreman, continually drive over the whole of the main roads of the county, and superintend the carrying out, so far as possible, his own instructions; prepare estimates for material, team labor, and money payments, advertise for and receive all tenders for work, and lay same before the Highways Committee; keep all accounts, and prepare the necessary balance sheets.

Carriage Road.—The whole surface to be swept or scraped as often as required, and on no account shall the road, under any condition, be left for more than eighteen hours (Sunday, Good Friday and Christmas Day alone excepted) after rain or bad weather, without being carefully attended to. The scrapings, etc., when not wanted to repair the footpaths or for filling hollows in the roadside, or stone depots, must be carted away when dry, and on no account to be heaped and left on the roadside. The water-table at the roadside or side channels to be lined with material if soft or too low, and any clay or other matter which may prevent this being properly done shall be taken out and carted away, and the road filled and rammed with large stone. The channels shall be frequently inspected, and kept clear of all obstructions, the whole being carefully sided, and outlets cut open at least twice during the twelve months. After rain the sand-drifts shall be at once removed, and no weeds, etc., shall be allowed to grow in the side channels, so as to interrupt the free passage of the storm water. The material shall be applied to the road carefully, evenly, and smoothly, and frequently raked over, to prevent all tracking until the whole becomes one solid mass; the road, before any material shall be applied, being first swept and cleansed free of mud. Where the road is flat, care shall be taken and material allowed to raise the same to the gauge mentioned hereafter. Where the road shows soft, weak portions, the latter shall be removed, and the road made sound by means of ramming in large stones. Where the road shall require the ruts filling, care shall be taken to keep the filled-in ruts properly filled with material, so as not to allow other ruts to form at the sides; but no ruts shall be allowed to form after those already on the roads are carefully mended. Any loose stone on the road between the 1st of April and the 30th of September shall be at once picked off. If the road should be blocked with snow, so as to impede traffic, the local authority shall forthwith remove the snow, informing the County Surveyor of same, and the cost will be paid according to scale of charges appended herewith.

As far as practicable, all roads shall be formed with a fall of one-quarter inch to a foot from the center to either side.

The cross drains, gutters, culverts, and other surface water carriers shall be kept in good repair, and free from obstructions; where ditches are above the level of the road, the local authority shall see they are properly lowered and cleaned out.

During the summer, water-carts shall be employed watering through urban districts at the rate specified in the attached schedule.

All material shall be consolidated if possible by the use of a steam roller, and where same is hired for use, it shall be paid for at the rate shown on the attached schedule. Where new material is consolidated with a steam roller, it shall be applied thus: First the edges shall be cross scored from the center to the sides at an angle of 45 degrees; then the new material shall be applied, not more than two stones thick, rolled, and consolidated, the surface evenly rolled, and, if found necessary, a very slight binding material applied, carefully swept and watered; finally, rolled in, and all superfluous water and dirt swept off. The roller shall consolidate at least 1,400 square yards of new road surface in one day of ten hours.

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* Abstract of a paper presented at the annual meeting of Municipal and Sanitary Engineers and Surveyors, Liverpool, England, June 26, 1890, by E. Purnell Hooley, Assoc. M. I. C. E., County Surveyor of Nottinghamshire.

A CONVENIENT draughtsman's, so called, triangle has lately been devised, having one right angle and the adjacent angles of 45 and 60 degrees, which gives a very obtuse angle of 165 degrees opposite the right angle in the middle of the side opposite the right angle.

CONTRACTING INTELLIGENCE

Our readers will oblige us by notes, clippings, or any information which will put us in the way of obtaining early and reliable news for our "Contracting Intelligence." ***Information of importance sent to us exclusively, and not elsewhere published will be liberally paid for.***

For works for which proposals are requested see also the "Proposal Columns," pages i-ii-207.

AT a meeting of the trustees of the Masonic Home and Asylum, held at Utica, N. Y., August 27, the modified plans of architect W. H. Hume, of New York, were accepted. The plans will be on exhibition at Masonic Hall, in New York City, until September 20, the date of the opening of the bids. Bonds in the sum of $50.000 will be required for the faithful performance of the work. The grounds surrounding the building will be laid out after plans by John Y. Culyer, C. E., of Brooklyn, who will also plan the sewerage, drainage, etc.

WATER.

For Additional Water Items see Proposal Columns.

WELLESLEY, MASS.—The Water Commissioners of this place have decided to lay a new 18-inch syphon pipe from the filter well to the pump well.

MARBLEHEAD, MASS.—The Water Commissioners have received bids for digging a well to be used in connection with the system of water works recently built for this place. This well, which is to take the place of a number of small driven wells, will be 30 feet in diameter and about 24 feet deep, and water will be pumped directly from it into the stand-pipe.

BURLINGTON, COL.—A press dispatch says: "Burlington is suffering from a lack of water, and the citizens are praying the Council to take some step toward supplying the town with a system of water-works."

AMERICUS, GA.—It is stated that a reservoir, with a capacity of 88 000 gallons, will be built at the pumping station of the water-works. The Mayor can furnish additional information.

OXFORD, N. C.—The election to consider the issuance of $50,000 of bonds for the construction of water-works will be held September 8.

MILLEDGEVILLE, GA.—According to reports the Moran Springs property has been sold to parties who will establish a system of water-works, at an estimated outlay of $100,000.

SANTA ANA, CAL.—Press dispatches state that on August 19 the people of this place voted the sum of $60,000 in bonds for the purpose of establishing a system of water-works.

LANSDOWNE, PA.—Caspar Pennock, of this place, writes: "Some four years ago, I, for my own benefit, erected water-works to supply some houses of my own, and have gradually continued to supply my neighbors until we have over 90 houses at present, and have another pumping station under way. We pump from driven wells about 150 feet deep, very good water. Have obtained a charter for a water company, and about to put the plant into the water company."

MENASHA, WIS.—City Clerk P. J. Robertson writes: "There has no steps been taken yet to establish water-works here. The Garland Banking Company, of Minneapolis, Minn., is seeking to obtain a franchise to put in water-works, provided the city rents a certain number of hydrants for fire purposes."

SUMMIT LAKE, WIS.—Regarding the report that this place was to have water-works, William West writes: "There has never been anything said in this village in regard to water-works. As the village has less than 50 residents therein it is likely to be as it is for some years."

SPOKANE FALLS, WASH.—This place is to have water-works, at an estimated cost of $20,000.

WHITE SULPHUR SPRINGS, MONT.—The citizens of this place have decided to organize a company to supply the town with a system of water-works.

CONTRACTING NEWS DEPARTMENT.

A WEEKLY RECORD

OF SPECIAL INTEREST TO CONTRACTORS, BUILDERS AND MANUFACTURERS OF ENGINEERING AND BUILDING SUPPLIES.

WATER.

MIDDLEBURY, VT.—Village Clerk Henry L. Sheldon writes: "On August 19, the village appointed a committee of ten, A. A. Fletcher, chairman, to establish a system of water-works, by pumping the water from Otter Creek River through iron pipes, for fire, domestic and other purposes, with no reservoir or tanks. Funds to be raised by issuing 30-year village bonds. Estimated expense, $36,000, of which $6,000 was donated by a former resident. No contracts yet made."

WINCHESTER, TENN.—It is reported that G. L. Hogun & Co. have decided to establish a system of water-works at this place.

MARYSVILLE, KANS.—This place is to have a system of water-works. For particulars, address Charles F. Kolster, as above.

PORT ANGELES, WASH.—The Port Angeles Water Co., the Port Angeles Light Co. and the Port Angeles Construction Co. have been incorporated at this place. Combined they represent a capital of $750,000.

WELDON, N. C.—Reports say that a company of Northern capitalists have been formed at this place, under the name of the Great Falls Water Power Co.

COLDWATER, MICH.—The question of issuing $70,000 in bonds for water-works system was voted on at a special meeting held on August 18, the vote was carried by a majority of 184.

COLUMBIA, S. C.—The Water-Works Committee recommends the purchase of water wheels and pumps to the amount of $25,000, to increase the supply of water.

LAKE FOREST, ILL.—The projected water-works for this place will be established at once.

MT. VERNON, IND.—The question of establishing a system of water-works at this place is still being agitated.

ARKADELPHIA, ARK.—Reports say that the construction of water-works is contemplated at this place. For particulars address T. R. Tennisou, as above.

LOUISVILLE, KY.—A plant is to be established at this place by the Domestic Water Company, with a capital stock of $50,000. For particulars address P. J. Hobbs, as above.

SAN DIEGO, CAL.—Plans for the water supply system at this city will be prepared by J. D. Schuyler.

GREENVILLE, S. C.—Reports say that the American Pipe Manufacturing Company, of Philadelphia, Pa., which has a contract to construct water-works in Greenville, will organize a stock company to operate the plant.

CHURCH HILL, PA.—Reports say that the question of establishing a system of water-works is being discussed by the officials of this place.

STEELTON, PA.—A system of water-works to cost $180,000 will, it is reported, be established at this place.

EMERSON, GA.—Reports say that the people of this place have decided in favor of having a water-works system.

COMANCHE, TEX.—It is probable that immediate steps will be taken towards establishing a water-works system at this place. For particulars, address J. N. McCarthy, as above.

ELMA, WASH.—It is proposed to take steps at this place towards establishing a system of water-works.

QUANAH, TEX.—A complete system of water-works is to be established at this place by the Quanah Water, Ice and Electric Light Company. The estimated expenditure is $75,000.

BOSTON, GA.—Reports say that an artesian well is to be sunk at this place.

CHEYENNE, WYO.—The Wyoming and Nebraska Irrigation and Water Supply Company has been incorporated at this place, with a capital stock of $800,000. Water will be taken from the North Platte River and applied principally in Laramie County.

LEEDS, IOWA.—A company has been organized at this place, and a system of water-works is to be established at once. Operations will commence as soon as the preliminary affairs can be arranged.

NEW BRITAIN, CONN.—Civil Engineer Cadwell, of New Britain, has completed plans for the proposed new dam to be built at Shuttle Meadow, and submitted them to the City Council.

BUCHANAN, MICH.—A petition is in circulation at this place asking the Common Council to call a special election to decide whether to build water-works or not.

NEWMANSTOWN, PA.—The citizens of this place are, it is said, agitating the question of establishing a system of water-works.

INDEPENDENCE, KAN.—L. C. Mason, of this place, writes: "As yet there has been nothing done in the way of improvements or extensions. The works have passed into the hands of a new company. They expect to make some valuable improvements very soon, but no work done only on paper."

TORONTO, ONT.—Additional pumping facilities have been recommended by the water-works officials for the plant at this place.

MERIDEN, CONN.—It is probable that important steps will soon be taken towards increasing the water supply of this place.

WATER VALLEY, MISS.—A press dispatch of August 21 says: "Mayor Herring, by order of the Town Council, issued his proclamation this morning ordering an election to be held in this city on September 29, on the proposition to issue $10,000 of the city's bonds, to be placed on the market to raise the necessary funds for the erection of an electric light plant and the establishment of water-works in this city. It is generally supposed that the proposition will be easily carried."

BELMONT, N. Y.—The people of this place have begun to agitate the question of establishing a system of water-works.

KNOXVILLE, TENN.—Reports say that improvements are to be made to the local water-works system at that place. Gen. R. N. Hood can furnish particulars.

ORANGE, N. J.—A resolution asking the Water Committee to report at the next meeting of the Common Council as to the best means for increasing the water supply was adopted at a meeting of the Water Board held August 26.

MONTROSE, N. Y.—Reports say that a system of water-works is to be established at this place.

HUMBOLDT, IOWA.—This town voted, August 18, in favor of putting in water-works. The system will be commenced at once.

ROCHESTER, N. Y.—At a meeting of the Executive Board, held August 25, it was resolved that the Chief Engineer of the Water-Works be directed to have made the various improvements on the conduit line and repairs of gates at Rush Reservoir and Hemlock Lake, as recommended in his report on condition of the conduit, etc., presented August 18. Among the proposed improvements are renewals in the air valves, boxes, etc.; repairing the gates, resetting stone monuments, etc. Mr. Aldridge, of the Executive Board, can furnish details.

FORT SMITH, ARK.—As an extension of the system of water-works of this place, about eight or ten miles of mostly 6 inch pipe will be laid in the newly settled sections of the city, which are at present without any proper water supply.

ASHLAND, KY.—The proposed new system of water-works will be built by a company of which J. M. Gardner of this place is President. Water will be taken from the Ohio River and pumped into a reservoir having a capacity of 2,500,000 gallons.

GRIFFIN, GA.—This place is to have a system of water-works established by the Griffin Water and Light Company. W. A. Bedell can furnish particulars.

MADISON, GA.—Reports say that a proposition has been made to the local officials to construct a system of water-works.

NEW YORK CITY.—The following proposals for constructing an earth and masonry dam, Reservoir D, were opened August 27 by the Aqueduct Commissioners: M. S. Coleman, $397,262.50; Brenchand, Pennell & Company, $403,657.50; Clinton Stephens, $405,440; Smith & Brown, $407,037.50; Charles Peterson, $445,570.

For building an auxiliary earth and masonry dam, near Craft's Station, at reservoir: M. S. Coleman, $83,092.50; Brenchand, Pennell & Company, $84,602.50; Smith & Brown, $86,050; J. J. Ridgway, $96,142.50; Clinton Stephens, $113,875.

GAINESVILLE, GA.—The City Council has appointed a committee of six citizens to report as to the advisability of establishing a system of water-works. Address the Town Clerk for particulars.

SIOUX CITY, IOWA.—It is probable that about two and a half miles of water pipe will be laid in this city Alderman Powell can furnish information.

SOUTH ACTON, MASS.—This place is taking steps towards procuring a system of water-works.

EATONTON, GA.—The people of this place are agitating the water-works question. For particulars, address B. D. Lumsden, as above.

WATER-WORKS.—See our Proposal Columns for information regarding water-works and water-works furnishings at the following places: Algona, Iowa; Pasco, Wash.; Franklinville, N. Y.; Newport, Ky.; Blue Hill, Neb.; Goakum, Tex.; Allegheny, Pa.; Austin, Tex.

THE CONTRACTING NEWS DEPARTMENT of **THE ENGINEERING AND BUILDING RECORD** is edited with a view of giving space to no item that does not indicate where professional services or supplies may be needed in the near future, the prices bid for work or supplies, and the correction of false or misleading reports in some papers, that may subject readers to needless trouble and expense in going after something that does not exist.

SEWERAGE.

For Additional Sewerage Items see Proposal Columns

MARLBORO, MASS.—Work was begun last week on the new system of sewerage, by downward intermittent filtration, according to plans furnished by the engineer, M. M. Tidd, of Boston. The contracts for building 3½ miles of the main line and also the filter beds have been awarded. The street sewers will be built by the town itself. The main line will be about five miles long, and the effluent stream will discharge into Hagar's Pond. The total cost of this system will be about $175,000, of which $60,000 will be paid by the City of Boston as a compensation for so extending the system as to prevent contamination of certain sources of the Boston water supply.

NORTHAMPTON, MASS.—The Sewer Commissioners have awarded the contract for the Hawley and Market Street sewer to A. Brazos & Sons, of Middletown, Conn., at $12,000.

JERSEY CITY, N. J.—Work on the sewer that is to be constructed by Jersey City and the North Hudson Township is to be begun next month. It will cost about $200,000.

GRAND FORKS, N. D.—City Engineer W. S. Russell writes: "Have voted to bond for $50,000 for a sewerage system, and I am directed to prepare plans. Do not think anything further will be done this season."

TROY, N. Y.—Numerous sewer extensions are to be made in this city.

AUGUSTA, ME.—The question of establishing a new sewerage sytem is being agitated by some of the citizens of this place.

OAKLAND, CAL.—T. W. Morgan, City Engineer, writes us that he has considerable sewer work which is about to be constructed.

KANSAS CITY, MO.—E. Butts, of this place, writes: "There has been no steps taken recently to establish a new sewer system. I would say that the present system has been fixed on some time ago and extensive work is now being done on what is known as the O. K. Creek Sewer, one mile of which is under construction, and another mile will be ready for bids shortly."

COLUMBUS, GA.—Council Clerk M. M. Moore writes: "The matter of issuing about $100,000 of bonds to build a system of sanitary sewers is under consideration by the City Council, but the issue will first have to be authorized by the Legislature, which meets in December, so, as yet, nothing is definitely decided upon."

SEWERS.—See our Proposal Columns for information regarding sewer construction at the following places: Key West, Fla.; New Haven, Conn.; Cleveland, O.; St. Louis, Mo.; Tiffin, O., Avondale, O.; Elizabeth, N. J.; Buffalo, N. Y.; Para, Brazil; Somerville, N. J.; Harrison, N. J.

BRIDGES AND IRON STRUCTURES.

For Additional Bridge Items see Proposal Columns.

PROPOSALS will be asked for the building of the Eighth Street Viaduct at Cincinnati, as soon as the Board of Public Improvements decide the questions at issue.

MINERAL SPRINGS, UTAH.—The Carlton Improvement Co., of this city, will erect a bridge to Stansberry Island.

WINONA, MINN.—The Milwaukee and St. Paul Railroad will erect a new bridge across the Mississippi, opposite the city of Wabasha.

GREENSBURG, N. Y.—A new county bridge is to be erected over Sewickley Creek at Hunker Station.

HARPER FERRY, W. VA.—Charles H. Grail, Secretary of the Harper's Ferry and London Bridge Company, writes: "The Harper's Ferry and London Bridge Company was incorporated in July, and has organized and expect to build the bridge this coming winter."

EWING, N. J.—An iron bridge is to be erected at this place. For particulars address Mr. McGuire, of the Board of Freeholders, as above.

ST. JOSEPH, MO.—Chief Engineer Godley, of the K. C., is supervising plans which are being made for the construction of a new iron bridge, with stone wall abutments, over Whitehead Creek, at the railroad tracks.

GALVESTON, TEX.—The Sabine Street bridge is to be rebuilt, at an estimated cost of $5,783. Address the Mayor for particulars.

HUNTERDON COUNTY, N. J.—It is proposed to expend the sum of $8,000 in repairing bridges in this county.

EAST TEXAS, PA.—The Lehigh County Commissioners will, it is said, soon want bids for erecting a bridge over the Little Lehigh River, at this place. It is to be an iron structure, 60x16 feet.

NEBRASKA CITY, NEB.—At a special election the vote to bond the city for $100,000 for the purpose of building a bridge across the Missouri was carried.

BALTIMORE, MD.—It is proposed to erect a bridge over Druid Lake in Druid Hill Park, this city. The structure is to be 2,000 feet long. For information, address the Mayor, as above.

AUGUSTA, GA.—Reports say that the City Council has appropriated $8,000 to construct a bridge over the canal at Broad Street in West End. The Mayor can furnish information.

CHESTERTOWN, MD.—It is proposed to either repair the present bridge over the Chester or build a new structure.

BRYAN, TEX.—An iron bridge is to be placed over the Navasota River, near Chaney Crossing. Address the Town Commissioners, as above.

MIDDLESBROUGH, KY.—Reports say that it is proposed to construct a through girder iron bridge of about 70 feet span and 100 feet width across the canal on Cumberland Avenue. B. L. Lloyd, City Engineer, can furnish details.

JACKSON COUNTY, W. VA.—The County Commissioners of this county have ordered two new bridges to be built, one over Little Mill Creek and the other over Dudden's Fork. Both bridges are to be of steel.

DENISON, TEX.—This city will soon let the contract for the construction of an 1,800-foot viaduct, 20 feet wide, across the railroad at Gandy Street.

NORFOLK, VA.—The Norfolk Company has, it is stated, purchased the Ghent and De-Brees properties, will improve same and construct an iron bridge over De Brees Creek.

LATONA, WASH.—The County Commissioners have been asked to aid in the construction of a bridge across the eastern arm of Lake Union, at Latona. The estimated cost is $6,000.

SALISBURY, MD.—The Baltimore and Bay Shore Railroad Company will erect a new bridge over the Nanticoke River, at this place.

BRIDGES.—See our Proposal Columns for information regarding bridge construction at the following places: Brooklyn, N. Y.; Bastrop, Tex.; Pineville, Ore.; Big Island, Va.; Northampton, Mass.; New Gretna, N. J.

NEW DEPOTS.

SALISBURY, MD.—A new depot is to be erected at this place by the Baltimore and Bay Shore Railroad Company.

KANSAS CITY, MO.—Reports say that a Grand Central Depot is to be erected in this city, at an estimated cost of $400,000, by the Winner Investment Company.

SHELTON, CONN.—Reports say that a new depot will be erected at this place.

RAILROADS, CANALS, ETC.

TRENTON, N. J.—The Perth Amboy and Long Branch Railroad Co. has filed articles at this place for a road to connect the New Jersey Central in Middlesex County with the New York and Long Branch Railroad at the north end of the Raritan River Bridge in the same county. The connection will be 6,000 feet long. The incorporators are James N. Duberry and Henry D. Welsh, of Philadelphia, and others.

STREET-WORK AND PAVING.

CHESTER, PA.—Considerable street work is to be done at this place in September.

MONROE, N. C.—Considerable street paving is to be done at this place.

READING, PA.—A large amount of street paving is to be done in this city. See our Proposal Columns for particulars.

HARRISBURG, PA.—Considerable street paving is to be done at this place. Address M. Schaffer, of the Board of Highway Commissioners, as above.

GAS AND ELECTRIC-LIGHTING.

EARLINGTON, KY.—This place is to have an electric light plant.

MERRIMAC, MASS.—The people of this place will establish a gas plant at an early day.

SHELBINA, MO.—The sum of $5,000 has been appropriated at this place for the purpose of establishing an electric light plant.

JACKSONVILLE, ILL.—The sum of $15,000 is to be expended on improving the plant of the Jacksonville Gas Light and Coke Company at this place.

MOMENCE, ILL.—The Momence Electric Light Company has been incorporated at this place, and a plant will be established at once. Address I. C. Riker, as above.

BAY CITY, MICH.—Reports say that another electric lighting company is to be established at this place.

LIMA, O.—The Lima Electric Light and Power Company is to double the size of its plant. Particulars can be obtained by addressing S. W. Moore, the Superintendent and General Manager, as above.

OSCODA, MICH.—An electric-lighting plant is to be established at this place.

UNIONTOWN, PA.—The Uniontown Light and Heating Co. contemplates putting in a large arc dynamo.

BUCKSPORT, ME.—The electric-light plant at this place is to undergo extensive improvements. Address E. H. Gouring, of Bangor, Me., for particulars.

CAMDEN, N. J.—The Camden Lighting and Heating Company will enlarge its plant and increase the machinery. A 700 horse-power engine will be added, about 5,000 incandescent lights and 300 arcs. The work of making these additions will be commenced immediately. In addition to the above they propose extending the circuits for lighting the southern section of the city, the plans for which have been perfected. The estimated outlay is $75,000.

CRAFTON, PA.—This place is to have an electric light plant at once.

MONROE, N. C.—The question of establishing an electric light plant at this place is to be decided by the people at a special election to be held at an early day.

ANDERSON, S. C.—An electric lighting plant is to be established at this place by the Anderson Hotel Co.

WELLSVILLE, O.—The Valley Electric Light and Power Co. has been incorporated here, with a capital stock of $25,000.

HUNTINGTON, IND.—The Huntington Light and Fuel Company has been incorporated at this place with a capital stock of $250,000. John K. Price is at its head.

JAMAICA, N. Y.—The Jamaica Gas Company offers to supply gas for public lighting on the basis of a $20 per lamp per annum payment, for all night lighting, the burners to be rated to the passage of 4 feet per hour.

PHILIPSBURG, MONT.—An electric lighting plant is to be established at this place.

BREWER, ME.—An electric light plant is talked of for this place.

TULARE CITY, CAL.—An electric light plant is to be established at this place.

ELECTRIC RAILWAYS.—New electric railways will be built and improvements will be made to those already established at the following places: Duquoin, Ill.; Toledo, O.; McKeesport, Pa.; Trenton, N. J.; West Lynn, Mass.; Attleboro, Mass.; Keokuk, Ia.; Davenport, Ia.; Los Angeles, Cal.; Ogden, Utah; Dayton, O.; Akron, O.

BIDS OPENED.

NEWARK, N. J.—The following contracts have been awarded for work on Prudential Insurance Company's building: J. B. & J. M. Cornell, New York, iron work, $275,000; Geo. W. Roydhouse, Philadelphia, mason work, $269,900; Geo. Brown & Co., Newark, cut stone work, $179,850; V. J. Hedden & Sons, Newark, carpenter work, $111,000; Otis Bros & Co., New York, elevator work, $42,350; Baker, Smith & Co., New York, heating and ventilating, $33,468; J. M. Bonnell & Son, roofing and metal work, $27,350; Perth Amboy Terra Cotta Co., terra cotta work, $8,950. Contracts for minor work, amounting to about $50,000, are yet to be awarded.

WASHINGTON, D. C.—The Phœnixville Iron and Steel Company, of Phœnixville, Pa., has been awarded the contract for the iron and steel work for the Washington Loan and Trust Company's building.

PORT HURON, MICH.—The contract for excavating the approaches for the St. Clair Tunnel at Sarmi and Port Huron, has been awarded to Messrs. Nihan, Elliott and Phinn, of Bradford, Ont., at $200,000.

SAN FRANCISCO, CAL.—The contract for the iron and steel work on the Crocker Building, this city, has been awarded to the Phœnixville Iron Company, of Phœnixville, Pa. The cost of the building is $1,250,000.

SIOUX CITY, IA.—The contract for the erection of St. Joseph's Hospital was awarded to W. E. Stevens. The following bids for plumbing work in connection with same were received: A. F. Paige & Co., $2,173; Lewis Kettleson, $2897.50; W. O. Merrill, $2,417.91; Fitts & Co., $2,163; J. F. Gearen, $2,073, to whom the contract was awarded.

ALBANY, N. Y.—Superintendent Hannan opened bids August 25, that were received for dredging 18,000 cubic yards of earth, and excavating 150 cubic yards of rock from the channel of Rondout Creek. The contract was awarded to P. W Myers, of Albany, N. Y., whose bids are 15 cents per yard for the earth, and $9 for the rock.

GOVERNMENT WORK.

WASHINGTON, D. C.—The following proposals for the work specified were opened on the given dates by the Supervising Architect of the Treasury Department:

Augusta, Me.—Decorative painting, etc., first story and main stair hall of the United States Post Office and Court House at this place, opened August 22. Bidders: Peter Ackerman, Bangor, Me., $1,573; John W. Berry, Gardner, Me., $1,425 and $1,150.

Pittsburg, Pa.—Marble work, etc., for the United States court house and post office at this place. Opened August 26. Bidders: Pickel Marble & Granite Co., St. Louis, Mo., $98,900; Samuel Young, Allegheny, Pa., $109,900; if Georgia or Tennessee marble is substituted for specifications, $99,900; Sherman Flavin, Chicago, Ill., $121,400; Blue Ridge Marble Co., Cincinnati, O., if Georgia marble is substituted for specifications, $59,298; Davidson & Sons, Chicago, Ill., $129,000.

Washington, D. C.—Repairs, etc., to the heating apparatus at the United States Treasury Department. Bidders: John Lyon, Washington, D. C., $1,548; William E. Wood & Co., Baltimore, Md., $3,250.

INDUSTRIAL.

WINDSOR, ONT.—Reports say that a wagon and passenger tunnel will be built under the Black River at Port Huron, from a point in Point Huron to be determined upon, to the Canadian shore at Sarnia. The principal stockholders, it is said, will be Mayor Kenney and W. H. Anderson, of Port Huron, and Mayor White, of this city.

SALT LAKE CITY, UTAH.—A press dispatch to the Omaha *Bee*, dated August 24, says: "Plans are ready for a hotel at Mineral Springs, bordering on Carlton Beach, Great Salt Lake, together with about 50 cottages, a school-house, a mill, stock houses, servants' quarters, etc. A bathing resort will be erected on Stansberry Island, and, later, a hotel. Engineers have already made surveys. It is understood that the Union Pacific has a controlling interest in the company."

APPLETON, WIS.—An effort is on foot to form a company, with a capital of $500,000, to build a cotton factory at this place.

NEW CORPORATIONS.

SAN FRANCISCO, CAL.—The Tulare Electric Light and Power Company has been incorporated. Capital, $50,000. The incorporators are F. W. Eaton, John C. Turner and others.

RUTLAND, VT.—The Marble City Electric Light and Power Company has been incorporated. Capital, $50,000. The objects of the company is to furnish arc and incandescent lights for street and commercial use, and electric power for manufacturing purposes. The directors are A. C. Bates, J. E. Creed, E. Pierpoint and others.

PROPOSALS.

(Continued from page ii.)

PROPOSALS FOR PLUMBING, ETC.—Depot Quartermaster's Office, David's Island, N. Y. H., August 4, 1890.—Sealed proposals, in triplicate, will be received until 11 A. M., WEDNESDAY, September 3, 1890, and opened immediately thereafter, for supplying and fitting up **BATH-TUBS, WATER-CLOSETS** and **URINALS** in basement of 1889 Brick Barrack at this place. Plans, specifications, general instructions to bidders and blank forms of proposals will be furnished to bidders on application to this office. The right to reject any or all bids is reserved to the United States. Captain J. MCE. HYDE, Assistant Quartermaster, U. S. Army, Depot Quartermaster. 13

PROPOSALS FOR THE ERECTION OF Barrack. Office of the Quartermaster, U. S. Military Academy, West Point, N. Y., August 12, 1890. Sealed proposals, in triplicate, subject to the usual conditions, will be received at this office until 12 o'clock, noon, on the 1st day of September, 1890, for the erection of one **BRICK CAVALRY BARRACK** as per plans and specifications to be seen at this office. Inclose proposals in envelope marked "Proposals for Erection of Barrack," and addressed to the undersigned, CHAS. W. WILLIAMS, Captain, and A. Q. M., U. S. A. 13

IMPROVEMENT OF PHILADELPHIA HARbor. U. S. Engineer Office, 1428 Arch Street, Philadelphia, Pa., August 16, 1890.—Sealed proposals, in duplicate, will be received at this office until 11 A. M., TUESDAY, September 16, 1890, and then opened, for **DREDGING** in Philadelphia Harbor, Pa., for removal of Smith's and Windmill Islands. The attention of bidders is invited to the Acts of Congress approved February 26, 1885, and February 23, 1887, Vol. 23, page 332, and Vol. 24, page 414 Statutes at Large. For all information apply to C. W. RAYMOND, Major of Engineers, U.S. Army. 15

SEWERS, Tiffin, O.—Proposals are wanted until September 6, for the construction of certain sewers. Address Jeremiah Rex, City Clerk, as

PROPOSAL.

BRIDGE, Northampton, Mass.—Proposals are wanted until September 10, for the erection of an iron bridge over the river at Loudville. Address the Highway Committee, as above.

SEWERS, Buffalo, N. Y.—Proposals are wanted until September 8, for the construction of certain sewers. Address George E. Mann, engineer, as above.

SEWERS, New Haven, Conn.—Proposals are wanted until September 3, for the construction of certain sewers. Address A. B. Hill, City Engineer, as above.

PAVING, Reading, Pa.—Proposals are wanted until September 20, for paving numerous streets. Address City Clerk Fetter, as above.

SEWERS, Elizabeth, N. J.—Proposals are wanted until September 8, for the construction of certain sewers. Address H. J. Stratemeyer, Jr., Street Commissioner, as above.

IRON WORK, Newark, N. J.—Proposals for iron work and bluestone work on the new jail building for Essex County will be received until September 4. Address Peter Mullins, Chairman Building Committee State Bank Building.

LEVEES, Convent P. O., La.—Proposals are wanted until September 3, for the construction of seven levees. Address A. M. Cook, President of the Board of Commissioners for the Pontchartrain Levee District, as above.

PUMPING STATION, Allegheny, Pa.—Proposals are wanted until September 3, for the erection of a pumping station, Twelfth Ward. Address James Borem, Comptroller, as above.

SEAWALL, San Francisco, Cal.—Proposals are wanted until September 15, for the construction of a seawall, 1,000x200 feet. 70,000 tons of stone and 84,000 cubic yards of earth will be required, also 60,000 feet of wharf. Address the Board of Harbor Commissioners, as above.

WATER-WORKS, Blue Hill, Neb.—Proposals are wanted until September 11, for the construction of a system of water-works. Address A. A. Richardson, Consulting Engineer, as above.

COURT HOUSE, Kansas City, Mo.—Proposals are wanted until September 15, for the erection of a court house and jail at this place. Address A. Van Brunt, Architect, No. 200 West Sixth Street, as above.

SEWER, Harrison, N. J.—Proposals are wanted until September 2, for construction of pipe sewer in Fourth Street. Address John Wade, Chairman Sewers and Drainage Committee.

SEWERS, Avondale, O.—Proposals are wanted until September 8, for the construction of certain sewers. Address W. Ellwood Wynne, Corporation Clerk, as above.

SEWERS, St. Louis, Mo.—Proposals are wanted until September 5 and 12, for the construction of about 44,833 feet of sewers. Address Robert E. McMath, C. E., Sewer Commissioner, City Hall, as above.

PAVING, Brooklyn, N. Y.—Proposals are wanted until September 2, for paving numerous streets. Address John P. Adams, Commissioner of City Works, as above.

BRIDGE, Bedford City, Va.—Proposals are wanted until September 5, for the erection of a bridge over Reed Creek, near Big Island. Address B. F. Coxe, Big Island, Va.

BRIDGES, Loup City, Neb.—Proposals are wanted, no date specified, for the erection of two bridges over the Middle Loup River. Address the Sherman County Clerk, as above.

TECHNICAL INSTRUCTION.

TOO LATE FOR CLASSIFICATION.

EASTON, PA.

LAFAYETTE COLLEGE. PARDEE SCIENTIFIC DEPARTMENT. Courses in Civil, Mining, and Electrical Engineering. Chemistry, Metallurgy, Geology, Physics, Drawing. Free Course in Highway Construction. For Catalogue of the above or other Departments address the Registrar.

POSITIONS WANTED.

TOO LATE FOR CLASSIFICATION.

WANTED.—SITUATION AS ARCHITECtural draughtsman. Three years' experience. Address BENJ. JONES, 363 East Third Street, Cincinnati, O.

CIVIL ENGINEER DESIRES A PERMANENT situation with reliable water-works company or in the water department of some enterprising city; the West preferred. Good salary expected and best of references given. Address WATER-WORKS, Box 7, this office.

HEATING ENGINEER, FOR STEAM OR HOT water, expert in estimating and planning of apparatus, desires employment. Ten years' experience. Willing to travel for heating firm. Address ENERGY, Box 12, this office.

CIVIL ENGINEER, GRADUATE, DESIRES position with some engineering firm where he can make himself useful. Willing to go anywhere. Address C. E., Box 15, Nutley, N. J.

AN ENGINEER EXPERIENCED ON EARTH work and masonry, also office and general field work, would like position on sewerage or water-works. Address CIVIL ENGINEER, Box 82, this office.

A YOUNG MAN WITH SOME EXPERIENCE in draughting and calculation, wishes an opening in some branch of engineering or architecture. Salary no consideration. Address J. J. A., Box 23, this office.

Building Intelligence.

We solicit from each and every one of our readers information relating to projected buildings in their locality, and should be glad to receive newspaper clippings and other items of interest.

ABBREVIATIONS.—*b s*, brown stone; *br*, brick; *br st*, brick store; *b s dwell*, brown-stone dwelling; *apart house*, apartment-house; *ten*, tenement; *e*, each; *o*, owner; *a*, architect; *b*, builder; *fr*, frame.

NEW YORK.

81 North Moore st, br store; cost, $7,000; o, P Dickie; a, C E Hadden.

18–20 W 4th st, brick, iron and stone store; cost, $80,000; o and a, A Wagner; m, P Tostevin's Sons.

80th st, n s, 100 n 9th av, s flat; cost, $35,000; o, W Eisenberg; a, J C Burne.

Columbus (9th) av, w s, 127.8 n 80th st, s flat; cost, $35,000; o and a, same as last.

Adams av, n w cor Kingsbridge road, br flat; cost, $12,000; o, H Hunneke; a, J J Vreeland.

N e cor 121st st and Manhattan av, 3 br flats; cost, $82,000 all; o, W Heginbotham; a, J H Friend.

S e cor Amsterdam av and 131st st, 4 br flats; cost, $72,000 all; o, T Moloney; a, Thom & Wilson.

S e cor 78th st and 5th av, br dwell; cost, $50,000; o, W V Lawrence; a, R M Hunt.

519–21 E 86th st, 2 br flats; cost, $40,000 all, o, D L Sturges; a, F Tyrrell.

N s 90th st, 30 w Lexington av, 2 br flats; cost, $43,000 all; o, Ebling & Winnemer; a, F Winnemer.

W s Park av, 117 n 39th st, br dwell; cost, $40,000, o, D W James; a, C C Haight.

S s 57th st, 400 w 8th av, br church; cost, $150,000; o, Church of Zion and St Timothy; a, W H Wood.

S s 133d st, 250 w 7th av, 5 br flats; cost, $137,000 all; o, F A Thurston; a, C P H Gilbert.

90 Park av, br dwell; cost, $31,000; o, C H Dodge; a, Stratton & Ellingood.

N s 91st st, bet Madison and 5th avs, 3 br dwells; cost, $42,000; o, B A & J W Williams, Jr; a, T Graham.

ALTERATIONS—NEW YORK.

146 W 23d st,, walls altered; cost, $7,000; exr, W Sherwood; a, Constable Bros; b, Springsted & Mockabee.

439 W 48th st, raised 1 story, 5-story extension; cost, $13,000; o, A Moore; a, G Keister.

BROOKLYN.

8th av, s w cor Carrol st, 1 granite dwell; cost, $60,000; o, E L Maxwell; a. M W Morris; b, P Cleary and Morris & Selover.

S s Prospect av, 254 w 8th av, 6 fr dwells; cost, $14,000 all; o, Fannie Fielding; a, R W Fielding.

W s Patchen av, 20 w Putnam av, 5 br dwells; cost, $15,000 all; o, E Garber; a, F W Ames.

S e cor Decatur st and Patchen av, br dwells; cost, $8,500; o, F W Ames; a, J W Booth.

N e cor Throop av and Decatur st, br office bldg; cost, $26,000; o, N Y and N J Telephone Co; a, R L Daus.

N w cor 6th av and 20th st, 4 fr dwells; cost, $19,000 all; o, D Atkin; a, R Dixon.

S s Linden st, 80 w Wyckoff av, 3 fr dwells; cost, $13,500 all: o, P Riebling; a, D Acker & Son.

S s Second st, 37 e Fifth av, br dwells; cost, $10,000; o, A N McBean; a, J L Young.

S s Second st, 57 e Fifth av, 2 br dwells; cost, $28,000 all; o and a, same as above.

N s South 4th st, 75 e Havemeyer st, br dwells; cost, $12,000; o, Marie Bruninghaus; a, I D Reynolds & Son.

S w cor Linden st and Wyckoff av, 4 fr dwells; cost, $18,000 all; o, P Roebling, a, D Acker & Son.

E s Sumner st, bet Jefferson and Putnam, br armory; cost, $300,000; o, city of Brooklyn; a, R L Daus.

S e cor Roebling and North 2d st, br factory; cost, $35,000; o, J Cavanaugh; a, M J Morrill.

N s Madison st, 127 e Evergreen av, 4 fr dwells; cost, $11,000 all; o, J W Lamb & Son; a, A J Lamb.

MISCELLANEOUS.

ADAMS, MASS.—Br parsonage; cost, $7,000; o, Church of the Seven Dolores; a, F S Newman.

ALLEGHENY, PA.—Osborne, P F W & C R R, 2-story fr dwell; cost, $11,000; o, W J Prentice; a, Alston & Heckert; b, Rose & Fisher.

ASBURY PARK, N. J.—A cottage to cost $12,000 is to be erected at this place by Rebecca Wright.

BALTIMORE, MD.—S w cor Pine and Lexington sts, 3-story br bldg; o, James Friedenwald.

S e cor Pulaski and Maryanna, br church; o, St Thomas Lutheran Church.

Maryland av near Oak st, 3-story br bldg; o, Julius A Eppley.

BOSTON, MASS.—164 Heath st, br manufactory; cost, $15,000; o, H H Reuter; a, F N Footman; b, D H Jacobs & Son.

Lyndehurst st nr Allston st, 2 fr dwells; cost, $9,000; o, a and b, Jos H Beale.

Richfield st, 3 fr dwells; cost, $9,000; o, a and b, W J Jobling.

Dudley st cor Nonquit st, br hotel; cost, $63,000; o, Frost Bros; a, J M Brown; b, M S and G N Miller.

566 Parker st, br offices and hall; cost, $16,000; o, Alice C Moulton; a, Fred Pope; b, Henry W Moulton.

Reedsdale st nr Brighton av, fr dwell; cost, $7,000; o, John D Wetherell; a, F D Fuller; b, J H McLeod.

Marginal st cor Cottage st, br church and Sailors' Home; cost, $25,000; o, Episcopal City Mission; a, W M Bacon; b, Holmes Bros.

Norfolk av nr Magazine st, br cordage works; cost, $20,000; o, Pearson Cordage Co; a, W F Clark; b, McMorrow & Gately.

Humboldt av nr Homestead st, fr dwell; cost, $11,000; o, N P Ryder; a, Eugene L Clark; b, H McLaughlin.

Austin st, br engine house; cost, $40,000; o, Fitchburg R R; a, E K Turner; b, as above.

380 Tremont st, br alteration; cost, $6,000; o, R T Paine; b, as above.

BRIDGEPORT, CONN.—Barnum av, br school house; cost, $40,000; o, City of Bridgeport; a, Longstaff & Hurd; b, H M Purdy.

CAMBRIDGE, MASS. — Cambridge st, addn to br church; cost, $12,000; o, Second Baptist Society; a, W J Paine: b, W C Ryder.

Harvard st cor Dana, fr dwell; cost, $40,000; o, O H Durrell; a, Hartwell & Richardson; b, W Filmore.

Lambert av, fr dwell; cost, $8,250; o, D W Ellis; a, J M Brown; b, C Leake.

Carlisle st, br and fr dwell: cost, $6,500; o, Wm O'Connor; a, G Fogarty; b, W H Paterson.

Lake Shore drive, stone and br residence; cost, $80,000; o, O W Potter; a, F R Schock.

Washington blvd nr Albany av, br dwell; cost, $12,000; o, S R Warner; a, Hetherington & Warner.

175 W Madison, pavilion; cost, $20,000; o, Geo Reichold; a, J E Scheller.

Ellis av, br dwells; cost, $12,000; o, L P Friested; a, G Bloedner & Co.

225 buildings costing less than $7,000 each.

CATASAUQUA, PA.—Fourth st, s and fr cottage; cost, $8,000; o, J W Fuller; a, L S Jacoby; b, Messrs Sterner & Kress.

CINCINNATI, O.—Pearl and Lawrence sts, 3-story stable; cost, $12,000; o, Cincinnati Railroad Omnibus Co.; c, Stein & Shulthoff.

McMillan st and Reading road, 1-story br power house for electric generating station; cost, $17,000; o, Cincinnati Street Railroad Co.; construction engineer, Bert L Baldwin.

Renner st and Dalton av, 4-story br furniture factory; cost, $7,000; o, DePinal & Rennekamp; a, G and A Brink.

Fulton and Nassau sts, 7 2-story br dwells; cost, $8,000; o, Sharp Bros; a, Frank Parmelee.

CINCINNATI, O.—Locust st and Ashland av, 2½-story br dwell; o, W H and H Wachtell a, W S Robinson.

Walnut and 7th sts, 4-story br bldg; cost, $80,000; o, Young Men's Christian Association; a, Jas W McLaughlin.

Grandin road, W H, stone foundation for chapel; cost, $9,000; o, Sisters of Notre Dame; a, E F Durang.

Race st, bet 6th and 7th sts, 5-story br bldg for store purposes; cost, $15,000; o, Wm H Harrison; a, Jas W McLaughlin.

A O Elzner, architect, reports the following plans nearing completion:

2½ story br and stone res for Dr A Springer at Norwood; 50x60 feet, to cost about $30,000.

A double 2½-story br res for Mrs Miller and Mrs McGraw, on Jane st, Walnut Hills, to cost $10,000.

COLUMBUS, O. — Buttles av, br and s dwell; cost, $6,000; o, Theophilus Rees.

Buttles av, 6 dwells; cost, $10,400.

DENVER, COL.—17th bet Erie and Boulder, br terrace; cost, $18,000; o, Evan G Owens; a, Alex Casin.

26th cor Arapahoe, br terrace; cost, $20,500; o, E Heilder; a, H F Lee.

Lafayette bet 21st and 22d avs, br dwell; cost, $10,000; o, T L Cachcart; a, Lang & Pugh.

Goss cor Kent sts, 2 br dwells; cost, $21,000; o, Mrs Whitridge; a, J J Huddart.

Penn bet 10th and 11th avs, s dwell; cost, $45,000; o, J A McMurtrie; a, I Hodgson.

THE Editor of THE ENGINEERING AND BUILDING RECORD is always glad to receive items of news for the Contracting News Department. But such items are not considered news except when the prices and particulars of the award of a contract are given.

The announcement that ——— has sold ——— to ——— without giving the *prices* and particulars concerns only the buyer and seller. Such notices are always excluded, except in the case where a certain firm is stated to have taken a certain contract, the execution of which would require that they should buy certain materials. Such an item would be used if deemed of more than local interest, because it would suggest to some readers the possibility of their making a sale or securing a subcontract.

GRAND RAPIDS, MICH.—East st, near Cherry st, additions and alterations in a fr church bldg; cost, $5,000; o, East St M E Church Society; a, W G Robinson; b, not let.

Plainfield av, 3-story and bmt red pressed br block with galvanized iron bays; cost, $10,000; o, M Shanahan; a, same as above; b, John Youngbacker.

Cor Ionia st and 6th av, br church bldg with finished bmt; cost, $7,000; o, Calvary Baptist Church Society; a, same as above; b, by the day.

HARRISBURG, PA.—North Front st, br and s res; cost, $7,500; o, W Calder, Esq; b, Wm Gates.

South Front st. br and s res; cost, $,.-000; o, Mrs Elbridge McConkey; b, Wm J Ball.

North 2d st, 4 s dwells; cost, $14,000; o, A J Stewart, Esq; b, B F Kimes.

LANSFORD, PA.—A church, to cost $8,000 is to be erected here. Address W D Hill, architect.

LOWELL, MASS.—East Merrimack st, 6-story br store house; o, Mass Corporation; b, not let.

Kirk st, high school; cost, $150,000 o, City of Lowell; a, F W Stickney; b, not let.

School st, 2-story fr store house; o, Boutwell Bros.

MANOA, PA.—A large opera house is to be erected at this place.

MEADVILLE, PA.—A hospital to cost $10,000 is to be erected at this place.

MILWAUKEE, WIS.—Cor Martin st and Junean pl, res; cost, $25,000; o, L A Field; a, A Fielder, of Chicago; b, John Jones.

MINNEAPOLIS, MINN.—2714–22 Washington av, fr block of flats; cost, $30,000; o, a and b, J Hanson.

601–3 Harrison st, br store and flats; cost, $8,000; o, a and b, E. F. Gagnon.

Cor of 4th av and 5th st, br elevator; cost, $18,000; o, City Elevator Co; a. Barnett & Record

PEORIA, ILL.—Wechselberger & Reeves, architects, have completed plans for a $12,000 residence for Newton Mathews. It will be heated by hot water.

READING, PA.—4th and Douglas, 2-story s stable; cost, $7,200; o, C Wilhelm; a, Mr Lansdale; b, Mr Jacobs.

11th and Douglas, 15 3-story Queen Anne houses with all improvements; cost, $3,000 each; o, Tucker & Rehr; a, Smith & Bro; b, Angstadt.

Center av, s church; cost, $12,000; o, Rev Stoner; a, same as above.

Elm, 3-story green s front; cost, $9,000; o, H Long.

Douglas and 2d, 3-story Queen Anne houses in pairs, 3 pairs; cost, $6,000 pair; o and a, C Stoltz.

SALT LAKE, UTAH.—A hotel is proposed for Garfield Beach, at this place. C S Mellen, Traffic Manager Union Pacific Railroad, Omaha, Neb., can give information.

First South st, 5 story br bldg; cost, $60,000; o, H Dinwoody; a, Carroll & Kern.

SOUTH BETHLEHEM, PA.—Lehighton st, fr and shingle bldg; cost, $8,000; o, J S Lentz; a, A W Leh.

ST. PAUL, MINN.—Cedar near Aurora, 2-story br ven dwell; cost, $10,000; o, Maurice Lyons.

E 7th, near Joellson, 3-story br block; cost, $12,000; o, E E Davidson.

Laurel av cor McKubin, 2-story br addn to school bldg; cost, $25,000; o, Board of Education.

TOPEKA, KAN.—Stone addition to Campbell University at Holton, Kan; cost, $12,000; a, H M Hodley; plans not completed.

UTICA, N. Y.—The trustees of the Masonic Home and Asylum met in this city August 27 and accepted the modified plans of Architect W. H. Hume, of New York City, for the building of the home. The plans will be on exhibition at the office of the Secretary, at the Temple in New York, and also in this city, until September 20, when the bids will be opened at the Temple in New York. Bidders will be required to give $50,000 bonds for the faithful performance of the work, which is to be commenced at the earliest possible moment after the contract is let. John Y. Culyer, C. E., of Brooklyn, N. Y., is preparing plans, etc., for the grounds around the edifice as well as for the sewerage and drainage systems.

WEST CHESTER, PA.—A hotel to cost $100,000 is projected for this place.

WHEELING, W. VA.—Br and s brewery; cost, $150,000; o, Schmulbach Brewing Co; a, Kerstner & Co, Chicago, Ill; b, not given out.

WILKES BARRE, PA.—202-15 E Market, 9 br warehouses; cost, $15,000; o, S L Brown and Williams Bros; a, Kipp & Podmore; b, E T Long.

BUILDINGS.—There is nothing over $7,000 in value to report at the following places: Ogdensburg, N. Y.; Geneva, N. Y.; Worcester, Mass.; Charleston, S. C.; Chester, Pa.; Binghamton, N. Y.; Canton, O.; Clinton, Ia.; Dennison, O.; East Saginaw, Mich.; Youngstown, O.

THE ENGINEERING & BUILDING RECORD

AND

THE SANITARY ENGINEER.

A JOURNAL FOR THE ARCHITECT, ENGINEER, MECHANIC, AND MUNICIPAL OFFICER.

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A LESSON FOR ARCHITECTS.

THE lesson for building departments which we drew in a recent issue, from the structural defects of a theatre building in Brooklyn, by no means exhausts the suggestiveness of that affair. It contains a valuable lesson for architects as well. A costly building, to whose security many hundred people are, almost every night, to be invited to trust their lives is found, in some particulars at least, to be weak in design and much slighted in its construction. How did it happen? It is easy to say that the architect was careless or incompetent, but the question then arises, how does an incompetent man come to be entrusted with such important work, or, if competent, why is he careless? We may find the answer in considering the requirements of a building and of the man who wants it built.

Every building should display wisdom in its arrangement, strength in its construction, and beauty in its design. Of the first of these requirements the owner is perhaps as good a judge as anybody, and he is apt to think that he is of the last also, at least he gives some attention to the subject, and knows, or thinks he knows, what he wants; but about structural strength, without which everything else is useless, he usually knows little or nothing, and takes it for granted that his architect will attend to all that. Nor is the building itself apparently more obtrusive in requiring attention to its structural features. If it is awkwardly arranged, or unsatisfactory in appearance, the architect will speedily hear of it; but it may be dangerously weak and nobody ever find it out, for the ordinary factors of safety require such a surplus of strength that a considerable deviation from what would be regarded as safe practice may occur without causing disaster

The question of strength is, therefore, not forced upon the architect's attention, and the temptation to slight it is increased by the fact that it usually entails greater cost than do either of the other requisites. Patient planning may secure convenience and artistic skill, a fine appearance without materially increasing the cost, but strength requires good workmanship and sufficient material, as well as careful calculation, and these take time and money. Furthermore, an architect gets no credit for mere strength; that is taken as a matter of course. His reputation depends on the convenience and beauty of the structures he designs, provided they do not fall down or exhibit dangerous weakness.

It is easy, then, to see how an owner may choose an architect who is ignorant of the principles of good construction, or how an architect, who knows how to make a building strong, may be tempted to neglect to do so. Another reason why structural weakness may sometimes be overlooked by the architect lies in the fact that the artistic and constructive faculties are not always, perhaps not often, combined in the same individual. Indeed, they are sometimes considered antagonistic, as shown by the remark of a young architect, who has since grown wiser, to the effect that he did not "wish to know anything about construction as it would spoil his artistic taste." In such cases it is to be expected that appearance will be paramount, and that the artistic architect will, even if competent to perform them, shrink from the tedious and uninteresting calculations that are often necessary to ensure the safe and economical disposition of material. It may be said, then, that if the convenience of a building depends on the cunning of the architect's brain, and its appearance on his training of hand and eye, its strength rests mainly on the tenderness of his conscience

An architect has, doubtless, as tender a conscience as that of any other professional man, and when it has been sufficiently awakened to lead him to ask, "What shall I do to be saved from having my building fall down, or even having it dangerously weak?" the answer is simple. Have some competent person design its structural features or revise your plans. Even if you are perfectly competent to do it yourself, it will be better in an important structure to get outside advice, for it is difficult to pursue two such different objects with equal zeal, and the temptation to neglect one for the other, or to permit the requirements of one to obscure those of the other will be great, and so will be the corresponding advantage of having one person give his whole attention to structural considerations, apart from everything else. If you are not competent to do both, of course this advice goes without saying.

It is gratifying to note an increasing tendency towards this rational division of labor on the part of the better class of architects. In describing the office routine of some leading practitioners not long since, we had occasion to note the fact that, in several instances, the chief of staff was not an architect at all, but an engineer, and when a prominent New York architect had occasion, a few years ago, to take charge of the erection of one of the finest office and insurance buildings in that city, he employed a competent civil engineer for a year or more, at a good salary, to design its structural features and superintend its erection. Such instances could easily be multiplied. The young architect cannot, of course, do this, but he can do what is just as good—namely, consult a competent civil engineer in any case of difficult or important construction. This practice ought to result in making a good business for some engineers who will qualify themselves to advise with architects on all the various engineering problems from foundation to roof, and from heating to sanitation, that may arise in the construction of an important building. It would insure good construction and leave the architect free to give his entire attention to the subjects more congenial to his taste and training.

It should result, also, in securing finer, stronger, and more convenient buildings in which to live, to work, or to seek recreation.

STEAM METERS.

ONE of the questions which suggests itself every now and then is why some one does not produce a good steam meter. Every one who has had anything to do with the measurement of steam, particularly when used in the form of jets for heating and boiling liquids, has had to do considerable guess-work in getting at the amount used. Formulas for determining the flow of steam from orifices and jets, of course, abound, but simple calculation will show that the results obtained from the several current rules will vary to a surprising degree, though the conditions may be exactly alike in all the chosen cases.

A reliable meter would not only do away with this uncertainty, but would commend itself highly considered from the standpoint of convenience alone. Nevertheless there is not now on sale, so far as we know, a single appliance worthy of the name. Some of those which were on the market were, in fact, absolutely untrustworthy, and required such an amount of testing in order to find out what their indications really meant that they were entirely impracticable. A good meter, capable of measuring with reasonable accuracy both large and small flows of steam, and at suitable variations of pressure, still remains to be brought out, and would, no doubt, bring profitable returns.

A PNEUMATIC TUNNEL ROAD UP THE JUNGFRAU.

The plan proposed by Herr Trautweiler, of building a single tunnel with a switch in the middle of the ascent, the cars to be operated by a cable, has been held in abeyance, according to *Kuhlow's*, while the plans of Colonel Locher have been under examination.

Colonel Locher proposes to build two parallel tunnels with a slightly curved profile, each 9.84 feet in diameter, up which cylindrical cars are to be forced by compressed air. Each tunnel is to contain three rails, two below and one above, securely fastened to the masonry in accurate position. After the rails are in place, the tunnel will be lined with cement and gauged to a perfect cylindrical surface by means of a revolving templet. The cars, 65 feet long and to seat 50 people, have their wheels attached to the platforms and present an end area of about 75 square feet. They will weigh, with the 50 persons, about 11 tons, and it is estimated that to keep the car at rest, on a grade of 70 per cent., a pressure of seven tons, or 184 pounds per square foot, must be applied. An increase or decrease of the pressure by 220 pounds is to govern the ascent or descent of the cars. This combination is claimed by Colonel Locher to give the safest mode of propulsion on such grades, as the brakes are set so as to press the wheels against the rails, and not only stop their revolution but increase their sliding friction, and, if they fail, an automatic set is to be thrown into use.

The length of the tracks is to be about 3¼ miles, and the time required for a trip, at 23 feet per second, is estimated at 15 minutes. The power is to be derived from three rotary fans, 21 feet in diameter, driven by turbines directly coupled to the fans, the axes being in one piece. It is estimated that about 1.971 cubic feet of air, at a pressure of 16.5 pounds per square inch, must be furnished every second, besides that allowed for leakage around the sides of the cars. This will be reduced to a minimum by means of rings of iron plate, spaced two inches apart, and projecting to within one inch of the sides. For this 2,835 cubic feet are to be provided, an amount which can be furnished by two fans 21 feet in diameter, making 310 revolutions a minute. These plans have been pronounced feasible in every respect by four of the largest engineering firms in Europe.

Kuhlow's, however, doubts if the project will be remunerative, as, for topographical reasons, the tunnel will stop near a little plateau 1,200 or 1,500 feet below the top, the last 1,000 feet or so of the Jungfrau being a great needle, with nearly vertical sides, in which the tunnel would become a shaft, and the top, which is a mass of ice-covered rock, will not give room for more than 20 people.

PREVENTION OF ABRASION OF CREEK AND RIVER BANKS.

In a paper recently read before the Illinois Society of Engineers and Surveyors, E. T. Chamberlain explained that the wearing away or abrasion of creek and river banks may be caused by—

First, wave action; second, too great a velocity of the stream; third, an outflow of water through the substrata of quicksand that are generally found under alluvial lands. The water that, during a flood, fills all the beds of sand, running back to the river after the high water, carries with it the quicksand, causing the bank above to cave into the river and be carried away. Frequently the wearing away is done by a combination of all three of the above-named causes.

To prevent the injury by wave action nothing is better than a revetment of brush and stone. The mattress upon which the stone is to be thrown should be close enough to prevent the water from carrying away the soluble portions of the bank. Fascines, 10 to 18 inches in diameter, made of willow poles eight or more feet in length, are laid close together upon the bank, if above water, and the same well covered with stone. If the bank to be protected is submerged, the fascines are fastened together by wire or rope, so as to make the desired size (or section if too large for one mattress), then anchored and sunk to place by throwing stone upon the same.

Most of the abrasion of small streams is caused by too great a velocity of its waters. A few small spur dykes are the cheapest and most effective for such cases. The end projecting into the stream should point a few degrees up stream, from a right angle to the bank, so as to form a body of comparatively dead water above the dyke. For small streams a few large trees fallen into the stream, with small trees and brush to make all close enough to carry stone to hold it in place, will frequently be all that is necessary for a dyke. The dykes, as generally made by the United States engineers, are willow mattress alternating with plenty of stone, and, when raised to the desired height, all well covered with stone, care being taken to have an apron extending from the lower side, at the bottom, or the water falling over the dyke will undermine the same.

The injury from the third cause is found only along banks of the large streams, or on embankments composed in part of quicksand and subject to one side only being covered with water. For the river bank the revetment above described, or, if room in width of the stream, some dykes so located as to deposit coarse river sand against the affected bank, will be necessary.

Mr Chamberlain described a cheaper substitute, used upon a bank of about half a mile of the Mississippi River, that was troubled by all three of above mentioned causes. The river bank was 6 to 10 feet high—and perpendicular—to the surface of low water, and thence about two feet base to one foot vertical for a depth of 8 to 15 feet, with a strong current, but recently directed so as to endanger, striking the upper end obliquely and following the concave bank until deflected towards the opposite shore.

As the river had encroached nearly to the base of the levee, something must be done, or a new levee, costing $8,000 to $10,000, must soon be made. Green timber and sand near by could be had for the asking. Large trees, with the tops entire—all that four mules could draw on frozen ground—were used. The first tier was placed with tops up stream and the butt kept close against the bank. After a good base had been secured, the top ends were turned down stream, and large trees, logs and brush (all green) were rolled off the bank until a wall of 5 to 15 feet in width was built higher than the bank. Then large stakes were driven into the bed and vertical bank as would best tie all together. Four dykes, about 80 feet long, and about 40 feet wide at base, and 15 wide at the top, which was above low water, were constructed in a similar manner. The dykes were weighted with a few boxes filled with sand. The work so constructed remained one year, and was covered with water once. All that had been completed as above remained, and the lower portion was found imbedded in sand and silt.

NOVEL PLAN OF RAISING WATER FROM A SHAFT.

W. Galloway described before the South Wales Institute of Engineers, a short time ago, a novel plan of raising water from the shaft sunk at Llanbradach by the Cardiff Steam Coal Collieries Company.

It was known that a considerable thickness of the Pennant sandstone series, which is invariably found heavily watered, required to be passed through, and surrounding collieries have heavy pumping fittings. The absence of any means of determining the probable quantity of water to be dealt with in sinking led to special provision for winding the water to the surface. The contract provided for certain allowances whenever the water exceeded 4,000 gallons per hour, whether pumps were provided or not. The largest quantity met with was 7,500 gallons an hour in the shaft bottom. Down to a depth of 135 yards the total growth was 9,000 gallons an hour, of which 5,000 gallons was walled out by brick and cement walling. It would have been impossible to proceed with the sinking without pumps had it been necessary to fill the water into the kettle by the ordinary means of bailing. Mr. Galloway accordingly devised what he calls a "pneumatic water barrel"

It consists of a cylindrical vessel of sheet iron, 4 feet 2 inches in diameter and 8 feet deep, closed at the top by an air-tight manhole door. The bottom is 5 inches above the lower edge of the cylinder, and has a circular hole in it 18 inches in diameter. This hole is closed by a faced valve of cast iron, mounted with a sheet of leather, capped and tightly clasped by an iron hoop. The valve is attached to a spindle by a ball and socket joint, by which it is kept in position, but allowed a certain amount of play so that it may readily accommodate itself to its seat. The cylinder is thus an air-tight vessel, the interior of which has communication with the exterior atmosphere only by means of a pipe, extending from close to the top of the cylinder in the inside, to the outside of the vessel halfway down. The outside end of the pipe is fitted with an instantaneous coupling identical with that used on the vacuum railway brake. In use the pneumatic water barrel is lowered into the shaft till its lower edge is under water in the shaft bottom. The interior is put into communication with a condenser air pump on the surface by attaching a flexible tube connected to the vacuum pipes in the shaft to the instantaneous coupling of the barrel. A vacuum equivalent to 20 to 22 inches of mercury is thus obtained inside the barrel, and the water rushes in through the bottom valve. A glass gauge tube on the outside of the vessel shows when it is full. The tube is detached, and the signal given to raise the barrel. When it reaches the surface a bogie is run under it, and it is lowered on a conical block of wood, which raises the valve, and the water escapes.

The Executive Committee of the Grant Monument Association, New York, have received plans from architects Carrere & Hastings, Charles W. Clinton, N. Lebrun & Sons, J. H. Duncan and John Ord.

PERSONAL.

City Engineer Charles A. Allen is busily engaged in the matter of providing for the abolishment of all grade crossings in Worcester, Mass.

Abraham Gottlieb, Mem. Am. Soc. C. E., of Chicago, has been appointed Consulting Engineer to the Chicago World's Fair Commissioners.

J. Wechselberger, formerly with Burnham & Root, architects, of Chicago, and William H. Reeves, a graduate of the Champaign, Ill., University, recently opened an office at Peoria, Ill.

Harry P. King, of Peoria, Ill., and W. A. Dickerson, of Dubuque, Iowa, have formed a partnership under the name of King & Dickerson, with offices at Peoria, intending to do an engineering and contracting business.

H. C. Merrick was recently elected to the office of City Engineer of Binghamton, N. Y., by the City Council. A. A. Caille, however, at present holds the office under appointment by the Mayor and has refused to transfer it.

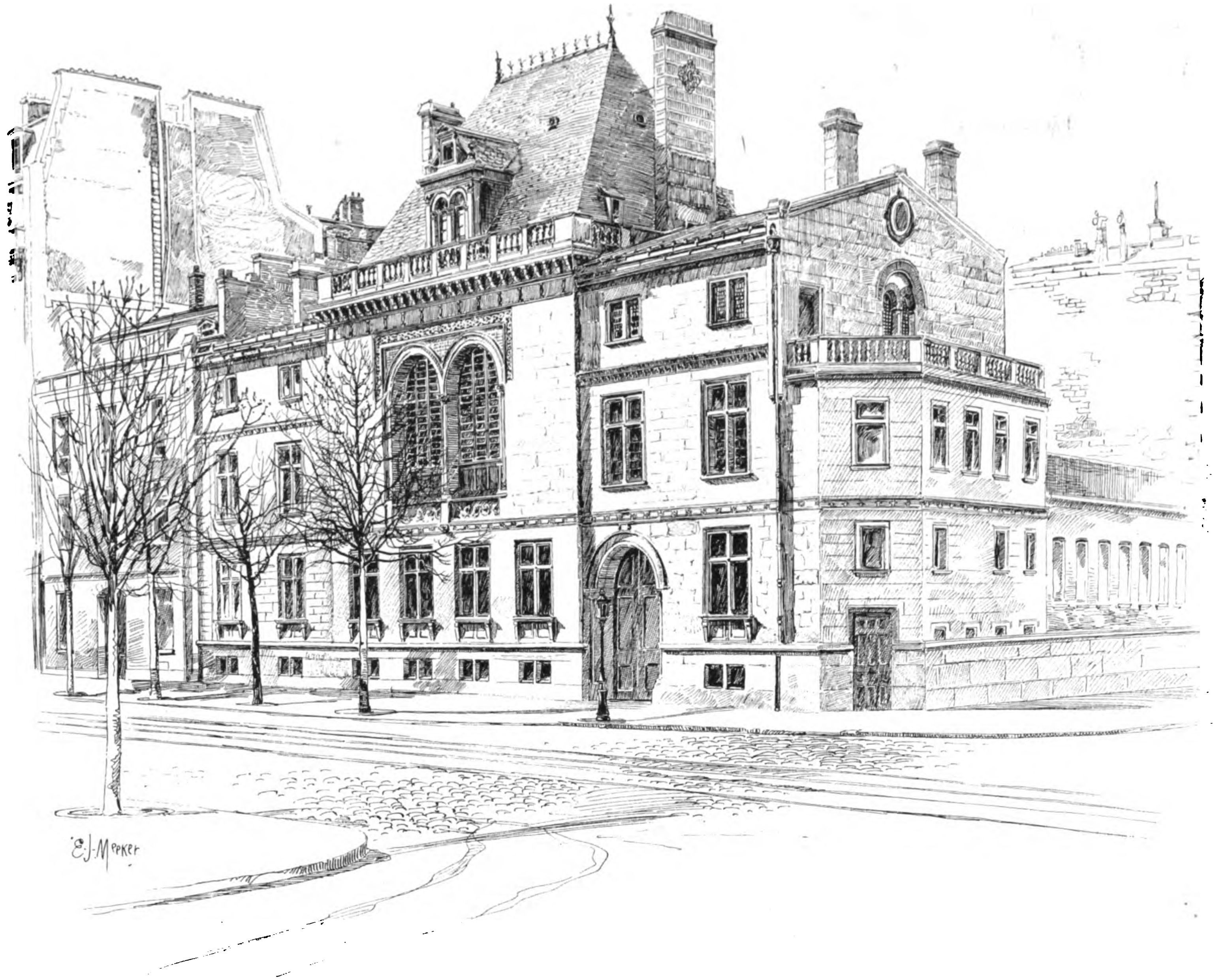
Major George W. McNulty and H. Waller Brinckerhoff, civil engineers, of New York City, are associated in the engineering work, including the preparation of the plans, for the inclined planes and hoisting machinery of the Dunderberg Spiral Railway, on the Hudson, of which G. H. Vedeler is Superintending Engineer.

A petition was presented to the Mayor this week by O. H. P. Cornell, of New York, asking that he be appointed to the place on the Aqueduct Commission made vacant by the death of Walter Howe. These names were affixed to the petition: Andrew D. White, Thomas L. James, Ellis H. Roberts, W. J. Arkell, Dr. A. W. Lozier, H. L. Hotchkiss, John J. Simpson, Charles H. Blair and Walter Katte. Letters from E. F. Winslow, A. Bonzano, Silas B. Dutcher, E. L. Conthell and George H. Sharp, of Rondout, praising Mr. Cornell's abilities as an engineer, accompanied the petition. Mr. Cornell has been twice a candidate for State Engineer on the Republican ticket. He is a son of ex-Governor Cornell.

OUR ARCHITECTURAL ILLUSTRATIONS.

A PARIS HOUSE,
BOESWIWALD, ARCHITECT.

CITY STOOP,
R. H. ROBERTSON, ARCHITECT, NEW YORK.



THE ENGINEERING AND BUILDING RECORD ILLUSTRATED SERIES.

A PARIS HOUSE.

BOESWIWALD, ARCHITECT,

NEW YORK. VOLUME XXII.

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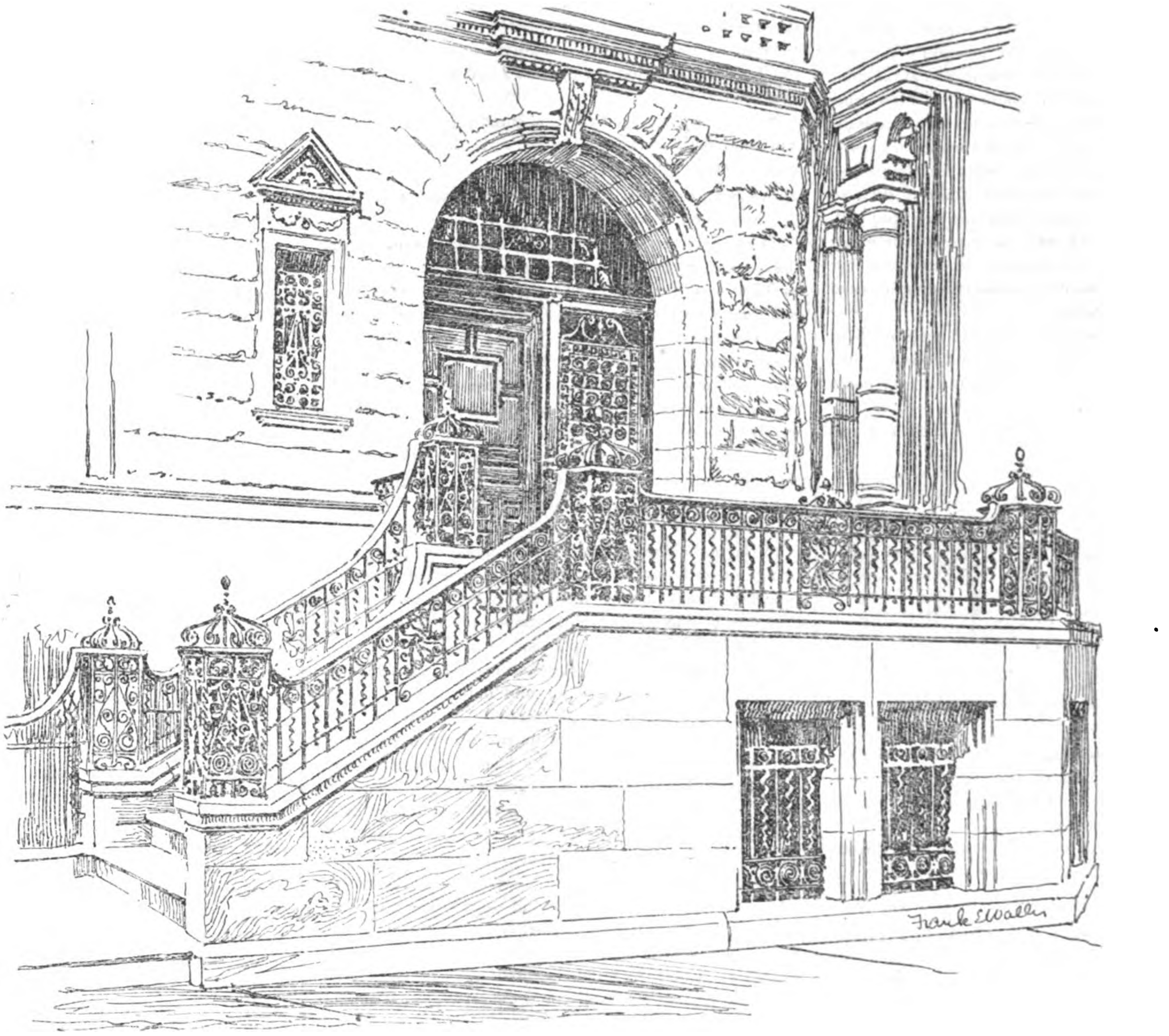
ENGINEERING SOCIETIES.

THE first regular meeting of the season was held by the American Society of Civil Engineers on September 3, with President W. P. Shinn in the chair. Regular business was transacted, and a paper on "Notes on a Mountain Slide," by William G. Curtis, was read and discussed. The following candidates were declared elected:

Members.—August William Bœke, City Engineer, Kansas City, Kan.; Charles Gleason Elliott, Engineer for drainage of large farms for private parties and for districts organized under the laws of Illinois, Gilman, Ill.; Charles Malon Mills, now Assistant Engineer the Phœnix Bridge Company, Phœnixville, Pa.; Joseph Allen Powers, Manager Troy Electric Light Company, with charge of Steam and Electrical Plant, and Village Engineer for Lansingburgh, N. Y.; Henry Hodge Quimby, for six years with Phœnix Bridge Company as Engineer in charge of Designing and Constructing Bridges, Viaducts and Buildings, Phœnixville, Pa.; Job Meade Tobias, Chief Engineer Cartagena and Magdalena River Railway, Cartagena, U. S. Columbia.



CITY STOOP.—R. H. ROBERTSON, ARCHITECT, NEW YORK.

Juniors.—Francis Winthrop Scarborough, Assistant Engineer Maintenance of Way Department Chesapeake and Ohio Railway, Richmond, Va.; John Joseph Tallon, Principal Assistant Engineer North Hudson County (Elevated Cable) Railway, Hoboken, N. J.; Wolfgang Gustave Felix Triest, with A. P. Boller, M. Am. Soc. C. E., New York City, address Paterson, N. J.

A CIRCULAR has just been sent to the members of the American Society of Mechanical Engineers, directing their attention to the Mechanical Engineers' Library Association, and urging them to become fellows of this association, which implies to give it financial support. It has not seemed judicious to meet the opportunity for enlarged usefulness now opening before the society by arbitrarily raising the dues, but the plan of Library Fellowships will enable all to accomplish the same result without making undesirable changes of the rules.

PLASTER HOUSES.

AN innovation in building is to be tried at Pittsburg, Pa. F. Lingenfelser, a prominent master plasterer of the city, is said to be the prime mover in the project, according to which the framework of a house is erected the same as is done for any frame building. For larger buildings, iron or steel may be used.

After the framework is complete, a metal lathing is nailed on the studding, completely covering the sides of the building, excepting doors and windows. The meshes of this lath are diamond-shaped, and the surfaces are turned at an angle. This lath is coated with a mixture of mortar and cement. On that is put an inch or more of cement, which is finished and lined in imitation of any kind of stone. The cost, it is claimed, will be but little in excess of that of the customary methods.

THE TORONTO, CAN., SEWERAGE SCHEME.

CITY ENGINEER JENNINGS, of Toronto, Can., has submitted a comprehensive report on the Toronto trunk sewer scheme, agreeing, in the main, with that handed in by Messrs. Hering and Gray. The total approximated cost of construction, as determined by Mr. Jennings, will be $1,632,538, exceeding the estimate of Messrs. Hering and Gray by $161,490.

Accompanying the report are tables showing the length, dimensions, capacity and cost of the proposed system of sewers, also the maximum population and area which they will serve. There is also a plan giving the course of the sewers recommended.

A CYLINDER head in one of Nashville's $100,000 Holly-Gaskill engines is cracked, and the new pumping station is idle.

PIPE-LAYING IN MARSHY GROUND.

JOHANN FRIEDRICH FISCHER, of Worms, Germany, has patented a method of, and apparatus for, pipe-laying in marshy or swampy ground, during inundations or in other similar circumstances, and for forming foundations in wet ground. *Kuhlow's Review* explains that in laying a line of pipes in accordance with this system, a trench is excavated to the water level with a wide bearing on each side for laying the sleepers and rails, on which the machines have to travel. As soon as the trench is ready, a line of pipes is put together and made tight. The next stage is to erect a sinking frame or caisson, constructed of sheet iron with angle-iron frame and stays, open at top and bottom, and placed above the connected line of pipes, which are suspended in slings. The line of pipe is covered at each end with porous caps, which permit the water to enter, but not the dirt and soil. The pipe and the sinking frame are then lowered by digging away the ground from under them, and when the proper depth has been reached and the end of the pipe joined on to the portion previously laid, the sinking frame is withdrawn by hydraulic power. The caisson is made in sections; so that, while the rests are taken up, the portion covering the pipe ends may be left, if so desired, until the joint is made. Herr Fischer prefers to make the joints with India-rubber rings on a spigot which would allow for any slight irregularity of the ground. The invention has nothing to do with the freeing of the trenches from water, but merely suggests a way for substituting iron framing to keep a trench open, instead of the timbering usually employed for this purpose.

TAMPA, FLA., has a garbage cremator capable of destroying forty cubic yards of material in twelve hours with about three-quarters of a cord of wood.

THE MAINTENANCE AND OPERATION OF WATER-WORKS BY PRIVATE COMPANIES.

SOME time ago Messrs. Howland & Ellis, civil engineers, of Boston, Mass., prepared a pamphlet, entitled as above, and giving, at length, descriptions of the various books of record and account, as well as of the numerous forms, reports, etc., to be used in different cases.

The wide interest of the subject and the fact that the pamphlet had but a limited circulation have suggested the desirability of reprinting it for the benefit of our readers. The pamphlet, as will be understood, treats only of those matters pertaining to the business of the companies, and does not touch on the mechanical and engineering departments.

The experience of our readers will doubtless suggest points for discussion, and this we invite.

In all business, a definite system of procedure must be established and followed, and especially in the business of supplying water to a municipality, where the customers are from all walks of life and their personal and business customs and habits are so varied. It is, therefore, absolutely necessary to have a standard of procedure that will best satisfy the largest number of persons, and at the same time protect the interests of the company. In too many places a large number of the people look upon the water department, whether public or private, as a common enemy, from which it is perfectly right to obtain, in almost any manner, as much as possible and return therefor little or nothing. The rates to be charged are liable to, and will, vary in different localities, as well as some of the minor methods of transacting the business of the company, but the general business system of all private companies need not vary on account of locality.

There are, probably, few places that will employ all of the books, forms, or accounts given in what follows; but, whenever applicable, they should be used for the purposes and in the manner indicated.

The account books necessary. Messrs. Howland and Ellis enumerate as follows·

No.	Name.	Record No.
1.	Application Book	924
2.	Rate Book	925
3.	Day Book	926
4.	Accounts Receivable Book	927
5.	Alphabetical Index	928
6.	Street Index	929
7.	Invoice Book	930
8.	Cash Book	931
9.	Journal	932
10.	Ledger	933

These books are all of uniform size, with pages 13¼ inches long and 8 inches wide.

The first six books relate wholly to the detailed records of the customers and earnings of the company; the seventh covers the expenditures; while the last three are the business books of the company.

There will also be several books of record and various blank forms to be used, which will be treated of later.

1. APPLICATION BOOK. 200 leaves. Record No. 924.

The pages of the Application Book should be paged on the left-hand page only, with even numbers, the first one being numbered 0. Each should have the printed form of application at the top, while underneath should follow suitable *numbered* rulings for *twenty* applications to fill out; thus each numbered page will contain the numbers of the applications that commence with the figures of the number of that page, and all that occur before the figures of the number of the next page—*i. e.*, page 6, will contain numbers 60 to 79 inclusive, while the next page, No. 8, will commence with application No. 80 and end with No. 99, etc.

Each book will thus contain 4,000 applications, and will be numbered on the back and side, accordingly.

In cases of tenement houses, flats, blocks, etc., occupied by several parties, but having only one street number, except as below, only one application need be received, and that from the owner, who must become responsible for all the service supplied to the premises. If he desire the tenants to each pay their proportion of the bill for the whole, he must make application for each, have separate sidewalk stops, service pipes, and other fixtures for each, and separate bills will be made out against each tenant having a separate stop, but if the bill is not paid the owner will not be relieved from paying the whole bill, and, if he refuse, the water will be shut off, and not again turned on to the premises unless the bill, with charges, is paid, even if a new tenant moves in.

In cases of blocks divided by party walls, and having separate entrances and numbers, each number should be treated as a separate property; and one or more applications must be made for each such block.

In supplying applicants, one tap at the main may supply two or more; but there must be at the sidewalk, or curb line, one shut off stop and box for each applicant or separate customer, and no more, of which the company takes cognizance. So the number of customers will always be the same as the number of service stops and boxes; and the number of the latter shall be called the "stop number," and be the designating number of the customer through all the books.

If the owner cannot make an application in person, then he must, in all cases, fill out and sign one of the regular blanks furnished, authorizing some one else to sign for him; and such authorization must be numbered with the number of the application and the stop number, and then placed on file.

An application should be made for each private fire hydrant, stand-pipe, or sprinkler, when the same requires a separate connection with the mains, and is used and paid for, for fire protection only; and each will have a stop number.

No large special fire hydrants, stand-pipes, or sprinklers will be allowed to be connected with the works and the water used paid for at meter rates.

2. RATE BOOKS. 500 pages in each book. Each page numbered. Record No. 925.

The pages should be ruled and headed, proportioning the number in each book for fixture and meter customers as the size of the works and the basis of charges in use will render necessary. In places having a population of 10,000 or over, separate books should be used for the two kinds of rates. When more than one book is used continue the numbers of the pages from the first into the second, from that into the third, and so on, so that there will be but one rate page for each number, no matter how many books are used. Make all entries in the order of the stop numbers. They will not be continuous, for some will be fixture and some meter rates, but preserve the order.

In the main headings the owner's name should appear, being crossed out and the new one inserted when the property changes hands—the number and name of street, the dates of the application, number of stop, etc., all to be filled in in their proper places.

In the first column on the fixture rate pages give the date of turning on the water and dates when rates are changed, etc.; in the second column designate each separate fixture in use, giving it its proper name and size; and in the third column give its location, together with any general information or description thought necessary; in the last columns fill out the quarterly and annual rates.

Whenever there is any change in the fixtures, make the necessary corrections or additions, cross out the old rates, and make the new ones so as to have all old figures for reference, but only the present live ones will be used.

Public hydrant rentals: The last three pages of the fixture rate book will be devoted to the account of public hydrants. Enter the number of hydrants paying different prices per annum separately, and the gross annual amount of each class in the annual column. In the columns to the left, enter the monthly, quarterly, or semi-annual amounts due as per contract with the municipality. Correct these entries whenever any change is made in the number of hydrants.

There will be found plenty of room on each page for all data in relation to each customer, and to make necessary minutes as to penalties, times of turning on and shutting off of supply; and each record should be corrected once a quarter, so that the amounts shown in the last columns will give the exact amount of the quarterly and annual rates that the customers pay.

3 DAY BOOK. 270 pages (3 quires), all numbered. Journal ruled. Horizontal ruling 3 to the inch. Record No. 926.

In this book enter the details of charges for materials and labor furnished or done for any one at any time, whether service pipe work or repairs on the same.

All entries are to be made chronologically and fully, so that, in case the charge is ever disputed, the details can be shown.

The total charges each month must agree with the footing of the services and repairs column in the Accounts Receivable Book.

4 ACCOUNTS RECEIVABLE BOOK. 360 pages (4 quires), all numbered. Record No. 927.

On the last of each month, after all bills, or accounts receivable, which are due and payable on the first of the next month, have been made out, they will be entered in this book. In entering them; their numerical order must be observed, and quarterly enter every stop number; and then, when the names and amounts are filled in, any omission will be noticeable, and it can be looked up. If it is a dead number, so note it; but, if any bill has been overlooked, make out one, and properly enter it.

Enter the amounts in the proper columns, and carry footings forward from page to page for journalizing. "Fixture rates" and "meter rates" should be added together, then the combined amount, as well as the footings of the other columns, journalized and posted to the ledger.

Bills for hydrant rentals made out against the municipality will, when due, be entered at the end of the month's entries, and the amount placed in the miscellaneous accounts receivable column, with a note or heading to distinguish it, but bills for private hydrant rentals, and private fire protection of all kinds should be made out separately against each party, and entered in the private fire protection column.

If bills are made out and paid in advance of making out and collecting the regular monthly bills, the stubs must be used in place of the bills when making the proper entrie on the Accounts Receivable Book at the end of the month taking care at the same time to enter amount and date of payment in the proper columns.

In the "rebate" column, enter the amount of the rebates on all the bills entered on the same line. The subject of rebates, as well as the other entries, will be more fully treated in the details of the ledger accounts.

Each night when receipts are entered, from the stubs to the cash book, they should also be noted in the last two columns of the Accounts Receivable Book, giving date and amount of payment.

Except when bills are paid before they are due, they will not be entered on the Accounts Receivable Book till they are entered with the regular monthly bills, as before stated. Meanwhile, such stubs should be separately preserved in the cash drawer until entered on the Cash Book, and then kept until the end of the month, when they will be entered on the Accounts Receivable Book. After entry, all stubs should be filed away, each day and month's receipts in a separate package, and preserved till the bills they represent would be outlawed.

5 ALPHABETICAL INDEX. 270 pages (3 quires). Record No. 928.

The pages divided between the different letters in the usual proportion. All entries should be strictly alphabetical to the third or fourth letter if necessary.

In the first column give the name of the applicant, which should be the name of the owner. Next give the number and name of street, then the application number, then the stop number, then the page of the Rate Book where the details of the rate can be found. Against the stop number in the Record Book the details of the connection, including corporation cock, etc., can be found. Leave three times as many lines between names as a party has premises, so as to provide room to fill in the location of other premises owned by the same person, or the names of other parties whose alphabetical arrangement would bring them between.

6. STREET INDEX. 270 pages (3 quires). Record No. 929.

This book has a small index in the front in which to enter the names of the streets and give the number of the page in the book where the same can be found. The streets need not be entered in alphabetical order in the main part of this book, but space enough should be alloted each street to allow for all probable applications that there will ever be on that street.

In the first column give the street number. In the second column the name of the owner, then the application number, then the stop number, then the page in the Rate Book.

In making entries, have them come as far as possible in order of street numbers.

(TO BE CONTINUED.)

ACCORDING to the *Electric Age* there were, on August 1, 1890, 223 electric railways in operation and under contract in the United States and 4 in Canada. The same authority places the number of cable roads in the United States at 44.

BUILDERS' AND CONTRACTORS' ENGINEERING AND PLANT.

No. XCIX.

(Continued from page 136.)

THE FORTH BRIDGE CONSTRUCTION.

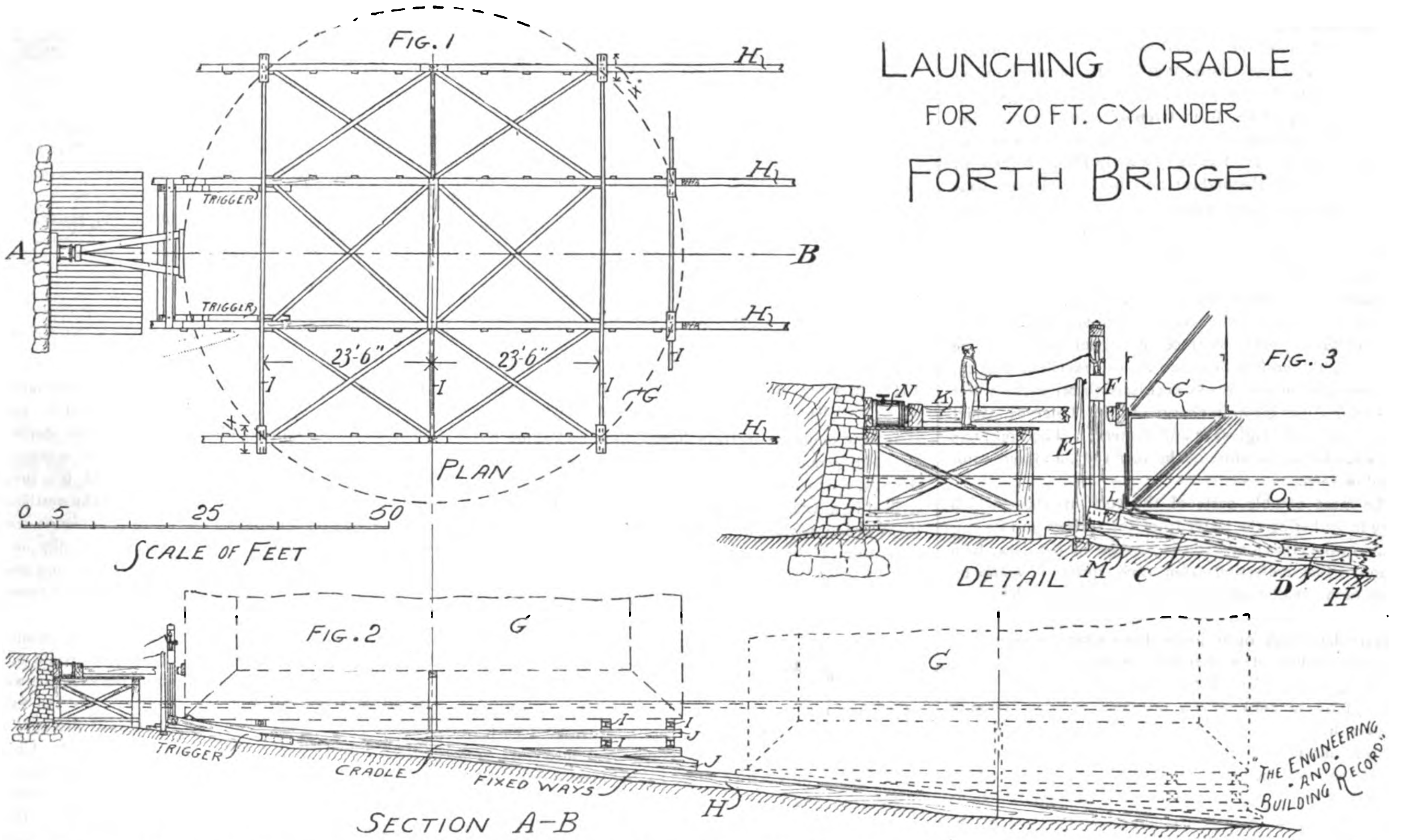
PART VI.—LAUNCHING THE 70 FOOT CAISSONS.*

THE pneumatic caissons which were illustrated on page 19, Vol. XVIII., were built on the shore adjoining the center line of the bridge, between high and low-water marks. The bed of the Firth of Forth at this point, after shelving somewhat rapidly to low-water mark, runs out about 1,700 feet with an almost level, muddy surface, giving only 18 feet of water at high spring-tides, where the caissons were built. The available depth was further reduced by the necessarily wedge-shaped cradle.

The caissons were built as high as possible, so that on reaching their site, and having been sunk to the bottom, it would not be necessary to add any more plates to their sides to keep out the sea at high spring tides, until the concrete required to sink them had been placed. The weight of the caissons so built, containing a small quantity of concrete as ballast, was about 400 tons each. When the building operations were completed as far as possible, four 15-inch hydraulic jacks were placed under the cutting edge and the caisson was raised to relieve the packings on the tops of the timber trestles, upon which the first portions of the girders, floor and shoe were erected, preparatory to their removal, the weight being supported the while on stacks of pitch-pine logs around the cutting edge.

Figure 1 is a plan of the caisson cradle, ways, etc., and Fig. 2 is a section and elevation at A B, Fig. 1.

The outlines of the caisson G are shown by the broken lines.



LAUNCHING CRADLE FOR 70 FT. CYLINDER FORTH BRIDGE

Four 12 by 12-inch pitch-pine skids, H H, etc., with smooth upper surfaces, were set at a uniform slope of 1 in 11 upon concrete blocks bedded in the ground. Upon these fixed ways the launching cradle was built, after the removal of the trestles already mentioned. It was composed of light wrought-iron beams, I I, etc., and 12 by 12-inch timbers, J J, securely bound together and provided with hard wood guides, bearing upon opposite sides of each pair of fixed ways, to keep the cradle to its path. Before it was allowed to rest upon the fixed ways, a few inches above which it had been put together, a thick coating of black soap and tallow was smeared upon the rubbing surfaces. The caisson was lowered upon the cradle by means of the four 15-inch hydraulic jacks already mentioned, and the triggers were fixed to hold it until the tide was high enough to launch it.

Figure 3 is a side elevation, on a larger scale, of one of the two triggers. Two 12 by 12-inch timbers, C, 13 feet 6 inches long, having rounded ends, butted into pieces of hard wood, D, bolted to the fixed ways. Bent iron straps, L, attached to their upper surfaces, caught the bottom angle, O, of the shoe. They were supported at their upper ends on movable steps, M, which prevented their becoming disengaged until the required moment.

All being ready for the launch, the remaining stack blocks around the cutting edge were removed. As the tide returned, the whole weight rested on the cradle, and its horizontal component was taken up by the trigger arrangement. At high tide, with the water standing about three feet above the cutting edge, on the signal being given the stops were drawn from beneath the trigger, and the weights, F, were let go (to disengage the triggers if they failed to fall by gravity), leaving the caisson and cradle free to move down the slip. If it showed any reluctance in moving it was assisted by means of the hydraulic ram, N, placed behind it. The cradle slid down the ways with its burden until the caisson drew sufficient water to float it off. The cradle remained under water, owing to the weight of iron used in its construction.

Two steam tugs were employed to tow the caisson to its site, where, after enough concrete had been placed in it to sink it to the bottom, the remainder of the plating was completed. The launching cradle was taken to pieces and kept for the next launch.

(TO BE CONTINUED.)

SOUTH ORANGE, Milburn and Short Hills, N. J., are to be supplied with water in future by the Commonwealth Water Company of Summit. The work of laying the mains, etc., will be done under the supervision of C. P. Bassett, of Newark, and the County Road Board. Contracts with the Water Company are to be made by the three villages named.

THE merits of disposing of garbage by cremation are shortly to be investigated by the New York Street Cleaning Department.

THE WATER SUPPLY OF MOSCOW, RUSSIA.

To most Americans, writes Consul Wertheim, of Moscow, to the Department of State, it will be utterly inconceivable how, within the present age, a populous city like Moscow, having close upon 800,000 inhabitants, could possibly have so long endured so great a privation as the scarcity of water, yet there is the fact that this town has managed to jog along for the last 50 years and still exists upon the scant supply of barely 1,500,000 gallons of water per diem. However, after a course of deliberation extending over a year, this vital question of providing the town with more water has been brought to a head. The municipality has issued a loan of about $3,000,000, bearing 5 per cent. interest, for the purpose of constructing a new system of water-works, and the first notice inviting public competition for the execution of the work has been published. Before entering any further upon the subject of reconstruction and extension of the existing old water-works of this city it may be of some interest to trace its history and origin.

During the reign of Empress Catharine II., somewhere about the year 1779, the city of Moscow depended entirely upon carriers for her water supply, brought from the outlying districts of the town. It is said to have been so bad that the Empress used to have hers brought for her all the way from St. Petersburg. On one of her Majesty's annual pilgrimages to the Monastery of St. Sergievo, overcome with the heat and fatigue of her self-imposed pedestrianism, she halted at Metistshe, a small village about seven miles northeast of Moscow, and, having quenched her thirst with some water obtained on the spot, her Majesty was so delighted with its purity and freshness that there and then she decided to utilize the source, that had so unexpectedly been brought under her notice, for Moscow. In June, 1779, an engineer named Bauer was commissioned to design a plan for conveying the water to the town, but his conduits of stone could not resist the effect of frost, and the work was abandoned. In the year 1820 another engineer projected a plan to supply the town with water from the river Moskva; but he, too, failed, and took his own life, in sheer desperation.

It was not before the close of 1834 that the existing water-works were executed by Baron Dervig, and the idea of the Empress of supplying her cherished old city with water from the Springs of Metistshe was successfully carried out. The water, obtained from a series of springs at Metistshe, is all that can be desired, and there is plenty of it. The fresh supply is to be obtained by sinking a number of wells of small diameter, conveying it by a 24-inch main to an intermediate pumping station, and thence to a water tower in the town. From this the distributing system will be supplied. The supply is now to be increased fro[illegible],000 to 4,500,000 gallons per diem.

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* Part I., The Tube Riveting Machines was published October 22, 1887. Part II., Material Lock in the Pneumatic Caissons, December 3, 1887. Part III., Oil Rivet Furnace, April 21 1888. Part IV., The 70 Foot Caissons, June 9, 1888. Part V., The Hydraulic Spade, June 30, 1888.

GRENOBLE WATER SUPPLY.*

THE City of Grenoble is situated at the junction of the rivers Isire and Drac, and is overlooked by high mountains, whence many water courses, fed by snows and glaciers, and the lakes of the higher table lands take their rise. In spite of the exceptional topographical situation, Grenoble was provided until lately with an insufficient water supply, derived from some springs whose total flow varied from 14.300 gallons to 17,600 gallons a minute, insuring only about 35 gallons a day to each of the 55,000 inhabitants. Even this amount was reduced to 22 gallons at most in exceptionally dry seasons. The pressure was too feeble to rise even to the first stories in the lower wards. For many years the Municipal Council had been trying to remedy the situation, and many plans had been considered to furnish a volume of water sufficiently large not only for domestic uses but also for industrial means. One of these projects, by Mr. Carron, was to raise by means of hydraulic machines and bring to Grenoble, with 656 feet of pressure head, the water of the Boiron and of the Rive, the total supply of which was estimated at 660 gallons a second. Beyond the volume of 55 gallons for domestic uses, there would be 610 gallons, which, at a pressure head of 656 feet, represented 5,500 horse-power; but this was abandoned on account of the expense of construction and a probable deficiency in receipts to cover expenses. In 1882 the Council adopted another project more simple and less costly, that of the introduction of the water of the Rochefort Springs. These springs, situated about 6¼ miles from Grenoble, yield a minimum supply of 110 gallons a second, at a gravity pressure due to at least 166 feet head at all points in the city, thus affording supply to the highest buildings. The temperature of these springs remains always between 10 and 13 degrees centigrade, and the weight of the saline residue obtained by evaporation is only 1.077 grains per gallon, or 0.237 grains per litre, composed of silica; 0,133 grains of carbonate of lime, with traces of magnesia; 0.062 grains of sulphate of lime, and 0.031 grains of sulphates and alkaline chlorides, with no trace of organic matter. The water should therefore be called a most excellent quality. The execution of the works necessary to bring the water to Grenoble was given in charge of Mr. Thiervoz, Chief of the Service of Highways and Waters. The contracts were awarded at the close of the year 1883, and were completed in 1885.

The most notable parts of the work are those which relate to gathering the water from the springs and its collection in the cistern and to the passage of the Drac by a syphon. The collection from each spring is made by means of a small tank placed at its source, as shown by Fig. 1. The foundation of each tank is made of blocks of concrete laid with open joints from which a secondary concrete conduit of a diameter of 12, 16 or 20 inches, according to the size of the springs, brings the water gathered by the tank into a principal aqueduct, passing however first through a storage tank. The abutments, the vault and floor of the aqueduct are all concrete. At the extremity of the ground the collecting conduit ends in a cistern (Figs. 2 and 3) connected by the aqueduct, as shown in Fig. 4, with a syphon under the bed of the Drac. The syphon which has been adopted for the passage of the stream is composed of two vertical shafts about 105 feet deep and an elliptical horizontal gallery 260 feet long. In this syphon are placed cast-iron pipes which replace the concrete conduits at a little distance from the shafts. Between the pipes is left a sufficient space for the passage of a man, and they are supported on brackets 6½ feet apart. The shaft and the gallery have been sunken in the rock which form the bed of the Drac. The inner wall or casing received a covering 15 inches thick, at maximum, of quick setting cement concrete mortar. At the end of the syphon the cast-iron conduits are replaced by two twin concrete conduits which bring the water down the river to Pont du Calir, beyond which cast-iron pipes are again used. Concrete conduits were computed to be safe and economical at Grenoble for pressures up to 49 feet head, above which cast-iron was preferable. The complete cost of the collecting pipes for bringing and distributing in the city amounted to nearly 2,000,000 francs. To this may be added the cost of the erection of the upright columns and branches along the lines, which the city has taken the burden of, to the end of rapidly developing the number of grants and contracts. The cost per litre per minute, constantly flowing, is only 80 francs, so that the city can establish a greatly reduced tariff and fixes the tax at only 0.055 francs per cubic meter. The following table shows that this price is less than in many important cities which are provided with the water distribution:

	Cost, francs, per cubic meter.	Daily supply per capita.	
		Litres.	Gallons.
Paris	0.3	200	44
Rouen, Reimes	0.3	....	...
Havre	0.3	45	89
Orleans	0.27	90	198
Clermont	0.25	50	110
Toulouse	0.20	80	176
Lyons, Reims	0.18	....	....
Bordeaux	0.15	...	....
Dijon	0.14	500	880
Geneva	0.10	70	123
Bienne, Berne	0.07	...	.. .
Grenoble	0.55	1000	1,760
Rome		900	1,584
London	....	100	176

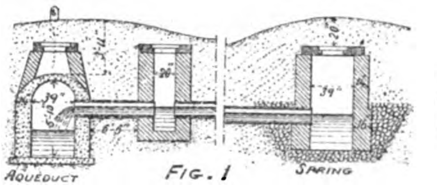

FIG. 1

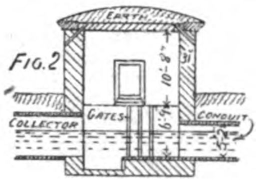

FIG. 2

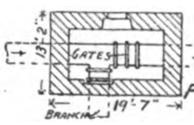

FIG. 3

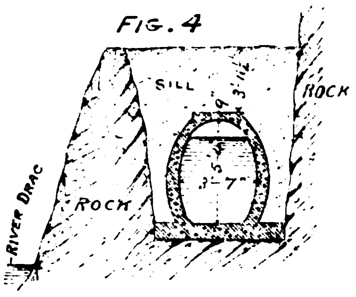

FIG. 4

"THE ENGINEERING AND BUILDING RECORD"

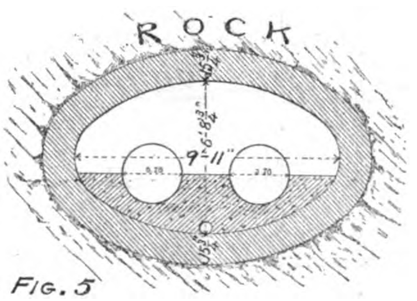

FIG. 5

GRENOBLE WATER SUPPLY

THE MANUFACTURE OF TILES AND SLABS FROM FIBROUS SUBSTANCES.

A NEW mode of treating hemp, jute, and other fibres for making materials for the manufacture of tiles, slabs, cisterns, boats, and other articles or structures, has been described in a recent English patent specification by B. A. Weatherdon, noticed in the London *Engineer*. The fibres are cut and boiled four to six hours in a strong solution of lime by steam at a pressure of from 20 to 40 pounds to the square inch. After being thoroughly washed, the material is passed to a pulping machine, where it is treated with alum about 7 to 14 pounds to the hundred weight, and in some cases with animal size, and in others with vegetable or other oils. From the pulping machine it is run into receiving or storing tanks, fitted with machinery for keeping the pulp in agitation, and whilst therein it can be dyed if required. Now the pulp fibre is pumped into vats, and from thence into wire molds, to be formed into slabs, blocks, etc., the liquor being extracted by suitable pressure. The slabs, blocks, etc., are brought into the drying-room, and when dry passed through solid steel rollers four to twelve times, steeped in a warm solution of alum, and again subjected to hydraulic pressure. Then they are brought into a bath of vegetable or other oil for four to six hours, and again pressed and steam rolled as many times as necessary. To finish the process they are dried in hot air, and in some cases passed through the rollers once more.

THE city authorities of Oxford, England, announce that they will make grants out of rates in accordance with the terms of the new Technical Instruction Acts for instruction in wood carving, drawing a scale for practical work and manual training in the use of tools for working in wood or iron. Report also comes from Rochdale of similar decisions in connection with cotton spinning and weaving, cloth weaving and plumbers' work.

CHICAGO is to have what, it is claimed, will be the largest building in the world in the new department store to be erected at State, Adams and Dearborn Streets. The building will have a front of 190 feet on State Street, 350 on Adams and 190 on Dearborn, will be 16 stories high, and will cost $3,000,000.

PROPOSED SEWERAGE OF WEST TORONTO JUNCTION.

THE town of West Toronto Junction, as its name implies, adjoins Toronto, the capital of Ontario, on its western side, covering about 1,200 acres on an irregular plateau, averaging some 150 feet above Lake Ontario, which is about 6,000 distant from the southern boundary of the town and toward which the plateau slopes at an average rate of one foot in a hundred. Two ravines extending up from the lake enter the town on its south side. On the north side the ground slopes toward Black Creek, which runs west to the Humber River, whose valley bounds the western side of the plateau, and which, flowing in a southerly direction empties into Lake Ontario. About half a mile east of the mouth of the Humber is the pumping station which supplies the town by direct pressure through a 12-inch force main, and has a submerged intake pipe extending out 700 feet into the lake.

Three different schemes of sewerage for the town are proposed in a recent report made by Willis Chipman, Civil and Sanitary Engineer, of Toronto. In each of them it is assumed that a population of 30,000 is eventually to be provided for; that 50,000 feet of sewers will be required to serve the present population, and that the storm water is provided for where necessary by separate sewers.

In the first, or scheme A as it is called, it is proposed to discharge by gravity all the sewage of the northern and eastern part of the town into the Dundas Street sewer of the city of Toronto, which extends to the limits of West Toronto junction and is of sufficient size and grade to serve for 50,000 people. The sewage from the ravines on the south and the high ground between them is to be collected at one point and treated chemically or pumped up to the Dundas Street sewer, and the same could be done with sewage from the high ground between the western ravine and the valley of the Humber. In the extreme eastern part of the town the "combined system" could be used, and for the northern part what Mr. Chipman calls the "restricted system," admitting rainwater only from roofs, cistern overflows, and in some cases from paved courts; but in the southern portion, where the sewage must be treated or pumped, the "separate system" will be required. The estimated first cost of this scheme is as follows, 10,000 feet of combined sewers, $30,000; 7,000 feet of storm sewers, $30,000; 40,000 feet of separate sewers, $60,000; 9,000 feet of mains to pumping stations, $20,000; 9,000 feet of inverted syphons across ravines, $20,000; 3 pumping stations, $30,000; total, $190,000; and the annual expenses as follows: Interest at 4½ per cent. on $190,000, $8,550; sinking fund to repay cost in 40 years at 4 per cent., $2,000; operating expenses at pumping stations, $1,250 to $3,450; total, $11,800 to $14,000, besides an unknown amount to be paid to Toronto for use of sewers.

In scheme B all the sewage is to be conveyed by the "separate system" to two or three points on the southern boundary of the town where, after being chemically treated in precipitation works, the effluent is to be conveyed, part to the lake and part to the Humber, or given a free discharge at the works. The estimated first cost is: 12,000 feet of storm sewers, $45,000; 50,000 feet of separate sewers, $75,000; 18,000 feet of mains, $35,000; precipitation works, $35,000; total, $190,000. Annual expenses, interest and sinking fund, $10,550; operating precipitation works for population of 5,000 to 15,000, $2,450 to $8,450; total, $13,000 to $19,000.

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* Abstract from the Paris *Nouvelles Annales de la Construction.*

In scheme C it is proposed to remove the water-works intake and pumping station to a point nearly three miles southwest of its present location, where there is no likelihood of contamination by sewage, and then to sewer the town on the "restricted system," allowing most of the storm water to flow off by the natural water courses, while the sewage is conveyed to the lake by two main sewers down the two ravines and by another main to the Humber River. The outlets are to be submerged, and, perhaps, the present water-works intake could be used for one of them. The estimated first cost is, for 12,000 feet of storm sewers, $45,000; 50,000 feet of separate sewers, $75,000; 22,000 feet of mains to lake, $45,000; 10,000 feet of main to Humber, $20,000; total, $185,000. To this must be added the cost of removing the water-works as follows: New 18-inch main, $53,000; buildings and grounds, $10,000; intake, crib, etc., $4,000; contingencies, $3,000; total, $70,000, making a grand total of $255,000. The annual expenses are thus estimated: Interest, $11,475; sinking fund, $2,675; total, $14,150. No operating expenses, though it is possible that at some future time it may be necessary to purify the sewage before discharging it into the lake if Toronto introduces sewage disposal works.

Scheme C is recommended as probably the cheapest, in view of the fact that the water-works would have to be removed before long any way on account of the increasing impurity of the water at their present location; also the mains leading to the lake could be used to sewer the intermediate territory which, since the date of the report, it has been decided shall be included in the town limits; third, the trouble and expense of precipitation and pumping works would be avoided; fourth, the improved quality of the water supply will increase the number of takers and consequent revenue, and fifth, a revenue should be received for fire protection from the town of Munico through which the new force main would pass, and also from water takers there.

The report is accompanied by a map of the town and proposed sewer system.

BRICK AND TILE MAKING IN THE THIRTEENTH CENTURY.

T. HUDSON TURNER, writing in the London *Architect*, says: "There is no mention of bricks in any ancient building account which has hitherto fallen under the writer's notice. The art of working clay, one of the earliest arts, never fell wholly into abeyance in any country in which it had been once practiced. In England it survived the period of Roman dominion, during which it was extensively cultivated; in the Domesday Survey potters appear among other crafts incidentally enumerated; and people who could work at all in clay were likely to have made bricks. The silence of early records on this subject is the more remarkable because there are still existing buildings of the thirteenth century constructed in whole or part of these materials; it may be accounted for by supposing that bricks continued to be made in the Roman fashion, and passed by the name of tiles; if so, tiles and tilers are mentioned as early as the twelfth century, and constantly occur in documents of succeeding periods. In 1289 Edward I. began to enlarge the moat round the Tower; the clay thrown up was sold by the constable to certain tilers who worked in East Smithfield. In that year it produced only 20 shillings; but the alterations in the fosse were 12 years in progress, during which time the soil excavated and sold for the same purpose yielded an average yearly profit to the Exchequer of rather more than seven pounds—a very large sum if the relative value of money be considered, and equal, at least, to a hundred pounds a year of the present currency. From this fact we may infer that the London manufacture of tiles was considerable at the close of the thirteenth century. The art of brick making must, however, have been carried early in this century to a great state of perfection, if the specimens of molded brick discovered in Essex, and attributed to the fourteenth century, were really the produce of native skill. But as it is in Essex and Suffolk, counties devoid of stone, that we find the earliest brick buildings, it is by no means improbable that the materials were imported from Flanders, or manufactured on the spot by Flemish workmen, many of whom, it is well known, settled in the eastern counties at a remote time. It is certain that in the fourteenth century tiles were imported from Flanders; during the progress of the works at St. George's Chapel in the time of Edward I. numerous entries appear in the accounts of the purchase of Flemish tiles; 3,000 were bought on one occasion to line the chimneys in the chambers of the canons. Among the varieties of tile mentioned are channel-tiles, paving-tiles and rug-tiles It is rarely that old accounts supply any information respecting the cost or manufacture of those tiles which were employed in the construction of decorative pavements. Perhaps the earliest notice extant occurs in the building accounts of Thornton Abbey, in Lincolnshire, under the year 1313; it is for the purchase of earth to color the tiles of the church."

CAST *VS.* WROUGHT IRON FOR GAS MAINS.*

WROUGHT-IRON mains have some advantages not possessed by cast iron; owing to its greater strength, it will resist heavier internal pressures; less liable to fracture by sudden jars or by the disturbance of its foundation; can be joined together with less expense and greater speed; has fewer joints and can be laid in some situations where it would be almost impossible to lay cast iron; but it has two disadvantages considered serious ones—the first cost of the pipe, and the limited life, as claimed by the friends of cast pipe, when compared with cast iron in many kinds of earth.

In making comparisons as to the cost between wrought-iron screw-jointed pipe and cast-iron pipe, I have figured as to the price by carloads delivered in Ohio. One mile of 6 inch wrought-iron pipe would be $3,485. One mile of 6 inch cast iron pipe would cost $1,930; a difference in favor of the cast-iron pipe of $1,555 per mile. One mile of 8-inch wrought-iron pipe would cost $5,710. One mile of 8-inch cast-iron pipe would cost $2,700; a difference in favor of the cast-iron pipe of $3,010 per mile. The labor for digging and refilling trench would be at least 25 per cent. in favor of the wrought-iron pipe. The labor, lead, and yarn necessary to lay and join 8-inch and 6-inch cast-iron pipe would be about $400 for the one and $300 for the other per mile, while the labor and paint-cement to join a mile of 8 inch and 6-inch wrought-iron screw pipe would be about $150 and $120 respectively—making a difference of $250 for the 8-inch and $108 for the 6-inch, per mile, in favor of the wrought iron pipe.

The labor figures and cost of pipe, on the wrought-iron pipes, are based on the supposition that screw joints and standard weight pipe are used. If the patent leaded joints with the light weight wrought-iron pipe is used, the difference in the labor and lead account will be very much increased in favor of the wrought-iron pipe over that of the cast iron—there being a saving in lead alone of 2,800 pounds for the 8 inch, and 2,100 pounds for the 6-inch pipe, per mile; and as the pipe is so much less in weight and a less number of joints to be made, it can be handled and laid with less labor and with greater rapidity.

Mains have been made of cast iron ever since the general introduction of gas for illumination, and when examined or removed are found to be, as far as the texture of the iron is concerned, in as perfect condition as if just placed in the ground. There are, of course, exceptional cases, but not many, where the ground has become impregnated with some foreign matter, which will and does act on and destroy the cast iron in a comparatively short time.

As a means of comparison in the life of wrought and cast-iron (when neither are covered with a protective coating, and are equally exposed to a very severe test), I will cite an actual experience which happened on one of the short streets in our city: On this street was a 2-inch cast-iron main, with a number of service connections all ¾-inch, except one (1½-inch), which conveyed gas to a machine shop; going south from a certain cross street there was no difficulty whatever, but north from this point we were compelled to renew the service pipes every two or three years. Now, for the cause of this trouble: For a number of years this portion of the street had carried as surface drainage the sulphur or commonly called "copperas" water from several coal mines. The street was paved with limestone, the spaces between the stone filled with sand, but not cemented with tar or pitch. The drainage from the coal mines percolated through the sand and saturated the ground, which was composed of a mixture of clay and gravel, in which the 2-inch cast-iron main was laid. In 18 years the texture or composition of the pipe was so changed or destroyed that the pipe, on being removed, was so soft that it could be shaved with a common penknife as easily as the plumbago in our lead pencils; there was not strength enough in a 7-foot length to carry its own weight when placed upon supports at the ends. You will notice the life of cast-iron pipe as compared with wrought in this instance, after making due allowance for the difference in the thickness of the metal, is as three and a-half is to one.

In this connection I will quote a few lines received from Mr. Cantine, of the Alliance Gas Light Company, Alliance, O. He writes as follows:

"We had a 4-inch cast-iron pipe leading from our main line through the Pennsylvania Railroad Company's yard to supply their ticket office and eating house; and, after having been laid some six or eight years, we found it leaking badly. This pipe was extra heavy and of sufficient weight to be known as water pipe. The ground in which it was laid was mixed with cinders from locomotive ash-pits. The action of the impurities in the cinders had rendered the pipe utterly worthless, it having no more strength than unburned clay. The process of decomposition is or would be much more rapid in wrought iron or steel than with cast metal. The contact of one cinder no larger than a walnut will eventually eat its way through any pipe."

I have called attention to these instances in the first two to compare the life of the two kinds of pipe under the same circumstances, and in the first and third to show that even cast iron may be readily destroyed when subjected to certain conditions.

Will not the question be asked, Why is it that one kind of pipe will last so much longer in the same kind of earth than will the other kind of pipe? A gentleman to whom I put this question suggested: Is it not that cast iron and wrought iron are different in their construction, different in their chemical formation? In cast iron, the particles of iron of which it is composed retain their crystalline or natural shape, and contains a proportion of carbon; these crystals are in nature hard, bright, and in a measure polished, and are more or less coated with graphite, depending greatly on the quality of the iron—all tending to preserve the metal from oxidation. In the manufacture of wrought iron a portion of the carbon is eliminated, rendering the metal softer; the crystal or natural form is broken up; the crystals are elongated or drawn out, presenting a stringy or fibrous appearance through the length of the metal. The graphite coating or protection of the crystals is removed, rendering the pipe more open to the action of the destructive agents.

Again: The question is asked, Why will the same kind of pipe last longer in one formation of earth than in another? Have you not noticed when your pipe, particularly cast iron, was buried in sand for a number of years, that a thin, hard coating impenetrable to almost anything had formed on the outside of the pipe? This coating forms to a certain thickness; there the decomposition stops. Nature in this case has provided a nearly perfect and perpetual protector. Is not this combination of sand and iron, which is almost like glass in its hard appearance, silicate of iron? And have you not further noticed that where this formation does exist there is no escape of gas unless it be at the joints?—the coating forming a gas-tight covering?

On the other hand when your pipe of either kind have been buried in white clay, the tendency has been to deteriorate, in many cases, quite rapidly. Can we not account for this in this wise? In nearly all cases white clay veins or banks, are overlaid with coal in some form; sulphur, in solution from the coal, saturates the clay, comes in contact with and surrounds the pipe; the sulphur having a strong affinity for iron, combines with it; sulphuret or sulphide of iron is formed and the pipe is destroyed, more or less rapidly, in proportion to the amount of sulphur. This same action takes place where the pipe is exposed to coal cinders, similar to the case referred to in the quotation from Mr. Cantine's letter, there the free sulphur in the cinder combining with the iron.

Again: If your pipe is laid in ground so situated as to absorb, or in any way to contain matter likely to ferment, near by, or in contact with the pipe, there is great danger; for, during the process of fermentation, carbonic acid is evolved. This acid is particularly destructive, and very persistent in its combination with iron; once it takes hold it never releases its grip until it has accomplished its purpose.

When the question is asked, "Which is the best material for street mains—cast iron or wrought iron?" we would likely answer at once, cast iron. Why? Because we have been accustomed to purchase the same for a great deal less money; it is cheaper, and it will last longer; and then we say again we have to renew our wrought iron services, and we do not the cast-iron mains. Have we not overlooked the fact that the wrought iron services are less than one half the thickness of the cast-iron mains; that where we have had occasion to make renewals, the wrought iron had been more exposed than the cast-iron. The services mostly gave out at gutter crossings, where the pipe was not of sufficient depth, and was exposed to air, and dampness, and frost. Is it not true that many of us have wrought iron services in use to-day, and in good condition, that were connected to our cast-iron street mains when gas was first introduced to our towns, 40, and in some cases 60, years ago? We know what to expect as to the lasting qualities of cast-iron pipe. We know that with cast-iron mains the leakage of gas will average as much as 10 per cent. This we gather from the reports received from a majority of the gas companies.

The wrought iron costs from 50 to 100 per cent. more than does the cast pipe. (This difference is greatly reduced in proportion as you get farther away from the points of manufacture). The wrought pipe, however, does not cost near so much to lay, and the saving in leakage will in a very short time balance the extra expense for the wrought-iron pipe. The most important question appears to be, Will the wrought pipe last? On the other hand, why not have our cast-iron pipe, which we think will last, properly coated with some material that will close the pores and protect the iron beyond a doubt; also, have the spigot end of the pipe turned or ground smooth so that a permanent and tight joint could be made.

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* From a paper by Eugene Printy read before the Western Gas Association at St. Louis, entitled "The Best Material For Street Gas Mains."

IN connection with the Newark-Passaic sewage controversy, recently referred to at length in our columns, it is of interest to note that Professor Austin, of Rutgers College, who is making an analysis of the Passaic River water, a few days ago made an interesting experiment. He placed several corks and some deleterious matter in the river at the point where Passaic City sewers empty. In three hours and fifteen minutes the matter floated down the river to the Newark pumping station. Inasmuch as it requires six hours for the tide to run out the experiment would seem to indicate that Passaic's sewage floats miles beyond the pumping stations of Newark and Jersey City. Samples of the water were gathered and they will be used as evidence in the court.

EXPLOSIVES.

THE extraordinary importance which just now attaches to explosive substances, says *Industries*, London, gives special interest to the Fourteenth Annual Report of Her Majesty's Inspectors of Explosives recently issued. The report deals chiefly with blasting compounds, so that we have more information afforded us on that class which is described as flameless than on the other, characterized as smokeless, designed for ballistic purposes. The latter are of more recent origin, and for the most part have not yet passed out of the experimental stage.

The inspectors report that in the year 1889 seventeen applications for license to manufacture or import new explosives were received, and four applications were made for permission to add a new ingredient to an explosive already licensed. Eleven out of these 17 applications were granted. This is a large addition to the list in one year. It is instructive to read the description of these new explosives, as we learn in what direction the efforts of inventors have so far been successful. First on the new list is the Chilworth Special Powder, a gunpowder containing ammonium nitrate to reduce the smoke. Then follows Camphorated Gelatine, which explains itself; Ballistile is a smokeless powder invented by Mr. Nobel, and is essentially a blasting gelatine with a very high proportion of nitro-cotton. Stonite is a new variety of stone carbonite, containing less nitro-glycerine and more woodmeal to diminish the tendency to exudation. Ionite, or Cotton Powder No. 3, is a gun-cotton compound. Smokeless Powder is also a gun-cotton preparation for use in rifles. Flameless Securite is a mixture of nitrate of potassium, or ammonium, with metadinitro-benzole. There are also Ammonite, a new name for the miners' safety explosive, picric acid, and electric fuses and detonators. The number of factories for the manufacture of explosives increased by ten last year, bringing the total up to 122. The number of applications for new factory licenses received during the year was 15. The inspectors remark that the year was one of unusual activity. They report further, that, notwithstanding these new additions and extensions, the number of accidents shows no tendency to increase. On the contrary, so efficient are the rules and regulations imposed, and so careful are the manufacturers to comply with them, that accidents grow fewer year by year. The arrangements now adopted in every factory contrast very favorably with those existing previous to the Act of 1875.

Among the matters of special interest to the users of blasting explosives, are two which will at once arrest attention in reading the inspectors' report. The first is the statement that dynamite—that is, the ordinary kieselguhr dynamite—is being constantly and steadily driven out of use by blasting gelatine. In a few years it will have ceased to exist. The other is a matter of the highest importance, as it affects the safety of the miners. With a view to ascertain the relative sensitiveness of blasting gelatine in the frozen and the unfrozen state, the War Office Committee of Chemists on Explosives carried out an exhaustive series of experiments. The results showed that in the frozen state gelatine is very sensitive to blows. A 58 pound weight dropped from a height of 1 foot was sufficient to explode the substance, which in the unfrozen state required a fall of 12 feet to cause explosion. This is a matter of great practical importance, and it points to the origin of many accidents in ramming a charge of blasting gelatine. The difference was much less with gelatine dynamite ; unfrozen explosion occurred with a drop of from 7 feet to 8 feet, and frozen with a drop of from 6 feet to 7 feet. These figures, show, moreover, that blasting gelatine in the unfrozen state is much less sensitive to blows and friction than gelatine dynamite in the same state. It is only when frozen that the former appears to a disadvantage. The section of the inspectors' report which treats of these experiments is worthy of careful consideration by all who have the handling of explosives.

PEDESTAL DESIGNS FOR THE ROBERT E. LEE STATUE.

REFERRING to the competition for pedestal designs for the Robert E. Lee statue, noted in our last issue, Mr. D. Adler, chairman of the committee having the matter in charge, writes that the competition may be participated in by any draughtsman under 30 years of age, and who is not a practicing architect. Enough funds are at the disposal of the committee to enable them to award several bronze medals, in addition to the gold and silver medals already provided for.

Correspondence.

Communications giving information or opinions on matters of general interest to the engineer, the architect, the contractor, or the municipal officer, will be welcomed in this column. Fairness will suggest that when communications are sent simultaneously to this and other journals we should be informed of it at the time. Anonymous letters will not be noticed.

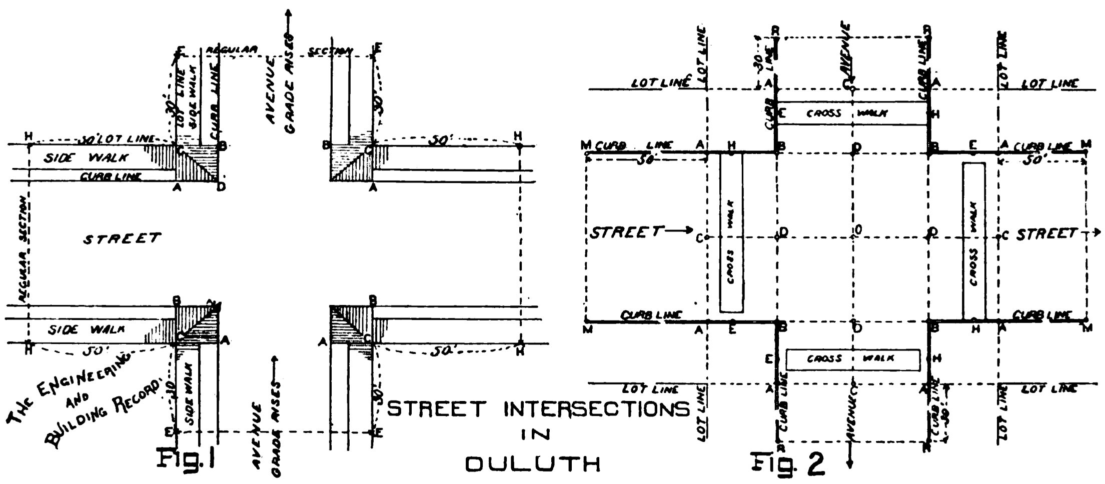
STREET INTERSECTIONS IN DULUTH.

OFFICE OF CITY ENGINEER,
DULUTH, MINN., August 13, 1890.

To the Editor of THE ENGINEERING AND BUILDING RECORD:

SIR: Noticing your recent articles on grades at street intersections I inclose a blue print of our standard form for sidewalk and roadway intersection grades. These blue prints are furnished the overseer for the formation of each intersection after the curbs are set, the blank spaces being filled in with the appropriate figures for that particular intersection. My practice in establishing the grades for intersecting curbs is as follows : When grades exceed 8 per cent. the center grade of the street across intersecting streets is broken at a point opposite the block lines, and from this point to a point opposite the curb lines it is made 8 per cent. where it is again broken so as to be 3 per cent. across the roadway intersection. When less than 8 per cent., and more than 3 per cent., no break is made opposite the block lines, it being made only at a point opposite the curb lines. When 3 per cent. or less the grade is carried unbroken across the entire intersection. The above rule applies also to the intersecting street on the same intersection. The four curb intersections B B B B (Fig. 2), are in one and the same plane, established by the center grades of the intersecting streets. The street sections at M M and R R are made with opposite curbs level, and the curb grades R B and M B are laid to a straight line except when modified by a maximum grade of 8 per cent. at A B.

WILLIAM B. FULLER,
City Engineer.



STREET INTERSECTIONS IN DULUTH

Fig. 1   Fig. 2

[The blue prints referred to by our correspondent are reproduced in Figs. 1 and 2. On these blue prints are the following notes :

NOTES ON FIG. 1.

1. When the difference of elevation between A and B on the line A C B is more than ¼ inch to 1 foot, the top of the sidewalk at C must be at a point whose elevation shall be a proportional one between those of A and B on the line A C B.

2. When the difference of elevation between A and B on the line A C B is less than ¼ inch to 1 foot, the top of the sidewalk at C must be at a point whose elevation will give a rising slope from A to C of ¼ inch to one foot.

3. Break the grade at H and E from the regular section of the street and avenue and build the sidewalk on a straight (not curved) grade to C.

4. Sub-grade for all points on sidewalk is 8 inches lower than top of sidewalk.

NOTES ON FIG 2.

True Grade Notes.

1. Finished surfaces at C, D and O shall all touch a straight line drawn between the tops of the nearest curbs.

2. Finished surface of roadway at A C A and B D B shall crown on the arc of a circle from C and D to a point .... inches below top of curb at A, and .... inches below top of curb at B, respectively.

3. Finished surface of crosswalks H E shall be on a straight line from curb to curb, and .... feet in width; then to slope gradually on each side to a line .... feet distant, where it shall conform to the sections A C A and B D B, respectively.

4. From the regular section of the street at M M curbs and roadway shall be built to a straight grade to section at A C A.

5. From the regular section of the avenue at R R, curbs and roadway shall be built to a straight grade to section at A C A.

Sub-Grade Notes.

1. Sub-grade at C shall be .... inches below finished surface at C.

2. Sub-grade at O shall be .... inches below finished grade at O.

3. Sub-grade section at A C A and B D B shall slope from C and D to a point .... inches below top of curb at A, and .... inches below top of curb at B, respectively.

4. For the width and length of the crosswalks the subgrade shall be .... inches below true grade of same, then to slope gradually on each side to a line .... feet distant, where it shall conform to the sections of sub-grade at A C A and B D B, respectively.

5. Abutments shall be put in at ends of crosswalks E and H, where necessary to allow water to pass, or as directed by the engineer, so as to allow .... inches in clear width for gutter, whose surface shall be .... inches below top of curb.]

THE Commissioners for the London Exhibition of 1851 have come to the conclusion that in order to utilize the balance of money in hand it would be advisable to institute a series of £150 a year scholarships for science students, tenable for two years, with a possible extension of one year at the pleasure of the Commissioners.

THIRTY-TWO years ago the first signals were sent through the Atlantic cable from shore to shore,

INFLUENCE OF SEA WATER ON PORTLAND CEMENT.

CONCERNING the influence of sea water on Portland cement, M. E. Candlot, according to the London *Engineer*, says: "The nature and quantity of the water used are of influence on the setting of cement. Sea water, by forming calcium chloride and sulphate by double decomposition of the magnesium salts it contains with the lime compounds present in the cement, retards the setting. Neat cement gauged with sea water is at first stronger than when fresh water is used, but retrogrades after some months. Cement, when made up into mortar by admixture with sand, shows no such tendency; the use of sea water may delay its reaching its full strength, but this is attained after the lapse of a year. This fact applies particularly to finely ground samples."

THE FRANKFORT ELECTRICAL EXHIBITION.

THE General Electrical Company of Berlin and the Oerlikon Engineering Work intend applying as motive power for their exhibits at the Frankfort Electrical Exhibition, next year, a water power of 300 electrical horsepower, transmitted from Laufen, on the Neckar, to Frankfort, a distance of about 109 miles, through a copper wire 5 millimeters in diameter. The object is to prove, experimentally, the practical possibility of supplying a large area, or even a whole province, with power and light from a single central station.

ARRANGEMENTS have been made in India, by the Forest Department of the Mysore State, for maintaining fuel plantations on a large scale for railroad supply.

Questions and Answers.

All questions relating to building construction, paving, sewerage, water supply, or kindred subjects, will be welcomed in this column provided they relate to matters of general interest and are not such as should properly be referred to a consulting engineer. Answers will be carefully prepared and a proof of both question and answer mailed to the inquirer as early as proper consideration will permit. They will be published for the benefit of other readers as soon as convenient. The full name and address should be given, not necessarily for publication, but as a guarantee of good faith, and to facilitate further correspondence in case the question is not sufficiently explicit.

Inquiries of the Editor, in order to secure prompt attention, should *not be written on the same piece of paper as a communication* to the *Publishing Department*. Letters renewing subscriptions are sent to a clerk in the publishing office, and matter for the Editor, if in the same enclosure, is likely to be overlooked unless it is on a separate piece of paper, so that it may be promptly sent to the Editor.

BUILDING INSPECTION.

W. D. CLARK, of Springfield, Mass., writes: "I must trespass upon your indulgence by expressing my pleasure in reading the discussions upon the subject of building construction and building inspection, and hope the discussions will continue. Brooklyn truthfully wrote that 'the subject of building inspection is a very serious one.'

"I am glad to know that within the past six or eight years there has been marked advancement in skill and scientific ability among architects of our country. Still there is room for improvement, and such letters as those written by Civil Engineer and Brooklyn will arouse public sentiment that will bring about a very much needed reform in the construction of private as well as public works.

"What is needed most is that public sentiment be enlisted in sustaining honest, reliable engineers, architects and superintendents, in the discharge of their duties. Dishonest contractors will not submit to having an honest, competent superintendent about their works, and will resort to every strategy possible to embarrass, annoy and drive them from their job, and I reiterate my hope that in the near future, integrity, skill and faithfulness will be recognized more than it has been within the past thirty years."

PURIFICATION OF WATER.

ALFRED SPEER, Passaic, N. J., writes: "Will you be kind enough to tell me of any work treating upon the cleansing of water used by factories, so that it may re-enter the stream clear?"

[The subject has been treated at some length in the columns of THE ENGINEERING AND BUILDING RECORD, and has also been investigated by the Massachusetts State Board of Health. Nichols on "Purity of Water Supplies" will be found to give some valuable information on the subject.]

HOW MANY LEAKS ARE ALLOWED IN AMERICAN WATER MAINS.

WILLIAM PERRY, JR, hydraulic engineer, Montreal, Can., writes: "Your valuable journal of August 23 is at hand. I am pleased to see the matter of leaks in water pipes receive the attention of such competent engineers and superintendents as Edwin Darling, of the Pawtucket W. W., R. I.; W. L. Cameron, of Memphis, Tenn.; G. H. Benzenberg, City Engineer of Milwaukee, Wis., and L. H. Gardner, of the New Orleans, La., Water-Works. Mr. Gardner says: 'I doubt if your correspondent is serious in his question.' I inclose you the complete letter, and if you would kindly insert the part referred to, you would be in a position to vouch for its genuineness."

[The letter referred to by Mr. Perry is in the shape of a clipping from the Montreal *Gazette*, to which it was sent as a reply to an earlier letter by Emile Vanier, Chief Engineer Lachine Water-Works, the latter being the works under consideration. The portion of the letter to which particular attention is directed, reads as follows:

"Now, as far as the joints are concerned, I will state that there were, on an average, four leaks per mile, all in the contractor's work. However, this is not at all excessive, for American water-works contractors always figure on seven per mile; this, I think, tends to prove that 'Lachine' absolutely knows nothing at all about the joints when he states that they were a 'disgraceful piece of work.'"]

AN electric street railroad, about one mile long, was recently inaugurated at Bremen, Germany. The line is the first to be carried out in Europe on the Thomson-Houston system.

Notes and Queries

on Domestic Engineering.

Communications relating to the practical details of plumbing, heating, lighting and ventilation will be welcomed in this column. The writer's true name and address must always be given, but an assumed name may be used for publication if preferred.

THE RELATION OF HOT-WATER BOILER HEATING AND RADIATOR SURFACE.

J. L. BROOKS, of Dayton, O., writes: "I cannot find in Baldwin's book on 'Hot-Water Heating and Fitting,' any data for the amount of heating surface required in a boiler. In some instances the author gives 1 to 49, in another 1 to 7, etc. Will you please give me what you consider about the proper and correct amount for ordinary conditions. Please state whether you consider the locomotive style of boiler a good one for hot-water heating if prepared as Baldwin recommends the horizontal boiler to be."

[There can be no fixed rule for determining the proportion of boiler to radiator surface for a hot-water apparatus. What you can determine is the amount of grate surface necessary to do a certain duty. Then you can proportion your boiler to your grate. Let us assume that we have 1,000 square feet of hot-water radiators, and that the average duty per square foot in warming air is 220 heat units per hour, and that the total duty will be 220,000 heat units. This is the equivalent of 210 pounds of water evaporated to steam, and for this you must burn from 21 to 28 pounds of coal per hour.

In a heating boiler from 4 to 6 pounds of coal per hour per square foot of grate is reasonable; therefore you must have a grate of from 5 to 6 square feet for your boiler when you have a fair draught, and a larger one with poor draught. If you use a small tube locomotive boiler you require between 25 and 30 square feet surface for each square foot grate, and with large tubes from 20 to 25 of boiler to one of grate, so that your boiler surface for 1,000 square feet of radiation will be about from 100 to 150 for locomotive boiler and the same for horizontal tubular. With some very plain boilers, cylindrical or upright, nearly all fire box, from 1 to 10, and even less, is often ample, and with pipe boilers you may require as much as 1 to 40.

Your experiences and discretion must serve you between those points. Ordinarily 1 of boiler to 10 of radiator will do with horizontal tubular locomotive boilers.]

PLUMBING IN A KANSAS CITY RESIDENCE.

THOMAS HENDERSON, Dallas, Tex., writes: "In your issue of August 23, page 187, 'T. H. S.' gives a sketch of a Kansas City job of plumbing, and asks for opinions as to its merits. I beg to offer the following:

"*First.*—In the first place, a system that requires an artificial means to promote circulation of air in vent pipe is defective.

"*Second.*—The steam coil to work in this case ought to be above tee.

"*Third.*—The local vent from grease trap will fill up at bottom by condensation.

"*Fourth.*—All local vents ought to enter flue above fixtures.

"*Fifth.*—The soil pipe C ought to be extended through the roof separately.

"*Sixth.*—The waste from basin on third floor ought to be connected to waste between bath-tub trap and soil pipe.

"*Seventh.*—The horizontal vents ought to have a fall towards the fixtures.

"*Eighth.*—The whole system of soil and vent pipes is very badly arranged."

J. W. HUGHES, Montreal, Can., writes: "The illustration of plumbing in a Kansas city residence, sent you by 'T. H. S.,' and published in your issue of August 23, is interesting as being different from prevailing practice, but in looking it over the 'why' test comes to mind. I would like information from your correspondent on the following points: Why is a steam coil necessary? Why is it a good thing in a dwelling? Do they have steam all the year round, or only in winter? If only in winter, what heats the ventilating stack in summer, the only time when steam or artificial heat would be required in such a stack? Why are the back air vents run from the upper floors down to the basement? What advantage is gained from so doing to offset the additional cost, also the additional friction entailed in such long runs, and increased number of ells? Why are the back air vents run up several feet before they turn down, and not started down at once on leaving the trap? Why is soil pipe C M D run across, under floors to soil-pipe B, instead of being carried direct through roof, which, if the drawing is correct, would have been the cheapest, easiest, most direct and best working plan? Why are the back air vents V carried back and forth and apparently mixed up and made as complicated as possible? Why would it not have been better to run a separate line of back air vents down alongside each stack of soil-pipe, branching the adjacent fixtures into it, if it was really necessary to run it down at all? Why, if the fresh-air inlet is necessary, is the pipe C run from it and connected to E? Will this pipe C not seriously affect the efficiency of the fresh air inlet? Why would it not have been better in every way to have omitted the vent stack A, run the lines of soil pipe, suitably enlarged, direct through roof, and connected the back air vents into it above the highest fixtures?

"The plan as shown doubtless possesses merit in the eyes of the man who designed it, and he has, doubtless, good and sufficient reasons for adopting it, and my desire in writing is to have the benefits, if my worthy confrère will explain the advantages of his system."

J. TUCKER, of Boston, writes: "Assuming that the drawing which is shown on page 187, in your issue of August 23, correctly shows the way the vent and soil pipes run in the Kansas City residence, and noticing the comments of your correspondent, T. H. S., I would like to ask him what the object was in deviating from the standard practice of carrying the vent pipes directly up, either through the roof, or into the main soil pipe stack above the highest fixture. As shown, it seems to me that a needless expense has been incurred in running the vent pipes down, and the bends in those pipes will restrict the movement of air. In the summer months it is not likely that there will be steam in the coil on the pipe A. This is certainly inferior to the regular method of carrying vent pipes as has been so often advocated in your columns."

BOOK NOTICES.

POOR'S HAND BOOK OF INVESTMENT SECURITIES. A supplement to "Poor's Manual of Railroads." H. V. and H. W. Poor, publishers Price, paper cover, $1 50; cloth, $2.50.

In the editions for 1886, 1887, and 1888 of "Poor's Railroad Manual" were given tables showing the range of stock and bond values at the leading exchanges in the country for a series of years. In the 1889 edition of the manual this information was omitted, in consequence of the great increase in the size of the volume. It has, however, now been issued separately, forming a valuable reference book for bankers, brokers, investors, and all others who may be interested in railroad and other investment securities. It contains a table showing the range of values at the leading stock exchanges of the country during the 12½ years from January 1, 1878, to June 30, 1890; a statement of all dividends paid by the railroad companies of the United States during the past eight year; a list of bond coupons, payable each month in the year, with the places where they are payable; a statement of the stocks and bonds listed on the New York Stock Exchange during the past 11½ years, January 1, 1879, to June 30, 1890; a statement showing for the leading railroad companies (*a*) close of fiscal year; (*b*) time of holding annual meeting; (*c*) closing and opening of books; (*d*) place of holding annual meeting, etc., etc.; a statement showing, by cities, the location of all railroad general and transfer offices.

MANUAL OF AMERICAN WATRR-WORKS, 1889-90. Published by the *Engineering News* Publishing Company, New York.

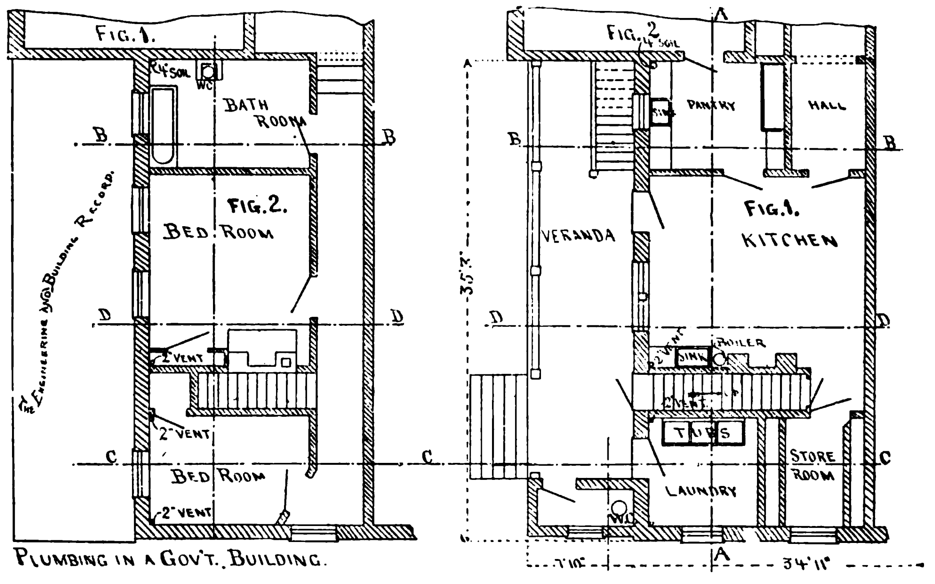
The general character of the "Manual of American Water-Works" has become so well known that it is not necessary to enter into it in detail. Briefly stated, it gives the history, list of officers, particulars of construction, source and manner of water supply, pumping machinery, etc., of the different water-works in the United States and Canada, and thus forms, as can readily be understood, a most valuable reference volume for all interested in the subject. As might have been expected, the work has grown since its previous edition, the descriptions of works and the data generally having been added to considerably. In several cases illustrations are given of dams and reservoirs, constituting features of special interest. The concluding pages of this volume are given up to family and meter water rates in various cities.

DOMESTIC PLUMBING HEATING LIGHTING & VENTILATION ENGINEERING

CRITICISM ON PROPOSED PLUMBING IN A GOVERNMENT BUILDING INVITED.

Figures 1 to 7, inclusive, show the plumbing in a Government building, and are prepared from drawings sent by Assistant Quartermaster Captain J. W. Jacobs, U. S. A., with a request for technical criticism of the system.

Figures 1 and 2 are first and second floor plans, respectively. Figures 3, 4, 5, 6 and 7 are sections at A A, C C, D D, E E, and B B, respectively.



PLUMBING IN A GOV'T. BUILDING.

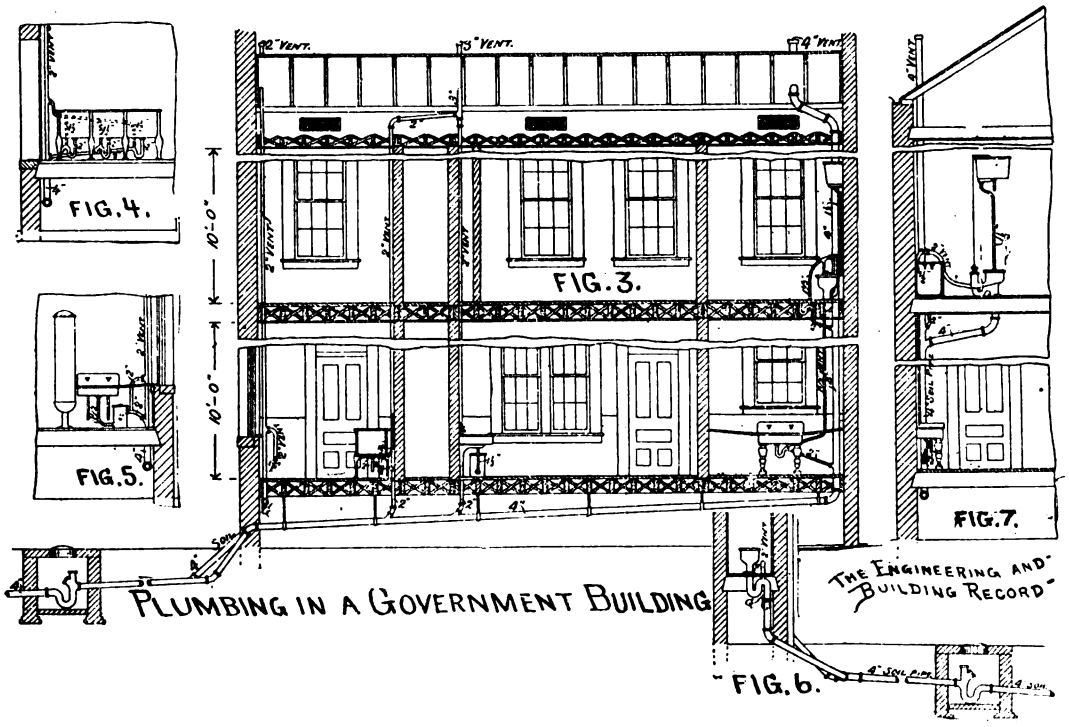


FIG. 4.

FIG. 5.

FIG. 3.

FIG. 7.

FIG. 6.

PLUMBING IN A GOVERNMENT BUILDING

THE ENGINEERING AND BUILDING RECORD

Figures 7′, 8 and 9 show the modifications herein suggested. The plans indicate a dwelling house, but nothing is stated as to its surroundings; presumably it is a detached building at some military post. With the evidence before us, the following criticisms suggest themselves.

An unnecessary amount of piping seems to be provided for. The offset, at roof, of the main soil-pipe is not desirable; if it is made to avoid windows in neighboring building it is not far enough away, if neighboring windows overlook it the pipe should be carried up the neighboring wall above the main roof. If no windows overlook the pipe, it will shorten the main line in the cellar to carry the main soil pipe up along the opposite partition, as shown in Fig. 7′. This allows a clean-out in the cellar, at the end of the main drain, which can be readily worked with clearing rods or wire.

Instead of hanging the main drain from the cellar rafters build 8x8 inch brick piers under each vertical column, and spike the pipe to the side wall with pipe hooks at frequent intervals.

If practicable place the main house trap inside the house and extend the fresh air inlet well away from the house and turn it up 18 inches above ground with ¼ lead and brass grating.

The present arrangement is good if the line to the trap is not too long and foul, in which case it will be vented through the house. If retained, as shown in Fig. 3, the vault cover should be freely ventilated, and protected from snow, and the cover should be shifted so that dirt may not fall through the grating into the open end of the fresh air inlet pipe. The choice of arrangement would depend on local conditions.

Do away with the 2-inch back vent riser from the kitchen sink, and carry the sink back vent across under the stairs and connect with the back vent to the laundry sink. In the same way do away with the 2-inch vent riser from the hopper closet and connect with laundry to column, as shown in Fig. 7′ and 8. This reduces the amount of piping and is equally efficient.

The hopper water closet on first floor has no flush tank shown. It should be provided with one placed on the laundry wall to protect it from frost, as shown in Figs. 7′ and 8.

Instead of the plunger closet on second floor bath room use a washout, short hopper or syphon closet.

Increase all vertical columns one inch in diameter at the roof, and protect open ends with wire globe cages.

Use only tested, extra heavy pipe with deeply-leaded joints, and after all work is finished except setting up of fixtures, test the complete system of drain and vent pipes with water or air pressure from beyond the house trap to the level of the open ends of the pipe above the roof. Have this done *after* lead traps and lead closet connections are in. After the fixtures are set and the work completed test with peppermint or smoke machine.

Use only brass ferrule screw-cover cleanouts.

Use only heavy lead pipe, and in short lengths. Carry the iron pipe-work as close to the fixtures as possible.

Fig. 7′ is a section through the house, as modified; Fig. 8 is a section at Y Y, and Fig. 9 is a section at X X, Fig. 7′. Fig. 10 shows a more desirable alternative arrangement for the laundry and kitchen, the main vent pipe A being here carried across on to the laundry wall.

Any further comments by our readers we shall be glad to publish.

HEATING AND VENTILATING SCHOOL-HOUSES.

(Continued from page 204.)

Prof. S. H. Woodbridge's paper was devoted to the application of furnaces to the heating of small school-houses.

The thing which is desirable to accomplish in the heating of a school-house is to secure an effective circulation of a large volume of air at a comparatively low temperature. The two important requirements in a furnace for heating a school-house are, first, that the furnace shall have a large heating surface, and, second, that such surface, heated to only a comparatively low temperature, shall evenly warm large volumes of air moving over it. It is necessary to have a special type of furnace in order to do this work. The ordinary furnaces are quite inadequate to such work.

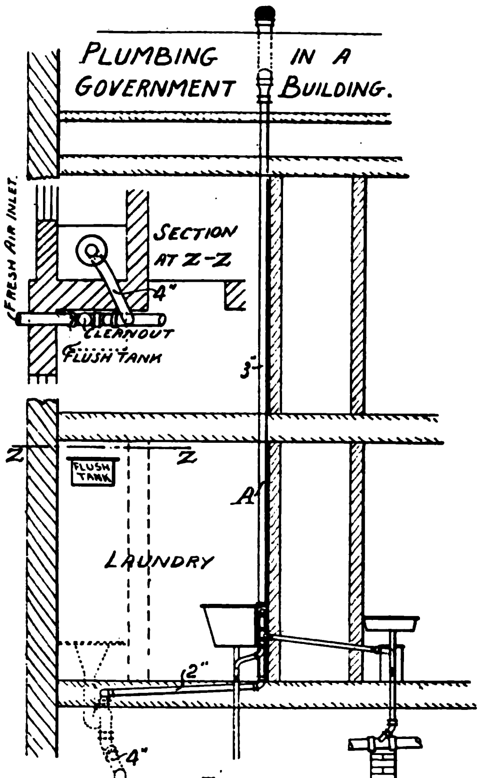
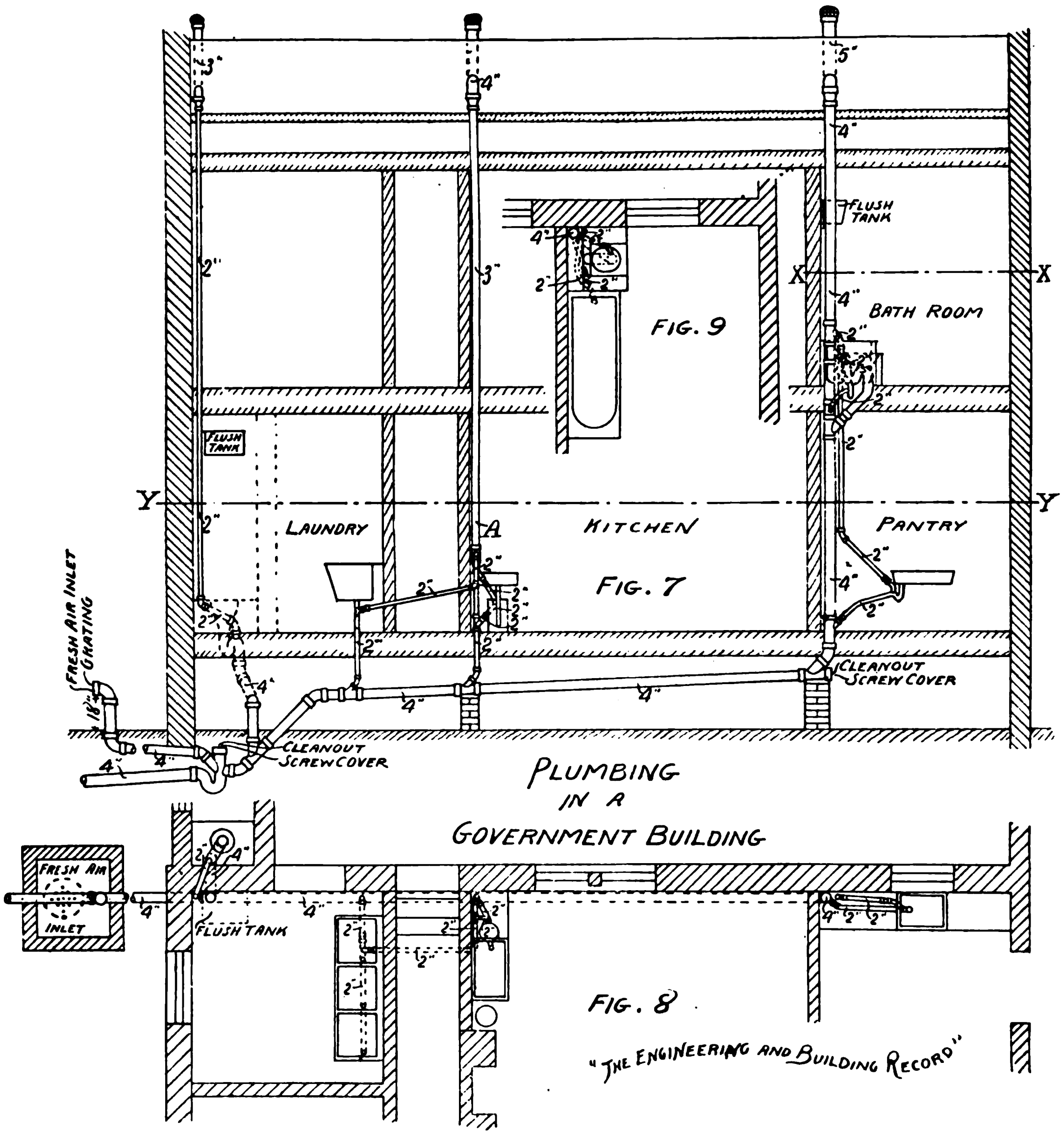


FIG. 10

We have as a usual thing, for instance, a cylindrical furnace standing within a case through which the air passes, ultimately finding vent through conductors to different parts of the building. We have here a comparatively small space, according to the distance between the furnace shell and the outside casing; we have a considerable vertical extension of furnace, that is, the air passing in at the bottom becomes more or less heated by contact with the lower part of the furnace, and in passing upward over that surface it grows hotter and hotter as it ascends to the top, until, when it reaches this point, it has a temperature of from 200 to 250, or even as high as 300 degrees. In this case the general extension of the furnace surface is vertical, the air being heated as, in relatively small quantities, it moves upward continuously against that surface. Furthermore, the heating surface, as compared with the grate area in a furnace well proportioned for ventilating work, is large. In the ordinary furnaces this is not found to be the case. The heating surface may be itself 20 times the area of the grate, but Professor Woodbridge thinks it is exceptional when we get as high as 30 or 40 times the area of the grate. What is wanted, then, in order to perform the work of heating and ventilating is a large heating surface in comparison with the area of the grate.

In the case of steam heating, radiators may have from 150 to 300 times the area of the fire grate, but in the ordinary furnace 40 times the area of the grate in heating surface is exceptionally high. What is wanted is a furnace with a large surface and relatively great horizontal extension instead of a small surface with vertical extension. If we could take, for instance, that cylindrical furnace, 3 feet in diameter and 6 feet high, and turn it over on its side, we should have a large area about the furnace through which the air could move, as compared with that of the annular ring in an ordinary furnace of vertical extension. Taking the other section of it for a horizontal extension of the same furnace, we should have a space for air movement of the same width as before, but of a length equal to the horizontal perimeter.

A large horizontal extension, rather than a vertical extension, is required for two reasons. In the first place, in order to get a greater area through which the air may move, and, in the second place, in order that the air may not be heated to too high a degree, as is the case with the furnace of vertical extension. When the air has reached the top of this furnace with longitudinal extension its temperature may be 150 degrees as against that of 300 degrees in a furnace of vertical extension.



PLUMBING IN A GOVERNMENT BUILDING

There are other things to be desired in the working and construction of a good furnace. The combustion should be good. The fire pot should not be too deep. The fire should be fairly shallow; there should be an intimacy of contact between the hot combustion gases on the inside and the air on the outside. The shell is the medium that transfers the heat of the combustion gases to the air on the outside; the air on the outside has to be heated, and the gases on the inside have to give up their heat.

Among the furnaces that best fulfill these several conditions, Professor Woodbridge places first, the Smead, because of the wider familiarity with it. In this furnace there is intimacy of contact between the combustion gases on the inside and the air on the outside, and a pretty complete transfer of heat is effected. The fires are shallow—the provision for complete combustion is good, and the area of the heating surface is large as compared with that of the grate. There are also the Fuller & Warren furnace and the Mahony furnace, worthy of mention as furnaces of the better type for ventilation work. But they are all connected with some system of ventilation, and the call comes for some furnace which is independent of any such system.

Professor Woodbridge then called attention to a furnace which is as old, in point of invention and manufacture, as any of those just mentioned. It is known as the "Gold Hygeian Heater." The general form is similar to that of a locomotive boiler. The body of the furnace (see Fig. 5) is in box form with arch top, and contains a fairly shallow fire-box and large combustion chamber. The cylindrical part of this furnace may be extended almost indefinitely by means of rings attached to the body of the furnace, and to each other by bolts. We have in this furnace a horizontal, rather than a vertical extension of surface. Beyond this, we have upon the body of the furnace itself and upon the extension rings, rigidly attached to them as one piece with them, cast-iron flanges, and attached to these flanges are spurs or pins, which greatly extend the surface of the heater. The heating surface is, therefore, so large in proportion to that of the grate that it cannot have a very high temperature.

The fire pot is lined with brick, so that that part of the furnace cannot be highly heated, or it cannot be heated to anything like a red heat.

The external surface is about eight times the internal, and the area of the exterior surface is about 100 times the area of the grate. This ratio may be made much larger by extending the cylindrical part of the furnace. The rings making up this part are very carefully put together, sleeving closely one into the other; and they are drawn and held together tightly by short bolts, so that it is practically a very tight furnace, and it is not especially liable to breakage by warping. There is one objection, and that is in the unequal heating of the shell and the flanges, tending to breakage, but that danger has been avoided by making the flanges of corrugated form rather than of more rigid plane form.

For completeness of combustion, which is always desirable, the furnace has a large combustion chamber, and the gases in rising from the coal have a chance to mingle and to complete the combustion before coming into contact with the cool surfaces of the furnace. There is, furthermore, a very finely perforated plate in front admitting air, which, on striking upon and passing over the fire, becomes heated, so that it is quite common to see, in the rear and upper part of the furnace, the blue flame characteristic of the burning of carbonic oxide gas.

Professor Woodbridge would not rely upon such a furnace as this to heat a larger space nor a greater air volume than would be required by 100 scholars, though it would provide liberally for what would be required by that number. As to the matter of applying this furnace to the heating of small school houses, Professor Woodbridge submitted several sketches. The general plan of the furnace and the proposed methods of encasing it are shown in Figs. 6 and 7. In regard to the furnace itself, it will be noticed that the smoke vent is so placed as to take the cooler gases from the combustion chamber. The furnace is placed in a case, seen to better advantage in Fig. 7. The cold air passes into the heating chamber through a large aperture 4 feet by 18 inches, at the lower part of the rear wall of the casing, passing up by the pin-covered flanges and becoming mildly heated as it reaches the upper part of the chamber.

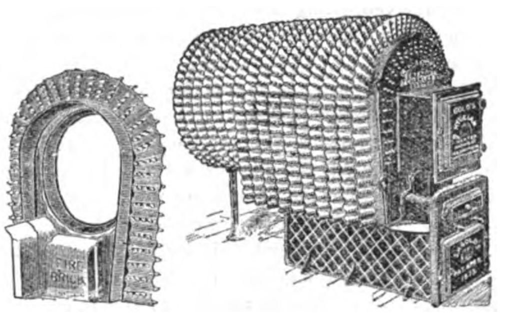


Fig. 5

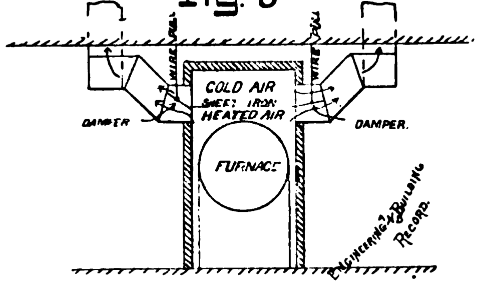


Fig 6

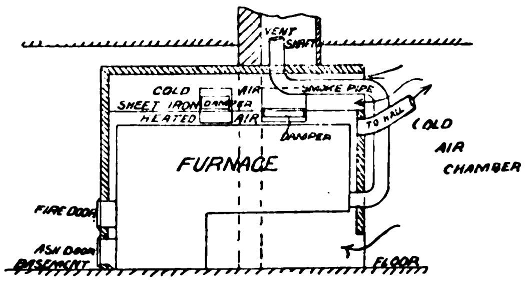


Fig. 7.

HEATING AND VENTILATING SCHOOL HOUSES

If several rooms are to be heated from one hot-air source, provision must be made for giving different or required temperature to the air distributed from that source. Sometimes it is required to heat one room to a certain temperature and another room to a different temperature. If only one room is to be heated, the fire may be regulated so as to produce the temperature required; if several rooms are to be heated, the fire must be regulated so as to produce the temperature required in the room most difficult to heat. The furnace temperature must be governed by the requirement of the room demanding the highest temperature of air supply, and some ready and effective means must be employed for reducing that temperature, but not the volume of air supply to other rooms.

In the lower part of the furnace is, as usual, the cold-air box terminal, but in this plan we have another cold-air chamber on the top of the furnace as well. Such an arrangement has the advantage that the top or any part of a furnace in close proximity to wood work is kept cool. This method affords an effective means of keeping the upper part of the furnace perfectly cool, so that when the furnace has been heated to its hottest the top will feel cool to the touch, for, the colder the weather and the hotter the fire, the cooler will this top be. But, further than that, it provides for cold air to be mixed with the heated air for distribution to the different rooms. The heated air and the cold air are separated by a diaphragm, and their passage into the supply conduits allowed or checked by the movement of a valve, which controls the quantities of each which may pass and mix beyond it. In the left-hand conduit the valve is shown in a position to allow the heated air to pass freely and to hold the cold in check. The right-hand valve shows a more equal movement, resulting in lower temperature of supply.

Flues of such size should be provided that the full quantity of air shall be supplied with the smallest difference of temperature between the air inside of the supply flue and the outside air, under which the system is to furnish required ventilation. The flues must be of such capacity as to supply and remove the required air volume when the outside temperature is just too cool to open windows. If we attempt to use such flues in cold weather without throttling them, the quantity of air moved through the furnace will be altogether too great to be heated, and greatly in excess of requirement. The most air is needed in the warmest weather, and the least air in the coldest weather. There should, then, be provided some means by which the ventilating flues can be reduced according to the increased difference between the inside and outside temperatures.

In Fig. 6 is shown the means for such regulation of flue area in the supply system. The sum of the hot and the cold-air apertures from the furnace to the conduits to which they belong is equal to the area of the conduits. The hot-air apertures are in area one-third, and the cold air are two-thirds that of the connected conduits. If the weather is cold not much cold air is needed, and by simply drawing up a damper by means of a wire and chain, the effective area is reduced to one-third of the total area available and required in mild weather, and shown in the right-hand conduit.

(TO BE CONTINUED.)

REMOVAL OF MINE GAS BY EXHAUSTION.*

EXPERIMENTS on the removal of mine gas by exhaustion were carried out a number of years at the King's Mine at Grenenberg, near Aachen, Germany.

The removal of the gas was effected by a disused compressor which, by an alteration of the valves, was made to do duty as an exhauster. From the compressor a main pipe of 3¾ inches diameter was carried down the pit and for a distance of about 1,300 yards, when secondary pipes of 2 inches were placed for about 300 yards in the main levels. Finally smaller pipes, of 1-inch bore and terminated by plate suction-roses, were extended into the front of the headings, and kept to the top of the level by clamps attached to the timbering. The roses were at first made of tin-plate perforated with fine holes on both sides, but these were found to admit too much air on the under side, especially in a weak gas current, so that ultimately the under side was closed and the perforations on the top surface were correspondingly enlarged. In places where the dip of the seam was comparatively low, the roses were made of a long rectangular form and covered with wire gauze like that used in safety lamps. Vacuum gauges were inserted at different points in the tubes to measure the effective rate of exhaustion. For a short time a Körting steam-jet exhauster was tried, but it did not prove equal to the work. The flow of the exhausted gases was regulated by a double-bell gasholder, so arranged that while one bell was being filled the other was delivering. This, however, did not work satisfactorily and was abandoned, the gases being forced directly by the pump into the delivery pipe. Several small gasometers were used for collecting gas for experimental purposes and testing, the latter being done every twelve hours.

The experiments as a whole proved a decided failure, on account of the fluctuation in the composition of the gas, which sometimes contained as much as 10 per cent. of firedamp and sometimes none, the variations taking place without any apparent cause.

The continued attention required in extending and varying the position and area of the suction passages was also very considerable, and such as to cause considerable hindrance in the levels when the driving was actively carried on.

The gas was applied to the firing of two boilers, a row of jets being introduced below the firebars from a tube which was connected with the main by a safely U tube sealed with water, and at all the joints of the pipes wire gauze diaphragms similar to those used in safety-lamps were inserted.

The boilers were experimented on for some time, but neither a more active evaporation nor any saving in fuel was obtained. The gas was also tried with the magnesia comb burner of Fahnjehelm, but only the lower third of the bars could be brought to the proper degree of incandescence. The third suggested application of the gas—namely, for driving gas-engines, was not tried.

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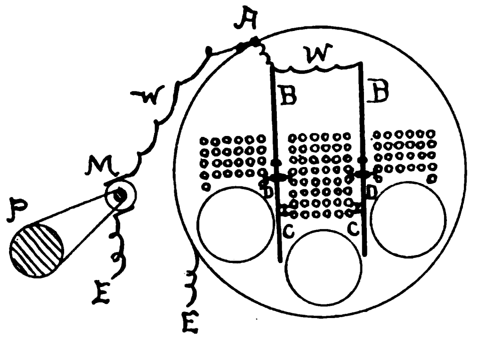
* *Zeitschrift für des Berg-Hütten und Salinewoesen*, abstracted in the Excerpt Minutes of the Proceedings of the British Institution of Civil Engineers.

A DYNAMO FOR THE PREVENTION OF BOILER INCRUSTATION AND CORROSION.

IN discussing a paper on "Water-Tube Steam Boilers," recently read before the British Institution of Civil Engineers, E. R. Dolby referred to the use of primary batteries to pass electric currents through boilers to get rid of incrustation, and described an arrangement supposed to have some advantages over that. The disadvantages in the use of galvanic batteries were stated to be that it was difficult with them to keep up a continuous electric current for any length of time; that the zinc rapidly wore out, and that, especially in hot climates, the solution required continual attention.

The system described by Mr. Dolby, is shown diagrammatically in the annexed illustration, which represents a marine boiler fitted up. The apparatus itself is shown by heavy lines. The propeller shaft is marked P. A small dynamo M is driven by this shaft through a belt. Two brushes are shown. From the upper brush is led a wire W to a point A in the outside shell, through which it is carried, being insulated from the shell itself. The wire then enters the boiler and is fastened to two rods B B above the water line. These rods are fastened below at about the center of the height of the tubes to two plates C C, which are held in position by cramp and bolts D D. The cramps are fixed to the tubes and are screwed up so as to wedge the plates in position, but they are insulated from the plates themselves. The small dynomo is an alternating machine, and the current, supposing the upper brush to be at first positive, will pass by the wire outside, enter the boiler, and from the two electrodes C C will pass through the water to the shell, from the shell by the short wire to earth, and back again to the other brush. When the next alternation comes, the current will pass by earth to the shell, and from the shell through the water to the plates. The effect of the alternation was believed to be that as the current passed through the water it would electralize a small part; the hydrogen, acting as a metal, would follow the course of the current, and would be deposited on the shell and flue tubes. With the change of current, oxygen would be produced on the same surfaces. The two would combine and form a thin film of chemically pure water which would prevent deposit upon the surfaces. The throbbing caused by the current alternations would also loosen any side already adhering. The apparatus is covered by several English patents. The insulator through the shell is woodite, and there are two washers of asbestos drawn together by nuts. The insulators inside might be of porcelain. The system is applicable also to land boilers.



DYNAMO for PREVENTING BOILER SCALE

AN INCLINED TURN-TABLE DRAWBRIDGE.

THE Adams Street drawbridge over the Chicago River is 257 feet long, with a central turn-table, and has three trusses, 21 feet to centers, giving a double roadway. The street grades on either side compelled a difference of level between the approaches of over two feet, and in order to accommodate this difference and, at the same time, have the bridge reversible so that it could follow a passing vessel around and thus avoid loss of time in swinging back, City Engineer William R. Northway tipped the bridge, turn-table and all, up on an inclination of 1 in 120, thus accomplishing the desired result in a simple and satisfactory manner.

THE National Library in Paris is the largest in the world. It contains 2,500,000 volumes.

TUNNELING ON THE COLORADO MIDLAND RAILROAD.

ACCORDING to the Louisville, Ky., *Courier Journal*, a piece of railroad tunneling of more than common interest is about to be undertaken by the Colorado Midland Railway Company. After leaving Leadville, which is at an elevation of 10,025 feet, the road runs around the mountains at a distance of 12 miles, reaching Busk at a height of 10,000 feet. From this point the road zigzags up the face of the mountains for a distance of five miles to reach a point 500 feet above Busk. On this part of the trip long lines of snowsheds are erected to protect the track, and in these drifted snow lies the year round. The old tunnel here pierces the continental divide at an elevation of 11,528 feet, which is within 30 feet of the height of the Alpine pass, on the Union Pacific road, the highest in Colorado. This tunnel is about 3,000 feet long. It is proposed to begin the new tunnel at Busk. Its length will be 9,350 feet, and the highest point reached will be the 10.948.7 feet. The maximum grade on the old line is 3 per cent., and the new is only 1.4 per cent. The length of new line required is 3.25 miles, and this replaces 10.18 miles of old line, effecting a saving of 6 93 miles. The section of the tunnel is 15 feet wide and 21½ feet high. Work was to have been commenced on August 1, and it is expected that 20 months will be needed to finish the contract.

HYDRAULIC RAMS.

ACCORDING to a paper on "Hydraulic Rams," read some months ago by Jay M. Whitham before the Arkansas Society of Engineers, Architects and Surveyors. Eytelwein seems to have been the first to investigate the mathematical theory of the ram. His experiments led him to the following formula in which

Q — cubic feet of water descending in one second through the drive pipe

q — cubic feet of water discharged in one second through the delivery pipe ;

H — fall in feet of Q;

h — rise of feet in q.

The rise, h, is the measure of the friction and static head against which q must be delivered. Then—

Diameter of the drive pipe in feet — $\sqrt{1.63\,Q}$;

Length of the drive pipe in feet — $H + h + \frac{{}^{2}h}{H}$;

Volume of air chamber — volume of the drive pipe.

The efficiency of the ram, that is, the ratio of the work done to the work expended, is *when h does not exceed 20 H,*

$$\frac{q\,h}{H\,(Q-q)} — 1.12 - 0.2\sqrt{\frac{h}{H}}.$$

and when h does not exceed 12 H, the efficiency is

$$\frac{10\,H}{10\,H+h}$$

The sizes of simple rams are given in the following table (when the discharge pipe is more than 1,200 feet long, use next larger size pipe):

Quantity of water furnished per minute by the spring or brook to which the ram is adapted.	Length of Drive Pipe.	Caliber of Pipes.	
		Drive.	Discharge.
½ gallon to 2 gallons per minute...	25 to 40 ft.	¾ in.	⅜ in.
1 gallon to 4 gallons per minute...	25 to 40 ft.	1 in	⅜ in.
2 gallons to 8 gallons per minute. .	25 to 40 ft.	1½ in	½ in.
3 gallons to 14 gallons per minute...	25 to 40 ft.	2 in.	1 in.
4 gallons to 25 gallons per minute...	30 to 40 ft.	2½ in	1¼ in.
8 gallons to 60 gallons per minute...	30 to 40 ft.	4 in.	2 in.
12 gallons to 120 gallons per minute...	30 to 50 ft.	6 in.	2½ in.
80 gallons to 250 gallons per minute...	30 to 50 ft.	9 in.	3½ in.

In order to operate these rams successfully the following rules must be observed—viz.:

The drive pipe must be from 25 to 50 feet long, so as to have the necessary uniformity in the flow of water through it. Where space is not available for such a length, a coil may be inserted in the drive-pipe aggregating the entire length. If a coil is used its radius should not be less than 2½ feet.

The fall of water, H, should be 18 inches or more. The capacity of the ram increases with the fall.

Water may be carried through a discharge pipe half a mile long, or raised through an elevation of 200 or more feet. A fall of 10 feet will raise water through 150 feet, yet as the elevation increases the quantity discharged decreases, other factors being constant. If the discharge and elevation are all that are required there is no advantage gained in having the fall, or the quantity flowing through the drive pipe greater than is necessary, for then the strain on the ram is not uselessly increased.

A safe rule in estimating for a ram where the discharge pipe is from 800 to 1,000 feet long is that Q = from 10 to 14 q, and H = 10 H; or, what is the same, Q = from 5 to 7 q when h = 5 H.

CONTRACTING NEWS DEPARTMENT.

A WEEKLY RECORD

OF SPECIAL INTEREST TO CONTRACTORS, BUILDERS AND MANUFACTURERS OF ENGINEERING AND BUILDING SUPPLIES.

CONTRACTING INTELLIGENCE

Our readers will oblige us by notes, clippings, or any information which will put us in the way of obtaining early and reliable news for our "Contracting Intelligence." *Information of importance sent to us exclusively, and not elsewhere published will be liberally paid for.*

For works for which proposals are requested see also the "Proposal Columns,' pages i-ii-223.

WATER.

For Additional Water Items see Proposal Columns.

RITZVILLE, WASH.—There is a movement among the local officials to investigate the water-works question, and just now it seems likely that a plant will be established in the near future.

CHAMBERSBURG, PA.—The report of Engineer John Birkinbine in favor of taking an additional supply of water from Gish's Dam has been adopted. The cost of the work is estimated at $26,000.

MARQUETTE, MICH.—The officials of this city have decided to expend the sum of $25,000 in improving the water-works system.

GAFFNEY CITY, S. D.—It is probable that the proposed water-works at this place will be established at once. Important information can be obtained by addressing the Town Clerk

MENASHA, WIS.—Reports say that a system of water-works is proposed for this place.

WATER VALLEY, MISS.—The city will hold an election September 29, on a proposition to issue $10,000 of bonds for the construction of water-works.

LOS ANGELES, CAL.—The West Riverside Land and Water Co., of this place, has filed articles of incorporation. The directors are: G. A. Fredricker, Shirley C. Ward and others. The capital stock is $100,000.

COLUMBIA, S. C.—The sum of $30,000 is to be expended in building gates at the canal and doing other work on the water-works plant. Address Mayor F. W. McMaster for particulars.

IRON MOUNTAIN, MICH.—A company with $75,000 capital has been organized, to be known as the Iron Mountain Water-Works Company, for the purpose of constructing and operating a system of water-works at this place. The company holds a franchise for 30 years from Iron Mountain, and will receive $9,000 annually for 156 hydrants, with $50 for each extra hydrant required. W. R. Coats will superintend the work as engineer.

HOPKINSVILLE, KY.—It is reported that a system of water-works is to be established at this place.

OCONOMOWOC, WIS.—There is a movement to establish a water works plant at this place at once. J. H. Thompson is interested.

TRENTON, TENN.—The people of this place have voted the sum of $20,000 for the purpose of establishing a complete system of water-works.

DANBURY, N. C.—It is reported that this place is to have water-works.

ST. PAUL, MINN.—The Minnesota Subway Conduit Company has been incorporated at this place. The capital stock is $10,000, and the project is to operate conduits and lay pipes conveying water from Lake Superior across Minnesota Point and Bay of Superior to the State line between Minnesota and Wisconsin.

HEMPSTEAD, TEX.—The people of this place have requested the officials to consider the water-works question. For particulars address C. C. Anisler, as above.

SOUTH PITTSBURG, TENN.—A water-works system is to be established at this place by the South Pittsburg City Water Company. The capital stock is $50,000, and Mr. Hyde is the Secretary.

PORTLAND, ME.—Improvements are to be made to the local water-works plant.

KEITHSBURG, ILL.—It is likely that operations will commence at once on the water-works system projected for this place.

CRESTON, IOWA.—The water-works at this place will be completed by a newly organized company, with a capital stock of $30,000.

BROOKVILLE, IND.—The taxpayers of this place are united for water-works, and the officials will consider the question at an early day.

MILBURN, N. J.—It is probable that a contract will be made with the Commonwealth Water Company, of Summit, N. J., for a water supply for this place. Several miles of pipe will be wanted in the event of the closing of the contract.

PUEBLO, COL.—The Pueblo Water Company has been incorporated by H. J. Fitch and others. The objects include the laying of pipes in Bessemer and Pueblo. Capital stock, $300,000.

PERU, ILL.—The committee to which was referred the proposition of the Peru Electric Light Company to put in water-works has recommended that a franchise be granted.

BLOOMINGTON, IND.—This place has voted for water-works. Information can be had by addressing Jessie Starr, as above.

BROOKFIELD, MO.—A committee which has been investigating the matter has reported in favor of establishing a system of water-works.

PALO, MICH.—Rumors say that a system of water-works is to be established at this place.

FRANKLIN, IND.—This place is to have a system of water-works established by the Franklin Water, Light and Power Company. The proposed expenditure is $100,000.

SPOKANE FALLS, WASH.—Oskar Huber, City Engineer, writes: "In regard to the contemplated reconstruction of water-works I can inform you that I am preparing plans for a system. I will furnish you a copy as soon as they are completed."

GAINESVILLE, GA.—The following bids for the construction of a complete system of water-works were received by E. P. Chambers, Water Commissioner's Clerk, August 26: J. R. Davis, Atlanta, Ga., $31,500; Faulkner, Killour & Moore, $34,430; J. G. Longstreet, Gainesville, Ga., $38,440; A. D. Candler, Washington, D. C., $39,000. The Water Commission rejected all bids. It will build itself, and is now ready for other bids.

GUTHRIE, OKLA.—Village Clerk George M. De Groff writes: "No change is anticipated at the water-works at present. Can give you more information in relation thereto some time in the near future, perhaps 30 or 60 days."

DELHI, N. Y.—Regarding the report that the water-works at this place were to be improved, Town Clerk R. P. McIntosh writes: "No important additions or improvements are to be made in the Delhi works this season that I am able to ascertain."

LEONARDSVILLE, N. Y.—A new reservoir and additional water mains are among the proposed improvements to the local water-works system. H. D. Babcock can furnish particulars.

HOOSICK FALLS, N. Y.—The matter of procuring a water supply has been referred to a special committee, of which Charles Q. Eldredge is chairman.

SAN JOSE, CAL.—The Glen Weber Water Company has filed articles of incorporation, with a capital stock of $2,000,000. Its purposes are to furnish water for drinking and for mechanical power to the cities of San Francisco, Oakland and San Jose.

ROCKVILLE CENTER, L. I.—The people of this place are moving towards the establishment of water-works. Daniel Van Allen, representing the Hempstead Township Water-Works, has been canvassing the village with a petition with this end in view, and has secured the signatures of nearly every real estate owner.

LENOIR, TENN.—A system of water-works is to be established at this place.

EUSTIS, FLA.—According to the plans submitted, the projected water-works for this place will cost $20,000. Steps are now being taken to proceed with the construction of a system. Address Colonel Hazzard for particulars.

ESTHERVILLE, IOWA.—There is a probability that a system of water-works will soon be established at this place.

SOUTH BEND, IND.—Reports say that improvements are soon to be made to the local water-works.

MADISON, N. J.—The following bids for furnishing materials and labor required to build a system of water-works were received by Borough Clerk F. E. Day, August 29:

BIDDERS.	Pipe.	Hydrants.	Special Castings.	Supply Well, per foot.	Pump Station.	Boilers.	Tower.	Street Valve Boxes.	Pump.	Total.
Moffitt, Hodgkins & Clark, Syracuse, N. Y*	......	$25.00	......	......	......	......	$6,950.00 5,690.00	$3.00	......	$56,925.00
Fogg & Scribner, New York	......	26.00	$1,050 00	$90.00	$6,950 00	$2,400.00	8,275.00 6,850.00	4.50	$2,475.00	57,767.80
W. F. Inman, New York†	$34,338.30	30.00	......	100.00	5,000.00	2,365.00	7,250.00 6,400.00	3.00	2,500.00	56,533.00**
Small & Berry, New York‡	32,658.20	27.50	1,200.00	72.00	4,615.00	2,500 00	7,468.00 6,060 00	4.25	2,500.00	56,792.95
F. A. Canfield, Stanhope, N. J§	35,809.82	40.00	1,028.00	120.00	5,550.00	2,500 00	7,500.00 6,000.00	4.50	23,000.00	63,084.12
Eastern Construction Company, Newark, N. J‖	33,693.30	24.75	1,122.00	275.00	5,950.00	2 900.00	9,400.00 7,400.00	4.00	25,000.00	67,163 15
John O. Merritt, Portchester, N. Y¶	31,920.02	27.49	720.86	123.33	6,334.00	1 869.00	5,665 00 4,840.00	189.86	2,209.00	55,755.58
Moore, Shaler & Co., Newburgh, N. Y††	34 428.96	25.50	700.00	250.00	5,247.00	2,568.00	7,308.00 5,841 50	150.00	2,350.00	63,126.96

* Gate Valves.—$29, $22, $14.50, $8.50; † $30, $22, $15.50, $9.55; ‡ $32, $25, $18, $13; § $38.40, $27.60, $18.80, $11; ‖ $28.60, $20.90, $14.40, $9.50; ¶ $29.58, $21.42, $14.30, $8.75; †† $29.25, $21.20, $14.50, $10. ** Tower No. 1, $900.

WILTON, IOWA.—The sum of $14,000 has been appropriated by the taxpayers of this place for the purpose of establishing a system of water-works.

LOUISVILLE, KY.—Reports say a movement is being discussed to place new pumps at the water-works station. Address the Mayor for particulars.

PALMYRA, MO.—The Palmyra Light and Water Co. has been incorporated to establish a system of water-works at this place. The capital stock is $50,000.

HAMILTON, ONT.—The question of introducing water meters is being considered by the city officials. Adlerman Dixon, of the Water-Works Committee, can furnish particulars.

ALTOONA, PA. — There is some talk of establishing an additional reservoir at this place.

SAN LUCAS, CAL.—The water-works question is being agitated at this place.

ROCHELLE, GA. — The taxpayers of this place want a water-works system.

CARLSTADT, N. J.—The people of this place are agitating the water-works question.

KINGSLAND, N. J.—Water-works will probably be established at this place soon.

ARLINGTON, N. J.—The local officials are discussing the water-works question.

LYNDHURST, N. J.—It is probable that this place will have a water supply.

RUTHERFORD, N. J.—A movement is on foot to establish a system of water-works at this place.

COHOES, N. Y. — At a meeting of the Water Commissioners held September 1, numerous water pipe extensions were authorized. For particulars, address President Thorn, of the Board, as above.

MADISON, FLA.—Reports say that a system of water-works is projected for this place and that J. A. Durst can furnish particulars.

AURORA, NEB.—The people of this place voted on August 26 to issue bonds in the sum of $7,000 for the purpose of making improvements to the water-works system.

ELMHURST, ILL.—It is proposed to establish a system of water-works at this place, at an estimated expenditure of $50,000.

NEW YORK CITY.—The Aqueduct Commission has awarded the contract for building the dam at Reservoir D, on the Croton River, near Carmel, to Michael S. Coleman, the lowest bidder, at $397,262.50.

NORFOLK, VA.—The Water Board has recommended the purchase of a 10,000,000-gallon pumping engine and proposals will soon be wanted for furnishing it. President W. A. S. Taylor can furnish particulars.

WATER-WORKS.—See our Proposal Columns for information regarding water-works and water-works furnishings at the following places: Newport, Ky.; Blue Hill, Neb.; Coldwater, Mich.; Yoakum, Tex.; Allegheny, Pa.; Austin, Tex.; Atlanta, Ga.

READERS of **THE ENGINEERING AND BUILDING RECORD** interested in the Contracting News Department of that paper are respectfully requested to examine those columns every week, and advise the Editor of any item which they may find that, in their judgment, is of no value to any one other than the person mentioned.

SEWERAGE.

For Additional Sewerage Items see Proposal Columns

PIERCE, NEB.—Geo. A. Latimer, civil engineer, of Norfolk, Neb., has completed plans and submitted his report, with estimates, for a system of sewerage and grades for this city. The plans were adopted, and work will be begun this season.

CARLSTADT, N. J.—A system of sewers is wanted here.

ARLINGTON, N. J.—The question of establishing a sewerage system is being discussed at this place.

ROCKFORD, ILL.—A project to construct a 24-inch central sewer is being discussed by the local officials. Should it be done 6,000 feet of pipe will be wanted and the sum of $15,000 will be expended.

LOWELL, MASS.—The question of borrowing the sum of $50,000 for the construction of additional sewers and drains, is now being considered by the aldermen, who will, it is said, grant the action at an early day.

Vicksburg, Miss.—Engineer Hayney has completed plans, specifications, etc., for a sewerage system for this city and steps towards its construction will soon be taken.

Davenport, Iowa.—The question of a proper system of sewerage is engaging the attention of the local officials.

Wilmington, Del.—Sewer extensions will be made here.

Des Moines, Iowa.—Sewer extensions are to be constructed at this place.

Norristown, Pa.—Additional sewers are to be established at this place. Address Councilman Adam Youngman for particulars.

Kingsland, N. J.—Sewers are to be introduced at this place.

Willimantic, Conn.—At a special borough meeting it was voted to construct numerous additional sewer mains. Address the Borough Clerk for particulars.

Lyndhurst, N. J.—It is probable that steps will soon be taken to establish a system of sewers here.

Rutherford, N. J.—The people of this place want a system of sewers.

Troy, N. Y.—At a recent meeting of the Public Improvement Commissioners, the construction of numerous additional sewers was authorized.

Sewers.—See our Proposal Columns for information regarding sewer construction at the following places: Avondale, O.; Elizabeth, N. J.; Buffalo, N. Y.; Binghamton, N. Y.; Somerville, N. J.; Cairo, Ill.; Wilmington, Del.; Para, Brazil; Key West, Fla.

BRIDGES AND IRON STRUCTURES.

For Additional Bridge Items see Proposal Columns.

Minneapolis, Minn.—The following proposals for fourteen 52-inch iron plate girders to carry the tracks of the Great Western Railroad, on Fifteenth Avenue, S. E. Estimated weight 240,000 pounds. The figures given are for f. o. b. cars at Minneapolis, per pound, and per pound erected ready for ties. Bidders: A. Y. Bayne, Minneapolis, 3.8c., 4.3c.; King Iron Bridge and Manufacturing Company, 3.98c., 4.28c.; Schiffler Bridge Works, 3.80c., 4.25c.; Wrought Iron Bridge Company, 4.16c., 4.66c.; Chicago Forge and Bolt Company, 3.395c.; 3.675c.; Chicago Bridge and Iron Works, 3.75c., 4.00c.; A. & P. Roberts & Co., Philadelphia, 3.73c., 4.43c.; Wisconsin Bridge Company, 4.125c., 4.70c.; Milwaukee Bridge and Iron Works, 3.84c., 4.24c.; Pottsville Iron and Steel Company, 3.59c.; Lassig Bridge and Iron Works, 3.425c., 3.90c.; Edge Moor Bridge Works, 3.55c., 4.15c.; F. T. Harrington, Minneapolis, 3.8c., 4.15c.; Keystone Bridge Company, 3.69c., 4.3cc. The contract was awarded to Chicago Forge and Bolt Company.

Carrollton, Ky.—Town Clerk R. J. Wilson writes: "There is an iron bridge to be built about four miles from here over McCole's Creek. Write to William Linsday, Committee."

Bryan, Tex.—Reports say that an iron bridge is to be erected over the Navasota River at this place.

Dallas, Tex.—According to numerous reports another bridge is to be erected over the Trinity River at this place.

New Haven, Conn.—City Engineer Hill states that the present bridge over Mill River on Chapel Street, New Haven, is not substantial enough for the traffic over it, and is of the opinion that a new bridge should be built as soon as practicable.

Willimantic, Conn.—At a meeting of the borough officials, held August 30, the committee on the bridge question reported that a foot-bridge could be constructed across the railroad tracks and Willimantic River, from Main to Pleasant Streets, for $11.500. The report was accepted, and it was voted to continue the committee and have it ascertain what share of the expense of either a drive or foot-bridge would devolve on the town. It was also stated a drive-bridge could be built for $25,000.

Duluth, Minn.—The question of bridging the Duluth Canal is in the hands of T. A. Thompson, Secretary of the Duluth Chamber of Commerce.

Bowmanville, Tex.—The Town Council has accepted the tender of the Trenton Bridge Company for a steel bridge of two spans, 85 feet long and 18 feet wide, for $5,320.

Brookline, Mass.—At a recent meeting of the Brookline Board of Selectmen a petition from the Boston and Albany Railroad Company was received asking for the bridging of the road at St. Mary's Street. The Board gave notice of its intention to call a town meeting on or about Thursday, September 18.

Detroit, Mich.—The Special Committee on Bridges has conferred with President Ledyard, of the Michigan Central, regarding the bridges over the tracks of that road at Lafayette Avenue, Twelfth, Fourteenth, Fifteenth, Howard and Baker Streets. It was decided that Chief Engineer Hawks, of the Michigan Central, and the City Engineer should meet and arrange a plan for building the bridges, fixing the grades, etc., and make their report to the committee.

Denison, Tex.—Reports say that this city will construct a 1,000-foot viaduct over the yards of the Missouri, Kansas and Texas Railroad and the Houston and Texas Central Railroad.

Duluth, Minn.—The Board of Public Works has awarded the King Iron Bridge and Manufacturing Company, of Cleveland, the contract for the iron work of Howard's Pocket bridge, for $27,100. There were six bids ranging from this amount to $28,600.

Richmond, Va.—The contract has been awarded to the Edge Moor Bridge Works, Edge Moor, Del., for building an iron- and steel highway viaduct 1,200 feet long and 40 feet wide and 75 feet high, connecting the properties of the Highland Park and Northside land companies with Richmond, Va. The contract price is $74,000.

Trenton, N. J.—The Board of Chosen Freeholders has resolved to build an iron bridge on the road leading from the Scotch road to Ewing. It will be an 18-foot span. Freeholders Maguire, Risdon and Ege were appointed the committee.

Olympia, Wash.—Plans have been submitted to the City Council of Olympia for the construction of an east side bridge, to cost $5,000.

Auburn, Me.—The following bids were received September 1 for an iron viaduct, 300 feet long, with 24-foot roadway and two 5-foot sidewalks: Dean & Westbrook, New York, $6,345; Groton Bridge Company, Groton, N. Y., $6,650; Pittsburg Bridge Company, Pittsburg, Pa., $7,450; Berlin Iron Bridge Company, East Berlin, Conn., $7,500. Each bidder presented his own designs. Contract awarded to Dean & Westbrook.

St. Charles, Mo.—The Senate has passed the House bill for the erection of a pontoon bridge across the Missouri River between this city and St. Louis County, Mo.

Bridgeport, Conn.—The Senators and Representatives of Fairfield County met in this city August 27, and settled the matter in regard to building a new bridge over the Housatonic River, between the towns of Huntington and Derby. They authorized the County Commissioners to go ahead, and in conjunction with the Commissioners of New Haven County build such a bridge as would accommodate and meet the demands of the public. They authorize them to borrow the sum of $35,000 to pay the part of the expense due from Fairfield County. The new bridge will probably be of iron or steel and cost about $70,000. The Building Committee, which will consist of the Boards of County Commissioners of Fairfield and New Haven counties, will shortly advertise for plans and specifications.

The Contracting News Department of **THE ENGINEERING AND BUILDING RECORD** is edited with a view of giving space to no item that does not indicate where professional services or supplies may be needed in the near future, the prices bid for work or supplies, and the correction of false or misleading reports in some papers, that may subject readers to needless trouble and expense in going after something that does not exist.

Pittsburg, Pa.—A sub-committe of Allegheny Councils will soon meet and examine the plans for the Federal Street approach to the new Sixth Street bridge. The directors of the bridge company will also hold a meeting and select the designs for the structure from a number of plans presented. It is reported that the Lindenthal design will be approved. It calls for a bridge to cost nearly $500,000. It will be built so that either cable or electric cars can be run over it at any required rate of speed. Colonel Merrill, United States Engineer, has already been consulted, and has entered into an agreement as to the height of the structure above the water level.

Boston, Mass.—The following proposals for the erection of the River Street bridge to Cambridge were opened August 25 by the Engineering Department. Bidders: Alexander McInnis, Winthrop, $12,500; William A. Norton, Boston, $14,500; B. F. Nay & W. H. Ellis, Boston, $17,700; John Cavanagh & Co., Braintree, $17,800; J. H. White & E. R. Cheney, Boston and Chelsea, $18,426; George Ellis, Boston, $19,632. Awarded to Alexander McInnis.

Hartford, Conn.—Judge Adams, chairman of the Park Commission, can furnish information of a proposed bridge at this place.

Bridges.—See our Proposal Columns for information regarding bridge construction at the following places: Northampton, Mass.; New Gretna, N. J.

NEW DEPOTS.

St. Louis, Mo.—It is stated that a meeting of the Union Depot and Terminal Company will be held in New York on or about the 20th of the present month, and at that time the location of the new station will be decided. Architects are at work on plans for the building.

STREET-WORK AND PAVING.

East Liveepool, O.—The paving of several of the city streets has been authorized. Address President Hanley, of the Common Council, for particulars.

Des Moines, Iowa. — Important street paving is to be done in this city.

Pine Bluff, Ark.—Numerous streets of this place are soon to be paved. Address the City Clerk, for details.

Kalamazoo, Mich.—It has been decided to begin the work of street paving at once. Alderman E. McCaffrey can furnish particulars.

GAS AND ELECTRIC-LIGHTING.

New Orleans, La. — Rumors say that another electric light plant will be established at this place by the Consumers' Electric Light Company.

Silverton, Col.—The Silverton Electric Light and Power Company has been granted a franchise to erect and maintain an electric light plant.

Portage, Man.—An electric light plant is to be established at this place by the Central Electric Light Company. For particulars address Robert Watson, as above.

Water Valley, Miss.—An electric light plant is talked of for this place.

Chester, S. C.—At a recent town meeting it was voted to authorize the Council to contract for a system of electric street lighting, provided it can be done at a cost not exceeding $2,000 per annum.

Marion, N. C. — A company has been organized at this place for the purpose of establishing an electric lighting plant.

Exeter, N. H.—This place is to have electric lights.

Humboldt, N. C.—Operations are to be begun at once on the projected electric light plant for this place.

Keokuk, Ia.—The J. C. Nubinger Co. has been incorporated here, with a capital stock of $1,000,000, for the purpose of furnishing electricity for light and power. J. C. Nubinger is the manager.

Willamette, Ore.—The Falls Electric Light Co., of this place, will increase the capacity of its plant by the addition of 1,500 incandescent and 100 arc lights.

Lyndhurst, N. J.—The local officials will probably establish an electric lighting plant soon.

Kingsland, N. J.—Steps towards establishing an electric lighting plant at this place are being taken.

Waynesboro, Ga. — The Waynesboro Electric Light Co. has been organized here, with a capital stock of $7,500. Incorporators: A. G. Whitehead, P. L. Corker and others.

Chattanooga, Tenn.—The Farrell Electric Light, Heat and Steam Co. has been incorporated here. J. A. Hart is interested.

Florence, S. C.—Electric lights are talked of for this place.

Marion, Pa.—The Indiana County Gas Co. has been incorporated to establish a plant here. The capital stock is $50,000. Address M. C. Watson, as above, for details.

Glasgow, Va.—It is probable that the electric light plant projected for this place will be established at once.

Portland, Me.—The Orient Electric Company will establish an electric light plant at this place.

Buckhannon, W. Va.—An electric light plant is to be established at this place by the Buckhannon Electric Light Company, of which G. M. Fleming is President. The capital stock is $7,000.

Hopkinsville, Ky.—An electric lighting plant is to be established at this place.

Sacramento City, Cal.—The California Gas Light and Fuel Company has filed articles of incorporation. Directors, H. B. Smith, Jr., of Alameda, and others. Capital stock, $10,000,000.

Rockport, Tex.—Propositions have been made to construct an electric lighting plant at this place.

San Francisco, Cal.—The Tulare Electric Light and Power Company has been incorporated here with a capital stock of $50,000. Directors, Messrs. F. W. Eaton, John C. Turner and others.

Ottawa, Can.—Improvements will probably be made to the Plant of the Chandiore Electric Light and Power Company of this place.

Los Angeles, Cal.—The Columbia Steam and Gas Company has been incorporated here with a capital stock of $100,000. Directors, L. E. Fish, R. W. Hinckley, and others.

Yazoo City, Miss.—Operations will begin at once on the electric light plant to be established at this place.

Hornellsville, N.Y.—The Steuben Electric Manufacturing Company of this place has been incorporated with a capital stock of $30,000. Incorporators, Charles Adsit, George A. Bronson, and others.

West Winfield, N. Y.—An electric light plant is to be established at this place at an early day. For particulars, address P. McFarland, as above.

Columbus, O.—Additional bonds for gas and lighting purposes will probably be issued soon.

Titusville, Fla.—The sum of $10,000 is to be expended on an electric lighting plant for this place.

St. Joseph, Mo.—Numerous new lights are to be added to the local electric lighting plant.

Cedar Rapids, Iowa.—Improvements are to be made to the local electric light plant.

Newark, N. J.—Improvements are to be made to the plant of the Consolidated Newark and Schuyler Electric Light Company. The estimated expenditure is $150,000.

Sag Harbor, L. I.—An electric lighting plant is to be established at this place by the Fahys Watch Case Company.

Portland, Me.—At a recent meeting of the City Council an order was passed authorizing the Committee on Street Lamps to contract with some responsible party for lighting the streets for the year ending October 31, 1891.

Wilton, Iowa.—This place is to have electric lights.

Palmyra, Mo.—An electric light plant is to be established at this place.

Mount Pleasant, Mich.—This place is to have an electric lighting plant.

Rutherford, N. J.—An electric light plant is wanted here.

Carlstadt, N. J.—This place will have electric lights.

ELECTRIC RAILWAYS.—New electric railways will be built and improvements will be made to those already established at the following places: Omosso City, Mich.; Newport, Ky.; Argentine, Mo.; Armourdale, Mo.; Westport, Mo.; Independence, Mo.; Centropolis, Mo.; Sheffield, Mo.; Harlem, Mo.; Memphis, Tenn.; Ottawa, Can.; Rockland, Me.; Ann Arbor, Mich.; Ypsilanti, Mich.; Springfield, Ill.

BIDS OPENED.

PEORIA, ILL.—The contract for the construction of the House of the Good Shepherd has been awarded to Peter Kinney & Sons for $18,793. Wechselberger & Reeves, architects, will superintend.

LOCKPORT, N. Y.—Reports say that contract for constructing the tunnel at Niagara Falls has been awarded to Rogers & Clement, of New York. The figure is not given.

BOSTON, MASS.—The following proposals for filling in on parkway, Tremont and Longwood entrances, Back Bay, were opened September 3, by the Park Department: Boston and Albany Railroad Company, Boston, Mass., per cubic yard, 51 cents; total, $61,200. Finnerty & Kelley, Boston, Mass., per cubic yard, 90 cents; total, $108,000. The lowest bidder got the contract.

Proposals for doing the Marine Park filling were opened on the same date, as follows: The first figures are for 200,000 cubic yards, and the second figures are for 400,000 cubic yards. Bidders: Perkins & White, Boston, Mass., $114,000 and $212,000; Eastern Dredging Company, Boston, Mass., $118,000 and $216,000; New England Dredging Company, Boston, Mass., $134,000 and $292,000. The contract was awarded to Perkins & White.

GOVERNMENT WORK.

OPELOUSAS, LA.—The following proposals for the erection and completion, except heating, of the United States Court House and Post Office at this place, were opened August 28, advertisement of August 2, by the Supervising Architect of the Treasury Department. The figures given are for the following work, in detail, in its respective order: 1, total amount; 2, price per cubic yard for additional granite bearing plates; 3, amount for extra plate glass throughout, except basement; 4, extra white oak in first and second stories; 5, price per cubic yard for excavation; 6, price per yard for concrete; 7, price per M. for selected bricks in wall; 8, price per M. for red brick in wall and piers; 9, kind of stone. Bidders: Robert M. Jack, Wichita, La., $40,000, $2.25, $900, $700, 50c., $6, $65, $17, Bedford; W. D. Southwell, New Orleans, La., $48,900, $2.50, $800, $1,050, 64c., $14.50, $60, $20.50; Bedford House; George Van Horn; New Orleans, La., $39,362, $2.25, $1,200, $1,000, 50c., $6, $60, $16, Indiana limestone; W. E. Speer & Co., New Orleans, La., $43,552.56, $3.50, $1,300, $2,000, 55c., $7.50, $65, $19.50, Bedford.

INDUSTRIAL.

MINNEAPOLIS, MINN.—The permanent improvements for Minneapolis for another year are to cost about $600,000.

NEWPORT, KY.—Reports say that the Swift Iron and Steel Works of this place has been bought by the Ironton Steel Works Company, and that it will be rebuilt and enlarged.

ELIZABETH CITY, N. C.—The city will hold an election September 8 to decide as to issuance of $10,000 of bonds for improvements.

PROPOSALS.

(Continued from page ii.)

WHARF, Boston, Mass.—Proposals are wanted until September 10, for the construction of a wharf at Deer Island. Address Howard A. Carson, Chief Engineer, Metropolitan Sewerage Commission, as above.

WATER-WORKS, Coldwater, Mich.—Proposals are wanted until September 16, for the construction of a complete system of water-works. Address J. D. Cook, Consulting Engineer, Toledo, O.

SEWERS, Cairo, Ill.—Proposals are wanted until September 9, for the construction of certain sewers. Address Casey Stiles, City Clerk, as above.

SEWERS, Binghamton, N. Y.—Proposals are wanted until September 8, for the construction of certain sewers at this place. Address W. J. Flanigan, City Clerk, as above.

TOWN HALL, Fern Bank, O.—Proposals are wanted until September 29, for the erection of a town hall at this place. Address T. Forman, Corporation Clerk, as above.

SEWERS, Wilmington, Del.—Proposals are wanted until September 11, for the construction of certain sewers. Address T. Chalkley Hatton, engineer in charge of sewers, as above.

POSITIONS VACANT.

TOO LATE FOR CLASSIFICATION.

WANTED AT ONCE.—A FIRST CLASS draughtsman, well up in detail drawings for bridges and roofs; none but experienced man need apply; also, a junior draughtsman, who must be a good tracer. Apply to NATHANIEL ROBERTS, Engineer, Wallis Iron Works, Jersey City.

POSITIONS WANTED.

A GRADUATE IN CIVIL ENGINEERING wishes permanent position in any department of civil engineering. Address F. G. DODD, Nutley, N. J.

WANTED—A SITUATION BY A YOUNG man to finish his time at the plumbing business. Has had three and a-half years' experience in plumbing and gas fitting. Industrious and willing. Can furnish the best of city reference. Address T. WALSH, Plainfield, N. J.

Building Intelligence.

We solicit from each and every one of our readers information relating to projected buildings in their locality, and should be glad to receive newspaper clippings and other items of interest.

ABBREVIATIONS.—*b s*, brown stone; *br*, brick; *br st*, brick store; *b s dwell*, brown-stone dwelling; *apart house*, apartment-house; *ten*, tenement; *e*, each; *o*, owner; *a*, architect; *b*, builder; *fr*, frame.

NEW YORK.

57 Henry st, br and s flat; cost, $20,000; o, T P Allen; a, H Palmer; b, m and c, Burke & Co.

170 Norfolk st, br flat; cost, $32,000; o, Leopold Herman; a, L F Heinecke.

135 Perry st, br and stone flat; cost, $20,000; o and b, J McKelvey; a, M V B Ferdon.

439 W 48th st, br flat; cost, $13,500; o, A Moore; a, G Keister;.

Madison av, n w cor 31st st, br and s flat; cost, $250,000; o, P N Ramsey; a, G F Pelham.

88th st, n s, 250 e Amsterdam av, 3 stone dwells; cost, $10,000 each; o, Young & Hinrichs; a, A Huttira.

West End av, s e cor 89th st, 7 br and s dwells; total cost, $95,000; o, J C Henry; a, C True; m and c, McDowell & Henry,

504 W 157th st, br flat; cost, $11,000; o, Depperman & Sauter; a, J Wolf.

506–510 W 157th st, 3 br and s dwells; cost, $6,000 each; o and a, same as above.

Convent av, s w cor 144th st, 4 br and s dwells; cost, $25,000 each; o, W H De Forest, Jr; b, R Dey.

St Ann's av, n w cor 141st st, br and s dwell; cost, $28,000; o, J McQuade; a, J Munckwitz.

N s 133d st, 240 w 7th av, br flat; cost, $23,000; o and a, G Robinson, Jr.

N w cor Laight st and Varick st, br store; cost, $30,000; o, L L Williams; a, J B Smook & Son.

E s Amsterdam av, 30 w 8th av, br ten; cost, $13,000; o, J McCallenn; a, A A Campbew.

N e cor 3d av and 156th st, 4 br flats; cost, $78,000 all; o, J Wicks, Jr; a, E Wenz.

S w cor 2d av and 96th st, 4 br flats; cost, $74,000 all; o, F A Clark; a, same as above.

S s 96th st, 74 w 2d av, 4 br flats; cost, $72,000 all; a and a, same as above.

S e cor 41st st and Broadway, br hotel; $65,500; o, L L Todd; a, T E Thomson.

N w cor Washington st and w 3d st, br stores, cost, $25,000; o, W Astor; a, H Dudley.

S e cor 59th st and 5th av, br hotel; cost, $800,000; o, P H Dugro and F Wagner; a, R S Townsend.

Alexander av, 75 n 138th st, br flat; cost, $18,000; o, N J O'Gorman; a, J A Webster.

11 Lexington av, br dwell; cost, $15,000; o, P C Hewitt; a, W B Biglow.

BROOKLYN.

W s 4th av, 42 s 33d st, 3 fr dwells; cost, $9,000 all; o, J Edwards; a, H L Spicer & Son.

N s St Marks av, 130 w Franklin av, 4 br dwells; cost, $30,000 all; o, T Monahan; a, W M Coots.

E s Driggs st, 25 n North 6th st, br dwell; cost, $8,000; o, P Blake; a, H Vollweiller.

N e cor 3d av and 46th st, 2 fr dwells; cost, $10,000 all; o, Mrs Catherine Schneider; a, C P Robedale.

BUILDING INTELLIGENCE.

BROOKLYN.—Continued.

E s Covert st, 46 n Nelson st, 2 br dwells; cost, $10,000 all; o, J F Nelson; a, not given.

S w cor 5th av and 14th st, br store; cost, $8,000; o, W Bolton; a, not given.

S s Sommers st, 200 e Stone av, 5 br dwells; cost, $25,000 all; o and a, J Frankel.

N s Putnam av, 100 e Reid av, 5 br dwells; cost, $25,000 all; o and a, W O Forrester.

THE Editor of THE ENGINEERING AND BUILDING RECORD is always glad to receive items of news for the Contracting News Department. But such items are not considered news except when the prices and particulars of the award of a contract are given.

The announcement that ——— has sold ——— to ——— without giving the *prices* and particulars concerns only the buyer and seller. Such notices are always excluded, except in the case where a certain firm is stated to have taken a certain contract, the execution of which would require that they should buy certain materials. Such an item would be used if deemed of more than local interest, because it would suggest to some readers the possibility of their making a sale or securing a subcontract.

MISCELLANEOUS.

BOSTON, MASS.—70–72 Chauncy st, br mercantile bldg; cost, $30,000; o, F W Marshall; a, W T Goodwin; b, Emery & Stuart.

Dundee st, 18 br dwells; cost, $100,000; o, G W Henderson; a, Wm Bassett; b, Geo W Adams.

Round Hill st, 15 fr dwells; cost, $45,000; o, Workingmen's Building Association; a, George W Pope.

Cheney nr Hartwell st, 2 fr dwells; cost, $7,500; o, S L Ward; a and b, W T Eaton.

21–27 Burgess st, 4 fr dwells; cost, $13,000; o, M Annie Clifford; a and b, A P Clifford.

Centre st cor Mt Vernon st, 1 fr church; cost, $25,00; o, South Evangelical Society; a, A H Vinal; b, Geo W Oliver.

K st cor E 6th st, 2 fr dwells; cost, $7,800; o, W I G Fogg; a and b, W T Eaton.

9 Waltham st, br apart; cost, $8,000; o, Mary M Adams; a, B F Heath.

Beacon st nr Montford st, 3 br dwells; cost, $35,000; o and b, W D Vinal and others; a, S D Kelley.

Maple st cor Cheney st, fr dwell; cost, $9,000; o, J A Jacobs; a, John A Fox; b, Burke Bros.

Crawford st nr Harold st, fr dwell; cost, $7,500; o, R D Hall; a, C P Mooney; b, J H Proctor.

54 Ashford st, fr dwell; cost, $7,000; o, Ada Hammond; a, E L Clark; b, A E Ellis.

Norfolk st nr Walk Hill st, fr dwell; cost, $7,000; o, J F Whittredge; a, C A Russell.

275–77 Chestnut av, 2 fr dwells; cost, $8,000; o, a and b, C A Russell.

Bartlett court, 2 br tens; cost, $7,600; o, F Ginsboro; a, C R Beal; b, Frank Finn.

48 Longwood av, fr dwell; cost, $7,000; o, J H Griem, a, Jacob Luippold.

Grant av nr Wilton av, 2 fr dwells; cost, 7,500; o and b, Samuel Hano; a, F H Shepard.

CAMBRIDGE, MASS.—Lambert av, frame dwell; cost, $6,850; o, D W Ellis; a, J M Brown; b, C Leake.

Brattle st, fr dwell; cost, $8,420; o, Mrs J B Parker; a, Cram & Wentworth; b, A Y Currie.

Broadway, fr factory; cost, $6,200; o, Leander Greely; a, C H McClare; b, Kelly & McKinnon.

BUILDING INTELLIGENCE.

CHATTANOOGA, TENN.—A residence to cost $60,000 is to be erected at Fort Wood, a suburb of this city, for Lewis S. Colyar.

CHICAGO, ILL.—Evanston st, near Early st, br dwell; cost, $8,000; o, C M Avery; a, R Rae, Jr; b, J W Cass & Co.

Fullerton and Clybourn avs, 3-story br warehouse; cost, $15,000; o, Wm Deering & Co.

1782–84 Oakdale st, br dwell: cost, $8,000; o, R S Elder; a, Ostling Bros; b, Jno Larson.

4845–47 Ashland av, br store and flats; cost, $8,000; o, M Cohn; a, Hy Kley; b, Ewalt.

Perry st, bet 72d and 73d sts, br flats; cost, $8,000; o, Shields & Cook.

Justin and 42d sts, br tank and storage rooms; cost, $110,000; o, Swift & Co.

270–6 Wells st, br store and flats; cost, $40,000; o, David D Lewis; a, Willett & Pashley.

Kinzie and Curtis sts, cooper shop; cost, $11,000; o, Jno Erzner; a, C A Weary; b, Jul Piske.

60–62 Michigan av, br warehouse; cost $22,000; o, Bell, Conrad & Co; a, H B Seeley; b, Angres & Girble.

W Van Buren st, br addition; cost, $8,000; o, Mrs M Bahe.

405 5th av, br office and warehouse; cost, $16,000; o, M E Wendell, a, F W Brown, Albany, N Y; b, Jno Forthson.

148 Curtis st, br store and flats; cost, $12,000; o, Chas Heck; a, A Warner; b, F H Roesseler.

3811 Wabash av, br dwell; cost, $10,000; o, L Kaltinsky.

232–42 Wells st, br store and flats; cost, $80,000; o, W S Johnston; a, Hy Gres Cobb; b, Jno Mountain.

37–45 Union Park Place, br factory; cost, $22,000; o, Chas E Hersen; a, J M Van Osdel & Co; b, A Loudquest.

Randolph and Clark sts, br story addition; cost, $13,000; o, Ashland Block; a, W L B Jenney; b, Geo A Fuller & Co.

46–48 Astor st, br dwell; cost, $32,000; o, W C Goudey; a, Burnham & Root; b, C W Demier & Co.

2624 Cottage Grove av, br store and flats; cost, $10,000; o, Hy Wachter; a, Furst & Rudolph; b, Geo Schneider.

Br structure; cost, $85,000; o, The Chicago Atheneum; a, Thos Wing.

29th st and Wabash av, br store and apartment house; cost, $40,000; o, Geo V Hantins; a, same as above.

Cor Ashland bl and Polk st, 3-story dwell. cost, $35,000; o, Mrs Minnie Morris; a, J E Thorn.

166 bldgs costing less than $7,000 each.

DENVER, COL.—24th av, bet Downing and Ogden, br terrace; cost, $10,000; o, Flower & Patterson; a, Balcomb & Rice.

32d av, bet Race and Wine, br terrace; cost, $16,000; o and a, Thos Freeman.

S 15th, cor 9th av, double br dwell; cost, $20,000; o, E M Holiday; a, Andrews, Jaques & Rantoul.

Ogden, bet 23d and 24th av, br terrace; cost, $10,000; o and a, Van Stone Bros.

Alemeda, bet Alta and Porter, 3 br dwells; cost, $10,000; o and a, J H Harmed.

High, bet Colfax and 16th av, 3 br dwells; cost, $16,500; o, A E Hull; a, Lang & Pugh.

DETROIT, MICH.—Howard st, bet 10th and 12th sts, 2 story br double res; cost, $7,000; o, Wm E Maloney; a, A E French.

FINDLAY, O.—West Park, fr factory bldg for the manufacture of glass bottles; cost, $8,000; o, B F Morrical, President of stock company; a, G J Horn; b, not let.

FOND DU LAC, WIS.—Fr dwell; cost, $7,000, o, W H Mihills; a, Conover & Porter of Madison.

HOLYOKE, MASS.—Cor High and John, 5-story bus block; o and b, John Cleary.

LEXINGTON, KY.—J F Alexander, architect, of Peoria, Ill., has completed plans for a public library building here to cost $150,000. It will be heated by the hot air system.

BUILDING INTELLIGENCE.

JOHNSTOWN, PA.—Cor Clinton and Locust st, br block, marble trimmings, for store and office purposes; cost, 25,000; o, Chas S Ruth; a and b, George Krueger.

Clinton st, br block, cost, $11,500; o, C Krieger; a and b, same as above.

Broad st and 3d av, pressed brick church and school; cost, $27,000; o, Rev E W Trautwein; b, Geo Krueger.

Bedford st, pressed brick bldg; cost, $7,500; o, J Zimmerman; a and b, George Krueger.

LANCASTER, PA. — Br residence; cost, $8,000; o, Henry Mettfett; a, Clifton Evans; b, Robert Morrow.

LANSING, MICH.—Baird's Opera House; cost, $30,000; o, Jas W Baird; a, Robbins & Charpie.

LONDON, ONT. — Banking house remodeled; cost, $7,000; o, Erie & Huron Loan Ass'n; a, Spier & Rohns, Detroit, Mich.

MADISON, WIS.—Fr dwell; cost, $7,000; o, Dr Jastrow; a, Conover & Porter.

Br block; cost, $12,000; o, Democrat Printing Co; a, O J Williams.

MEADVILLE, PA.—Mercer st, annex to Phœnix Iron Works, 40x75 feet; cost, with machinery, $25,000; o, Phœnix Iron Co; designed and building by their own men; Henry Church, manager.

MILWAUKEE, WIS.—Park st and Muskegon av, factory; cost, $7,000; o, Milwaukee Harvester Co; a, A J Inglis.

MINNEAPOLIS, MINN.—619–21 Nic av, br store bldg; cost, $60,000; o, Dickinson & Cumington, Willis & Dunham; a, W C Whitney.

Cor 6th s and 1st av, br club house; cost, $75,000; o, Minneapolis Club; a, as above.

519–25 3d av, N E., fr ten; cost, $15,000; o and b, Robert O'Brien; a, T W Kelley.

Cor Winter and Tyler sts, br round house; cost, $25,000; o, Great Northern Ry Co; b, A H Hogsland.

St Louis Ry nr Cedar Lake, br machine shop; cost, $25,000; o, Minneapolis and St Louis Ry Co; a, W B Hickson.

PITTSFIELD, MASS.—Two-story br electric light station; cost, $30,000; b, Hascal Dodge.

RHINELANDER, WIS.—Br School-house; cost, $10,000; o, city; a, Conover & Porter, Madison.

SALT LAKE CITY, UTAH. — Seventh South st, 3 dwells; cost, $9,000; o, Bolton, Hendricks & Co; a, Thompson & Weigel.

Owen st, 4 dwells; cost, $8,000; o, R B Hickock; a, W E Ware.

SCRANTON, PA.—Hyde Park, fr church; cost, $7,000; o, St David's Episcopal; a, F L Brown; b, W R Williams.

Wyoming av, s bank and office bldg; cost, $12,000; o, Chas Schlager; a, as above; b, subdivided contracts.

Clay av, s and fr res; cost, $13,000; o, E P Kingsbury; a, Mr. Holden; b, Conrad Schroeder.

Pennsylvania av, br store and office bldg; cost, $14,000; o, Mr Bloeder; a, F L Brown; b, as above.

SIOUX CITY, IOWA.—Leech st, in Greenville, addn to Sioux City, sausage factory; cost, $70,000; o and a, Adolph Heller; b, J P Wall.

SOUTH BETHLEHEM, PA.—Catasauqua, stone and shingle dwell; cost, about 9,000; o, Mr F Fuller; b, no contract.

SOUTH BRAINTREE, MASS.—Pearl st, granite depot; o, Old Colony Railroad; b, contract not yet let.

SOUTH SCRANTON, PA.—Convent; cost, $12,000; o, R C Congregation, parish of St Johns; a, Fred J Amsden, b, Boland & Battle.

ST. PAUL, MINN.—Grand av nr Avon, 2-story addn to br school; cost, $16,000; o, Board of Education.

Arcade nr Sims, 2-story br dwell; cost, $7,000; o, Chas Nordin.

BUILDING INTELLIGENCE.

ST. LOUIS, MO.—Page and Newstead avs, br dwell; cost, $7,000; o and b, J W Barness & Co.

Washington and Compton avs, br dwell; cost, $16,000; o, Pechman Bros; b, Wm Rieme & Son.

Wharf and Madison st, elevator; cost, $20,000; o, Farmers' Elevator Company; b, Hill & Kirgin.

S e cor Lafayette and Iowa avs, br dwell; cost, $9,500; o, J Schnaider; b, J H Remmers.

Jefferson and Wyoming avs, br dwell; cost, $8,400; o, Jannoponto & Gotsch; b, F Thoms.

Shaw's Garden, br dwell; cost, $10,000; o, Trustees Missouri Botanical Gardens; b, J W Givens.

TERRE HAUTE, IND.—Grand stand; o, Terre Haute Driving Club; a, W E Brown.

WORCESTER, MASS.—Pleasant, br bus block; cost, $20,000; o, R C Taylor; a, Cutting & Forbush; b, not let.

BUILDINGS.—There is nothing over $7,000 in value to report at the following places: Charleston, S. C.; Ogdensburg, N. Y.; Pottstown, Pa.; Wilkes Barre, Pa.; San Antonio, Tex.; Galveston, Tex.; Dennison, O.; Geneva, N. Y.; Waco, Tex.; Dayton, O.; Canton, O.; Saginaw, Mich.; Springfield, O.

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A valuable manual.—*San Francisco Chronicle, July* 13, 1890.

The volume is one which has a practical value, and should be studied by all interested in road improvements.—*Troy Times, July* 21, 1890.

A book which should be in the hands of every country Roadmaster or city Superintendent of Streets. * * *

The whole question of improved roads is yet to be seriously considered in the country. We excel the World, perhaps, in the comforts and facilities of railway travel, but our common highways, outside the immediate vicinity of large cities, are on a par with those found only in half civilized foreign countries.

The time will doubtless come when some system of thorough road construction, under skilled State or County supervision, will be applied to the main highways, the chief arteries of travel in every county.—*Springfield Republican, July* 2, 1890.

A most creditable and seasonable compilation. It is decidedly the best collection of data on this important subject that has yet appeared in book form. —*Engineering News, June* 21, 1890.

* * * It should have a place, especially, in the offices of street and county commissioners, where its suggestions might soon contribute greatly to the commercial welfare, safety and convenience of thousands of communities in our land.—*Iron Age, June* 19, 1890.

One of the most useful, interesting and practical books which has lately been issued from the American Press, and which is, no doubt, destined to have an important influence on street and road making in this country. * * * A large and very valuable mass of information in regard to the subject. * * * —*Boston Herald, June* 9, 1890.

This portly volume of more than 400 large octavo pages contains a vast amount of information not easy to describe in a limited notice. It is chiefly a compilation of articles which have recently appeared in THE ENGINEERING AND BUILDING RECORD, and which give the result of the Editor's investigation of work on streets and roads in England, France and other countries. * * * The subject is one of special importance to taxpayers and those having charge of road construction, and is here treated in a practical and thorough manner. * * * Farmers and tradesmen are beginning to realize that while good roads are costly, poor roads cost the country still more.—*Cincinnati Times Star, July* 25, 1890.

Mr. Love has done a public service in bringing together this information on pavements and roads in book form. At present there is an urgent demand for practical knowledge of this kind, especially in this country, where we are now passing through a transition stage and seeking to better the condition of the thoroughfares. It must be confessed that, taken at large, the practice here has by no means been up to the best standards, though there are notable exceptions, as, for example, the streets of Washington and some of the suburban driveways. Consequently when it is sought to remodel systems, as is now being done in so many American cities, to say nothing of the country highways, it becomes necessary to seek for the guidance of the experience gained abroad in the thickly populated European countries, where heretofore the most attention has been paid to the subject, thus avoiding costly and unnecessary experiment in directions already explored. By concentrating in this compilation the results reached in foreign practice, Mr. Love places a fund of information at the disposal of officials and engineers who have not had the advantage of personally studying the European methods. At the same time he gives much space to discussions of American practice, hitherto contained mainly in the transactions of a few engineering societies, and available for the use of a limited number of engineers. The editing is to be commended for the selection of matter relating to actual experience, and capable of being tested and compared by means of the numerical results quoted. As might be expected in a compilation of the kind the student will sometimes meet with discrepancies in the statement of the claims of rival systems; but nothing is lost by presenting a wide option of method in a matter where the conditions to be met vary so greatly.

The material from which the book is made up originally appeared in THE ENGINEERING AND BUILDING RECORD of New York. The compiler has eliminated what was of merely temporary and local interest, and appears to have kept in view the idea of producing a reference book of general applicability. The statements of cost and endurance in different places, being based on the records of actual trials, will serve as valuable data for estimating corresponding cost and endurance in other places where the variation in conditions is exactly known, and this feature of the book is the most useful one. We think, too, that the compiler has done well in letting the contributors speak for themselves in presenting the claims of different systems and the results of their experience. —*The Engineering and Mining Journal, July* 12, 1890.

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EXPERT ADVICE TO ARCHITECTS.

ON another page will be found a letter from a well-known civil engineer, whose name is withheld because of his business and personal relationship to the subject discussed. This calls attention to a practice of some architects, which from time to time has been alluded to in these columns, namely, relying on contractors to prepare plans and drawings that should be furnished by the architects. We are glad to know that there is a growing number in the profession against whom this charge cannot be justly made, yet the evil still exists, and the root of it undoubtedly lies, as is pointed out by "Civil Engineer," in the fact that architects too often fail to promptly point out to a client the necessity of their being permitted to retain special advice to assist them in preparing plans for special structural features, which are now often required in complicated modern heavy buildings. The architect whose practice is mainly in small buildings always looks forward to the time when he can get into what is called large work—*i. e.*, public and commercial buildings. Yet sometimes from lack of private means, again from failure to fully appreciate them, he takes risks from which more experienced men shrink, saving a consulting engineer's fee with the melancholy results which we are from time to time called upon to chronicle. The fact is, that architects in their practice should be less inclined to lead clients to believe that they know all about the varied complicated features of modern building construction, incident to the unprecedentedly rapid development of the art within recent years. It is unreasonable to expect it, and they should frankly admit it. Their duty to themselves and to their client requires it.

A lawyer, a physician, or an engineer, whenever any problem out of the ordinary presents itself, informs his client that on this or that point he would like special counsel. All men of business who are identified with large interests, know what it is to have special counsel retained in all important matters, and an architect should have no difficulty in impressing this point upon his client, and that his present regular commission—which is too often entirely inadequate—will not pay for this special service, and that it is to the interest of the client to authorize such special employment, and pay for it.

On the occasion of the disaster to a building in another city a few years ago, and in the discussion which followed, it will be remembered that we successfully urged the recognition by the American Institute of Architects of the principle that in important building a clerk of works should be constantly employed, to be paid for by the owner. The propriety of an owner paying for special advice on special problems should also be recognized. Just where the line should be drawn as to what special advice the architect or the owner should pay for in the planning and construction of modern buildings, would seem to be a legitimate subject for the earnest consideration of the American Institute of Architects, and we commend it to them as a live question to be considered at their forthcoming convention. We know of instances where an architect, realizing the importance of having special advice, has paid for such services, and for the drawings incident to the proper completion of the building, a sum greater than he received in fees, relying upon his private fortune to make good the deficiency and protect his reputation. This is all wrong. The recognized scale of compensation should be adequate to the service rendered, so that successful practice will secure better pecuniary rewards than it yet has done.

BAD SEWER WORK.

REPORTS from Mount Vernon, N. Y., indicate that some very bad sewer work has been going on there. According to a report in the New York *Tribune*, the filling in over the sewer pipe showed the gravest violation of the terms of the contract. The contractor, Bryan, had removed a large quantity of sand from the trench and replaced it, to a depth of several feet, with stone blasted out at other points. This stone was thrown in loosely, with no earth between the pieces, leaving the pipes exposed to great injury. Many of the pieces of stone were two feet or more in length and between two and three feet across, notwithstanding the contract limits the size to five inches and requires all pieces to be separated by earth.

Such work as this indicates gross carelessness, ignorance, or corruption on the part of the inspector and he should be promptly removed. If there is any engineer who has been supposed to look after the construction he is also culpable. If, however, the engineer who prepared the plans is not employed to look after the work of construction it is high time he was, otherwise the taxpayers' money will be thrown away and the town have a series of elongated cesspools instead of a sewer.

POLITICS IN WATER-WORKS ENGINEERING.

THE Cincinnati *Commercial Gazette*, in commenting on the present unhappy condition of Cincinnati's water supply and water-works plant, points out that its pumping station and intake was located in 1839, when the population of the city did not exceed forty thousand The water was drawn from what is now below the limits of the city. But Cincinnati has outgrown all this, yet the water-works are in the same locality. The sewage above the city is discharged into the river above the present site of the pumping station. There are at this time more people east of the water-works, so-called, than were in the whole city of Cincinnati in 1840. There is a greater population in Walnut Hills at this time than the whole city contained fifty years ago. Yet the pumping station has not moved a foot. The tunnels that supply the wells are located precisely as they were half a century ago, and the water that is supplied to the people is drawn from the same source that was then pure, but is now impure.

Yet, in face of this experience, which has been published far and wide, we notice that a Public Works Commissioner, of Rochester, N Y., where the election of a water-works engineer is under discussion, said that he had no objection to going on record as in favor of a "*Democratic* engineer." Nothing was said about the importance of the man being a competent civil and hydraulic engineer, but the essential requisite seems to have been that he voted for the candidates of a particular party. It will be unfortunate for Rochester or any other place if this political test is to be applied in the selection of its engineering officials. It is to be hoped that the public-spirited citizens of Rochester, of both parties, will have influence enough to have political considerations eliminated in the selection of their water-works engineer.

Since the foregoing was put in type, we learn that Emil Kuichling, a well known engineer, has been selected. Happily wiser counsels prevailed.

KEEPING WALLS DRY.

In a recent issue of the London *Architect*, W. L. Dearborn explains Sylvester's process for keeping walls dry.

It consists in using two washes or solutions for covering the surface of the walls—one composed of Castile soap and water, and one of alum and water. The proportions are three-quarters of a pound of soap to one gallon of water, and half a pound of alum to four gallons of water, both substances to be perfectly dissolved in water before being used. The walls should be perfectly clean and dry, and the temperature of the air not above 50° Fahr. when the compositions are applied. The first, or soap wash, should be laid on when boiling hot, with a flat brush, taking care to form a froth on the brickwork. This wash should remain 24 hours so as to become dry and hard before the second, or alum, wash is applied, which should be done in the same manner as the first. The temperature of this wash when applied may be 60 or 70° Fahr., and this also should remain 24 hours before a second coat of the soap wash is put on. These coats are to be applied alternately until the walls are made impervious to water. The alum and soap thus combined form an insoluble compound, filling the pores of the masonry and entirely preventing the water from entering the walls.

The French post-office authorities have lately been making experiments with a new wire, known as the "bi-metallic Martin," composed of steel with a surface of copper. The result is that the wire has been adopted to replace the wires in the telegraph service, and it will also be used upon the telephone systems.

The Bell Telephone Company is putting its wires under ground at Montreal.

OBITUARY.

John Westinghouse, senior member of the Westinghouse Company, manufacturers of agricultural implements, of Schenectady, N. Y., and eldest brother of George Westinghouse, the inventor of the air brake, died in Schenectady on the 2d inst., aged 50.

Charles J. Harvey, City Engineer of St. Johns, Newfoundland, died this week. He was engaged in the construction of the city's new sewerage system.

PERSONAL.

William P. Butler, for 11 years Assistant City Engineer of Bloomington, Ill., has been elected City Engineer.

F. Kirschman, C. E., of Milwaukee, has been engaged to assist in the construction of the Wisconsin Midland Railway, upon which work has been begun at Fond du Lac. N. Boardman, of Fond du Lac, is consulting engineer.

Sir Benjamin Baker, late Chief Engineer of the Forth Bridge, is on his way to this country in the steamer Aurania, which will arrive to-day or to-morrow. He is Consulting Engineer to the Canadian Government, and will probably in that capacity visit the Chignecto Ship Railway, at the head of the Bay of Fundy.

The following changes in the U. S. A. Engineer Corps have been ordered: First Lieutenant John Millis has been relieved from duty at Tompkinsville, N. Y., and ordered to New Orleans, relieving Captain D. C. Kingman, who is ordered to Oswego, N. Y., to relieve Captain C. F. Palfrey.

Emil Kuichling has been chosen to be chief engineer of the Rochester, N. Y., water-works. Mr. Kuichling entered the University of Rochester in the fall of 1864 and graduated from the regular art course in 1868. He then took a post-graduate course, and in 1869 received the degree of civil engineer. After completing his post-graduate course at the university he took the full three years' civil engineering course at the Polytechnic School in Carlsrhue, Germany. Mr. Kuichling's official career in Rochester commenced in 1873.

ENGINEERING SOCIETIES.

The fifty-seventh meeting of the American Institute of Mining Engineers will be held in the city of New York, beginning Monday afternoon, September 29, 1890, at 2 o'clock. All sessions will be held in Chickering Hall, 130 Fifth Avenue. Hotel headquarters will be at the Park Avenue Hotel, 482 Fourth Avenue, where the Institute will also maintain during the month of October a post-office and bureau of information for members and guests. Applications for rooms and all other communications concerning the New York meeting (except such as relate to papers) should be addressed to James F. Lewis, chairman of the New York Local Committee, 23 Park Place, New York.

The following programme is provisionally announced: Sessions of the Institute for the reading and discussion of papers on Monday afternoon and evening and Thursday morning, afternoon and evening. On Wednesday, Thursday and Friday mornings the sessions of the British Iron and Steel Institute will take place. On Wednesday afternoon there will be an excursion of the two societies and invited guests upon the Hudson River.

On Thursday afternoon the Holley Memorial will be unveiled in Washington Square. The commemorative address will be delivered in Chickering Hall, previous to the open-air ceremony, by Mr. James Dredge, editor of London *Engineering*.

On Saturday, members and guests will proceed by special train to Philadelphia; on Tuesday, October 7, to Lebanon and Harrisburg, and on Wednesday to Johnstown and Altoona, arriving Wednesday evening at Pittsburg, according to the programme of the General Reception Committee.

At Pittsburg, two joint international sessions will be held by the two societies and their guests, for the reading of papers. Further announcement will be made hereafter concerning these sessions, and special programmes will be issued by the Local Committees of Philadelphia, Pittsburg, and the principal points to be visited in the subsequent general excursions.

The general excursion will proceed from Pittsburg to Chicago, and at the close of the visit to Chicago will divide into two parties, going respectively north and south. According to the programme of the General Reception Committee, the northern excursion will visit the Menominee, Gogebic and Marquette iron ranges and the Lake Superior copper district, returning to New York via the Sault Ste. Marie Canal, the Sudbury (Canada) nickel and copper mines and Niagara, while the southern excursion will go from Chicago to Birmingham, Shelby and Anniston, Ala., returning to New York via Chattanooga, Tenn., Middlesbrough, Roanoke, Cripple Creek iron mines and Pocahontas coal mines, Luray, Va., and Washington. Both excursions will reach New York about October 28th.

THE GRANT MONUMENT DESIGN.

The sub-committee of the Grant Monument Association have selected the design of John H. Duncan, architect, 237 Broadway, New York, and will recommend to the full committee that it be definitely and finally accepted as the design of the Grant Monument, subject to any change or alteration in the plan that may be suggested by the committee and the architect.

The design provides for a square structure, capped by a dome. At the base it is 100 feet square, and rises to a height of between 160 or 170 feet. The body is placed in a crypt which opens through into the first story of the structure. In the crypt there are to be places for two coffins. A porch comes out in front of the structure running up to which are a number of steps. This porch opens into the first story, which is really like a gallery encircling the dome, and from which it is possible to look down upon the coffin as it lies in the crypt. In the exterior and in the character of the ornamentation the structure has been treated after the manner of the Grecian style of architecture. The material out of which the structure is to be built lies entirely with the committee. The drawings were made to allow the cost to fall within the limit of $500,000, the figure set by the committee.

OUR ARCHITECTURAL ILLUSTRATIONS.

ENTRANCE TO THE NEW YORK LIFE INSURANCE COMPANY'S BUILDING, MONTREAL, CANADA.
BABB, COOK & WILLARD, ARCHITECTS, NEW YORK.

FLOATING THE OHIO CONNECTING RAILWAY CHANNEL SPAN.

We begin in this issue the publication of illustrations relating to the noteworthy engineering feat, so successfully accomplished last month, of floating into position the channel span of the Ohio Connecting Railway.

In our issue of August 23 we gave a description of the construction of this channel span of the Brunot's Island bridge across the Ohio River, near Pittsburg, Pa., and the remarkable features of its bodily transfer, several hundred feet, and high in the air, floating, on barges, from the pile foundation on which it was erected to its permanent position on the lofty piers. Since then we have received photographs that show the different stages of the work, and represent it sucessively, as it was erected, lifted up, floated up stream, and finally deposited on its piers.

The span has a total length of 523 feet, a depth of 65 feet, and a width of 25 feet. Its upper members are about 150 feet above low water, as stated on page 178, from which we substantially reprint the following account of the work.

The principal waterway is underneath the span, and to avoid obstructing the large and constant traffic, which includes many unwieldy tows of rafts and barges, as well as to be somewhat less exposed to danger from flood, it was decided not to build any false work, trestles or piling whatever between the piers, but instead to assemble the span at the required level, with its axis perpendicular to the final position and far enough removed to be clear of the main waterway.

In the shallow water along the shore of the island piles were driven in an area of about 100x600 feet, the short side of the rectangle being about parallel to the line of the bridge and 300 feet below it at the upper end. Each row was cut off and capped about 13½ feet above normal water level, and several lines of 20-inch steel I beams were laid across the caps. These formed stringers on which timber trestle bents, 54 feet high and 90 feet wide at the bottom, and 30 feet at the top, were erected and secured by wooden bracing and special adjustable iron tie rods.

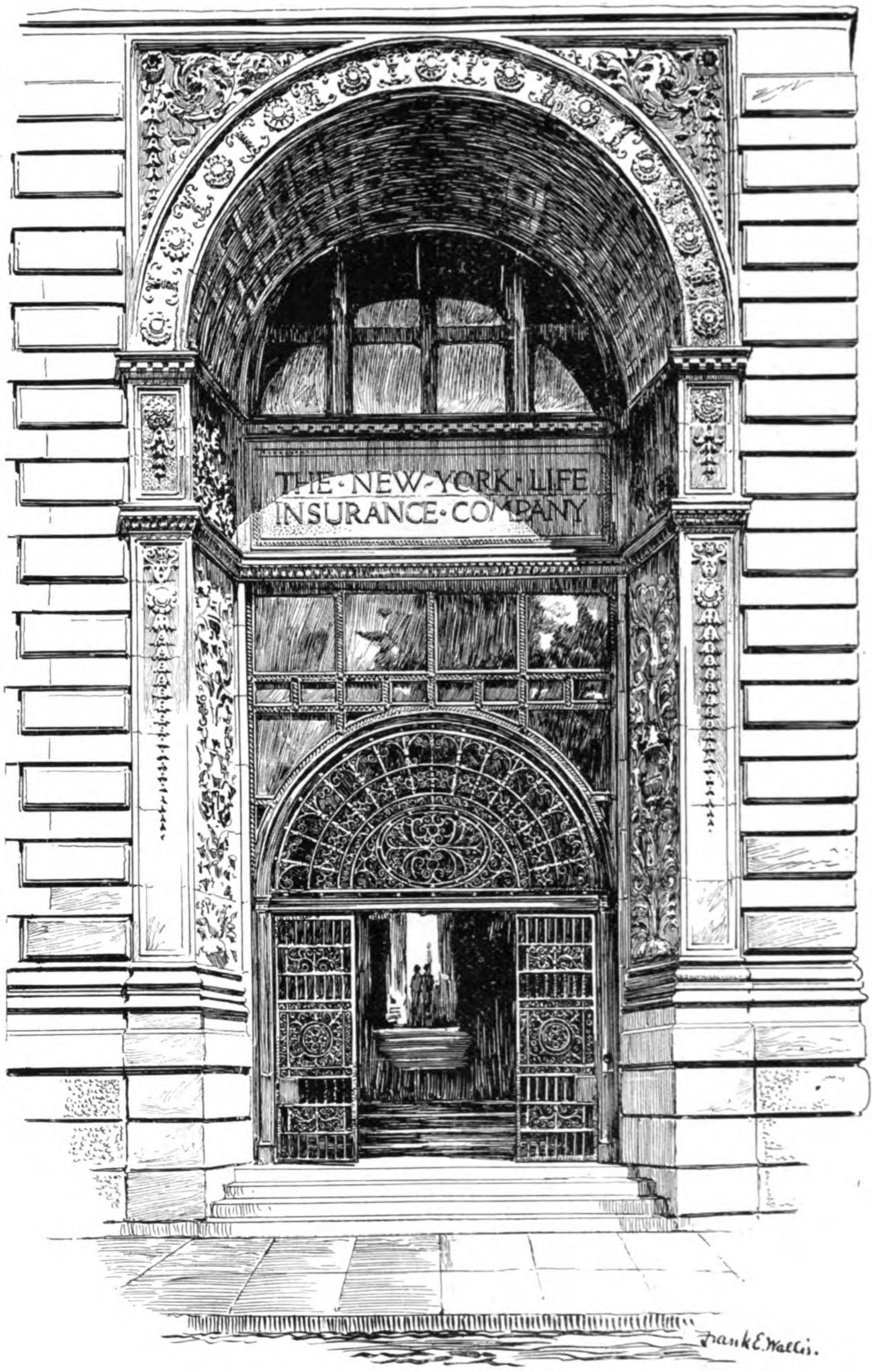
On this false work the iron and steel bridge members were hoisted, assembled and connected, as shown in Fig. 1. Nine specially constructed barges were then floated into position under the 20-inch steel beams and between the rows of piles. The barges were 130'x25'x8' deep, strengthened by longitudinal and transverse bulkheads, and contained inlet valves through the bottom of every chamber. These valves were opened and the barges partially submerged.

Suitable framing was erected on the barges underneath, and nearly up to the steel beams. The valves were closed, and on August 18 the water was pumped out in about five hours by steam pumps on three adjacent tug boats, and as the barges rose they finally received the entire weight of the bridge span and supporting false work and floated it clear above the piles.

The false work was securely connected and braced to the barges, which were connected together by stringers in front and longitudinal bracing, and temporarily bolted with iron plates to the piles, and the span was secured against overturning by heavy steel guy ropes from each end of each barge. One flat boat was fastened to the bows of the last three barges, at each end of the line; together they were equipped with four hoisting engines which operated about 60,000 feet of towing tackle. The lines were run to the piers and to both shores. On the land side they were attached to the piles on which the false work originally rested.

On the afternoon of Monday, August 18, everything was in readiness to begin the work of moving. Blocking was placed between the I beams and the caps of the piles and the structure held in this condition through the night, and on the morning of August 19 guy ropes were attached to the floating mass, the barges disconnected from the piles, and at 8.50 A. M. the hoisting engines, winding upon tackles made fast to the shore, slowly drew out the barges until, at 11.15 A. M., the structure, including the boats, was clear of the piles. Stringers were placed across the rear of the barges and extra braces where the piles had previously interfered. Figure 2 is an end view of the bridge and trestle as erected and still supported on the piles, but with one barge B floated into position. Figure 3 shows the barges all in position and supporting the structure, which has been swung clear of the piles.

(Continued on page 230.)



THE ENGINEERING AND BUILDING RECORD ILLUSTRATED SERIES.

ENTRANCE TO THE NEW YORK LIFE INSURANCE CO'S. BUILDING, MONTREAL, CANADA.

BABB, COOK & WILLARD, ARCHITECTS, NEW YORK.

NEW YORK, VOLUME XXII.

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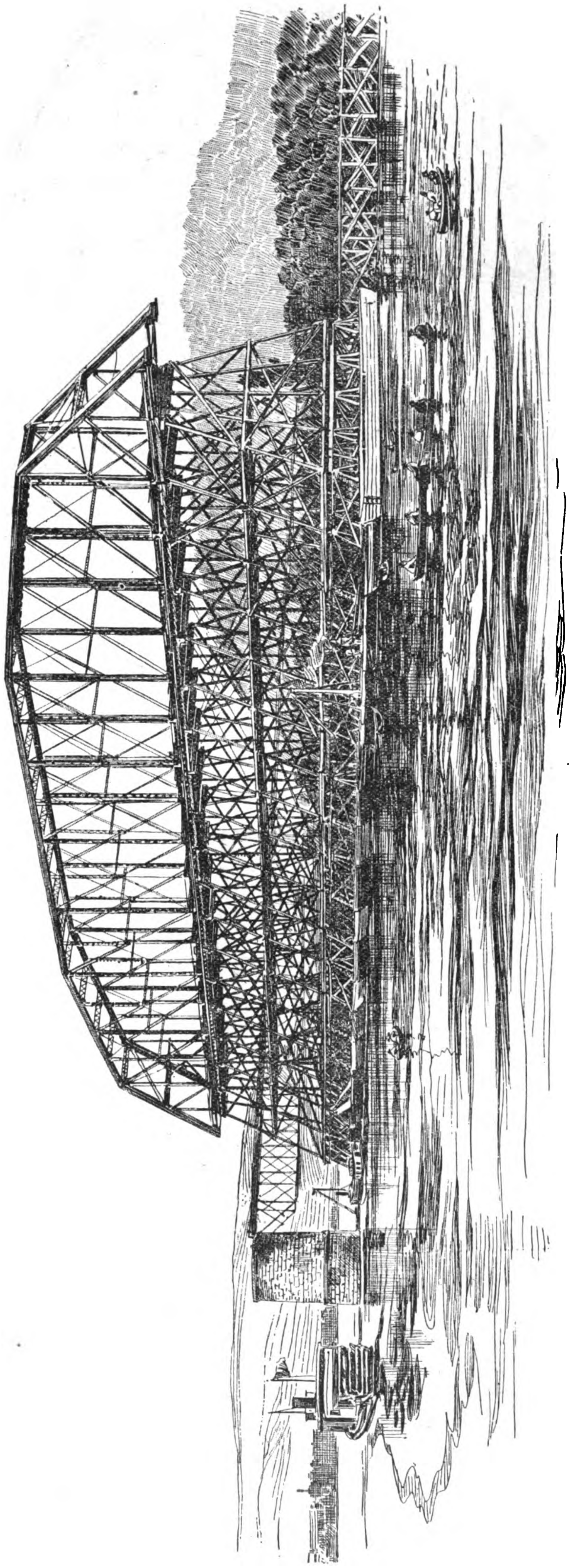
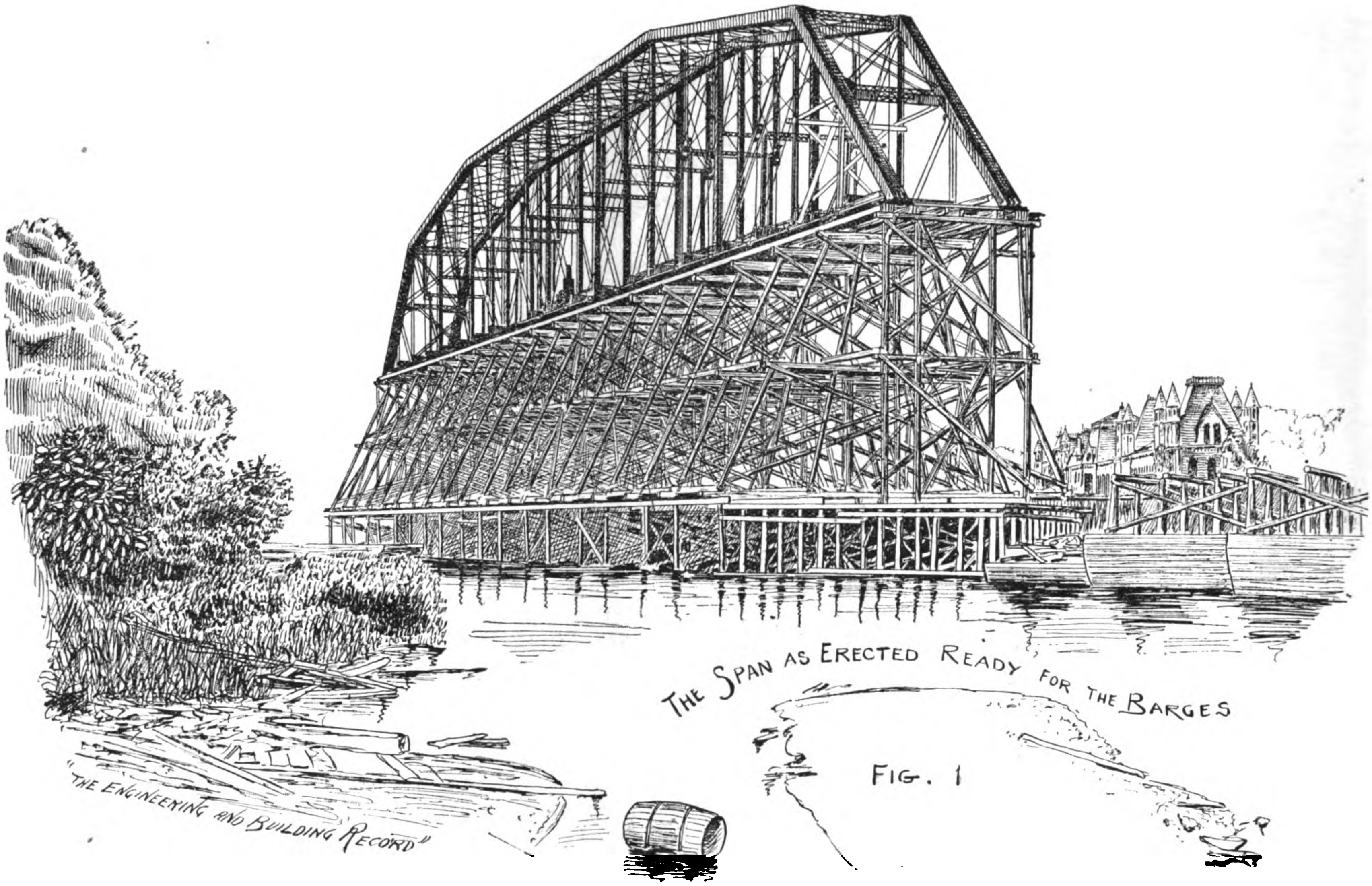


FLOATING A ONE-THOUSAND-TON BRIDGE SPAN INTO POSITION ON THE OHIO RIVER.


"The Engineering and Building Record"

The Span as Erected Ready for the Barges

Fig. 1

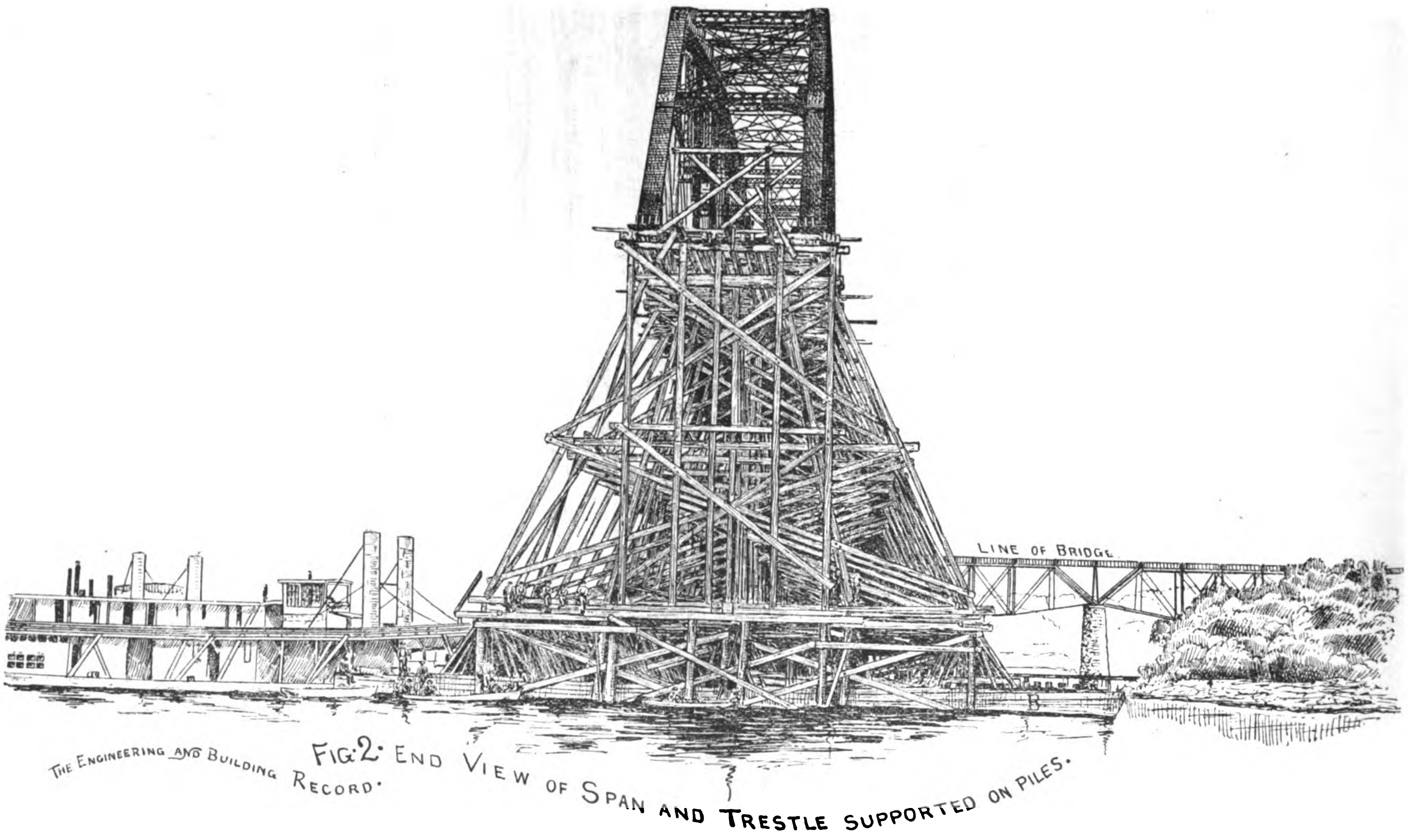

Line of Bridge
The Engineering and Building Record.

Fig. 2. End View of Span and Trestle supported on Piles.

FLOATING THE OHIO CONNECTING RAILWAY CHANNEL SPAN.

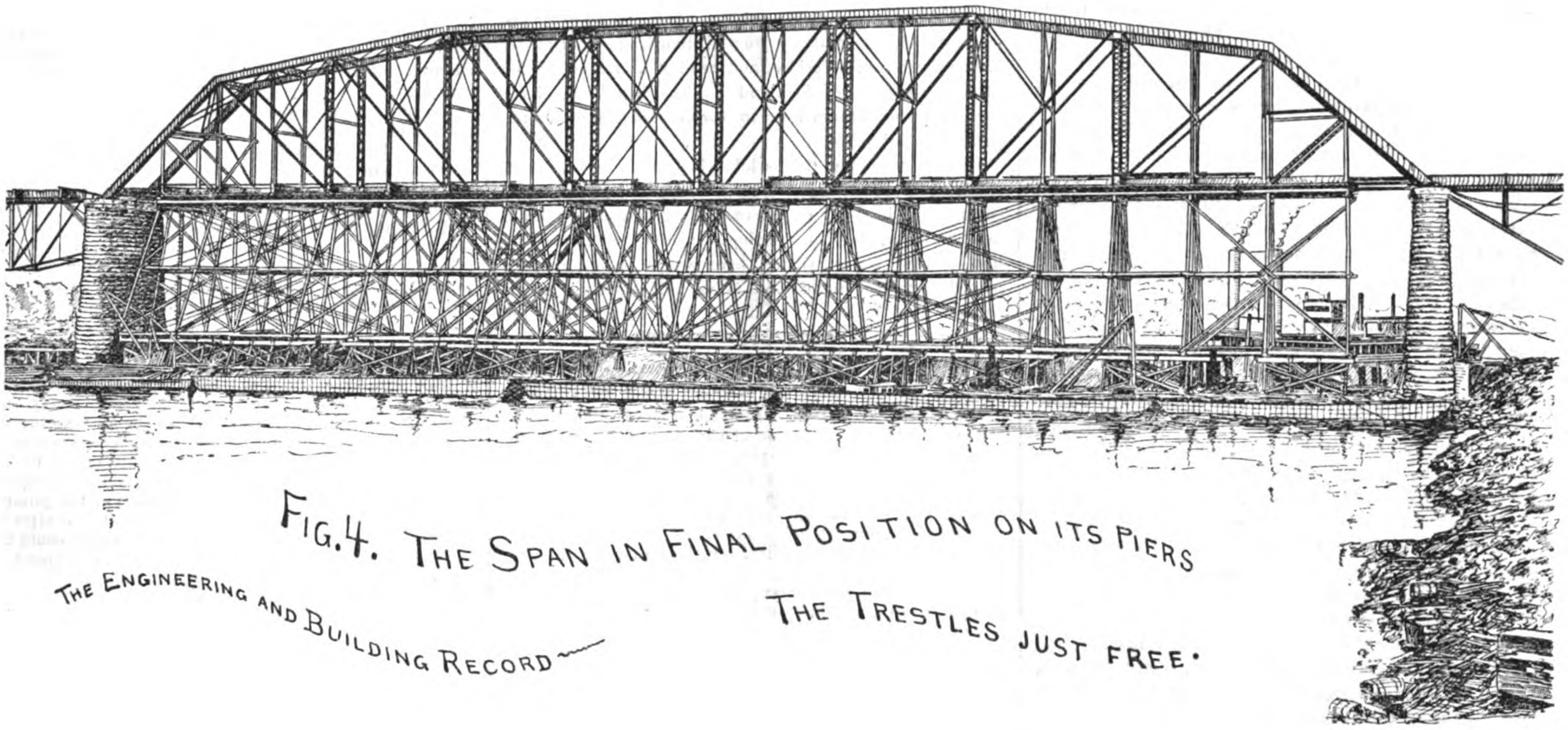


FIG. 4. THE SPAN IN FINAL POSITION ON ITS PIERS

THE TRESTLES JUST FREE.

THE ENGINEERING AND BUILDING RECORD

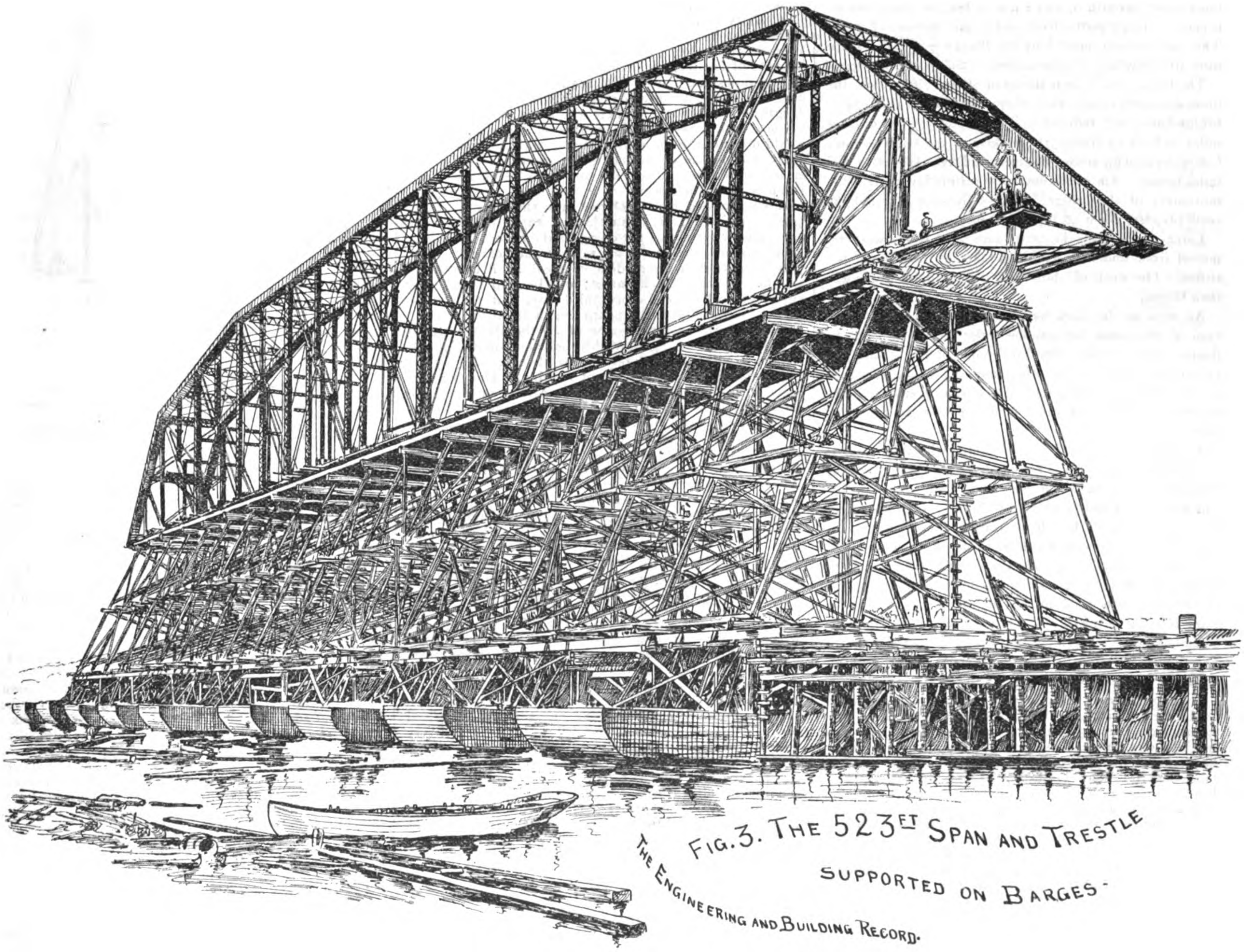


FIG. 3. THE 523 FT SPAN AND TRESTLE SUPPORTED ON BARGES.

THE ENGINEERING AND BUILDING RECORD.

FLOATING THE OHIO CONNECTING RAILWAY CHANNEL SPAN.

FLOATING THE OHIO RAILWAY CHANNEL SPAN.

(Continued from page 226.)

The line of barges, 500 feet long, with its topheavy burden, nearly 1,000 tons of which was from 100 to 150 feet above the water, was then moved out like a unit and swung about one end as a center through a quarter circle, until it was parallel with the line of the bridge, towards which it was steadily drawn, as shown in the illustration on page 227. This was prepared from a photograph, taken at a point below the floating mass, as its engines drew it up stream against the current, and through wind and frequent rain, until it arrived between the piers. These had about 25 feet clearance from the end barges. Two heavy rainstorms interfered with progress in the afternoon. There was, however, not very much wind. The movement was slow, owing to the many lines, the number of shifts that had to be made, and the distance apart of the men, and was always in very short stages, preceded by careful adjustment of the guy lines. The span was thus brought approximately to position over its seats, about 26 inches above the pier at the fixed end and about 24 inches at the roller end. Guide bolts were passed through the shoes and inserted in holes prepared in the masonry, and at 7.30 P. M. the valves in the barges were opened and the false work gradually sunk until, at 8.20 P. M., the span was 10 inches and 8 inches clear of piers at the fixed and roller ends, respectively. It was then concluded to discontinue work. Wooden blocking was therefore put under for the night, and the span made fast to the piers by means of lines.

The structure remained in this condition with the boats under the span through the night. At 7.30 the next morning the span had been lowered so as to rest entirely upon the piers, as shown in Fig. 4. In this the trestles and barges, though no longer supporting the span, still remain just beneath it, and a line of barges, like a boom, is seen stretched across from pier to pier in front of them. The total weight moved by the barges was about 1,800 tons, 915 of which was the weight of the permanent span.

The bridge site is near the head of a "riffle," and the normal current is very swift there, but was, at the time of bridge launching, reduced to an estimated velocity of three miles an hour by closing the wickets of the United States Government dam across the river at Davis Island, a few miles below. The conditions were mainly favorable to the movement of the bridge, which satisfactorily fitted the seats prepared for it on top of the piers.

Later in the day, the boats with false works were removed from under the span and taken to the original position. The work of shortening up the false works was then begun.

As soon as the piles had been driven for the 416-foot span of the same bridge, the false works were to be floated down stream, around the point of the island, and towed into place in the other channel. They were then to be lowered on the piles and the boats removed. The erection of this span was then to be done in the usual way.

Freshets in the Ohio River interfered with this work, as the level of the river was raised above pool stage, and the Davis Island Dam was let down. Owing to this delay, this work could only recently be done. The false works are now resting on the piles in the 416-foot span, and the work of raising this span will be begun in a few days.

While the work of moving the false works around the island was under way, a violent gale of wind sprang up. A steamboat was used to tow the structure, assisted by lines running to the shores. When it was found that the steamboat would not hold the structure unassisted, the barges were allowed to drift against the shore, and the structure held in that position until the storm was over.

Large spans over the Hawkesbury River, Australia, the St. Lawrence River, the Missouri River, and perhaps elsewhere, have been erected in a somewhat similar manner by the use of floating false work, but so far as we remember, none of them were as long as this span, nor was the false work for them built on piles and afterwards transferred to barges, but was originally constructed on them. The Keystone Bridge Company, of Pittsburg, are the contractors for the building and erection of the Ohio connecting railway bridge. C. L. Strobel is the Chief Engineer of the Keystone Bridge Company, Max J. Becker, Chief Engineer of the Ohio Connecting Railway Company, and George R. Buchan is Superintendent of Outside Construction for the Keystone Bridge Company.

We hope soon to publish detailed descriptions and illustrations, that are now being prepared, of the superstructure of this bridge, and the false work, traveler, barges and general erection plant.

AIR VESSELS ON PIPES AND PUMPS.

FOLLOWING the queries in regard to "Air Cushions on a Water Main," and the replies to them which were published in our issues of May 24 and June 7, the subjoined practical paper on the same subject will be found of timely interest. It was read by Dugald Baird, manager of the Leven Collieries, Fifeshire, and read at a meeting of the Mining Institute of Scotland. The illustrations have been reproduced from London *Engineering*, in which the paper was published.

It is noteworthy that while the author says, when speaking of the position of air vessels, that a number of them might be fixed on an extra long discharge column or force main, that in the single instance mentioned by him, in case No. 3, where there was a large air vessel placed on a discharge column about half way up, it seems to have had little or no effect. This corroborates the opinion expressed on page 394 of Vol. XXI., that it is of comparatively little use to put air vessels on a force main, and that the only proper place for them is at the pump.

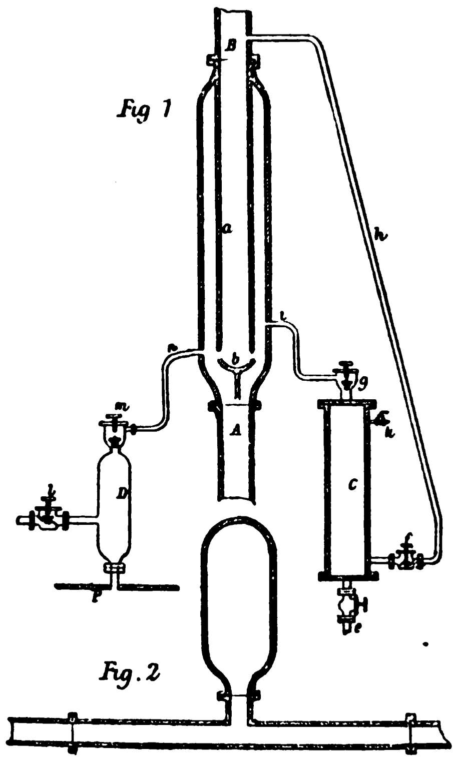
During the past six years I have had an excellent opportunity of studying the action of various kinds of pumping machines under many varying conditions, and, for the purpose of ascertaining the exact pressures and strains inside the pumps and pipes, my employer asked me to register these from time to time, and to do so a large number of diagrams were taken of steam cylinders, pumps, and pipes, and it is from these that the observations are based.

We have had during the time mentioned 35 different pumps at work, and have at the present time 27. Twenty-one of these are in operation night and day, and six are ready to start at a moment's notice. Their capacity varies from 40 gallons per minute up to 1,200 gallons per minute, and our total output in ordinary weather is 3,000 gallons per minute. From the notes kept of the working of these pumps we are satisfied that the air vessel plays a most important part in the working of pumps, and I propose to give the results of these inquiries and the conclusions come to based upon them.

1. Kelty No. 1 Pit. A 12-inch combined plunger and bucket Dook pump, where the motion was given by means of wooden rods. The bucket and ram had a velocity of 100 feet per minute, and the water in the discharge pipes had a velocity of 144 feet per minute. The length of the column was 200 yards, and had a vertical height of 28 fathoms. There was an air vessel on this column, but it was fixed on the side of the pipes and so could not trap the air that came up with the water, and there was no means of charging applied. This pump nearly always worked roughly and the wooden rods were often broken; the spurwheel of the engine also snapped and was renewed by a steel one, and three strong clack-pieces were burst. It was ultimately suggested that perhaps the air vessel was not doing its duty, and, having no other method, the oversman ran off the column. This was found to do a great deal of good as it caused the pump to go very much easier; and he also found that this had to be done every third day, and that, if he allowed it go longer, the pump began to work roughly, as before. It was a clear case of all the air that was in the air vessel escaping away with the water, and the pump, being left without a cushion for the shock caused by the high velocity of the water, went roughly. This arrangement of running off the column was carried out until the pump was no longer required, and there is no doubt that it prevented a large number of breakages. No diagrams were taken of this pump, but from a pressure gauge put on the pipes the pressure was seen to be three times the statical pressure when the air vessel was not acting. After this it was thought desirable to procure diagrams, which would show the pressure at different parts of the stroke, and M'Naught's engine indicator was used for the purpose, with good results.

2. The second case was that of the same class of Dook pump. At Pirnie a 10-inch combined bucket and ram pump had a velocity of 96 feet per minute, while the water had a velocity of 192 feet per minute; the column was 200 yards long and had a vertical height of 15 fathoms. There was an air vessel attached to this pump, which was charged by means of an air cock on the suction pipes, and the whole arrangement worked very well until the growth of water got too great for the pump going at a proper speed, and by-and-by the air cock got drowned. After a day or two the air evidently got exhausted from the air vessel, and heavy shocks came on to the pump and pipes and could be heard and felt even at the delivery end of the pipes. Owing to this extra pressure on the bucket the pump did not pump so much water, and before the cause was detected and a remedy thought of the pump itself was covered with water, and it looked as if the pump would be lost. A hole was, however, bored into the barrel, and this hole was tapped and a piece of pipe long enough to be above the water was screwed into it. On the end of this pipe a self-acting valve, which admitted air but shut during the back stroke, was fixed, and in ten minutes the pump was going as smoothly as ever it did, and mastered the water. Diagrams were taken of this pump, and show most distinctly the benefit of the air vessel when filled with air. With the air vessel the greatest pressure registered was 48 pounds per square inch, while without the air vessel the greatest pressure was 90 pounds per square inch, the statical pressure being 38 pounds per square inch. These diagrams are shown on Figs. 3 and 4.

3. This case was that of a 10-inch double-acting plunger pump going at 54 feet per minute, with the water in the pipes flowing at 150 feet per minute. The statical pressure was 104 pounds per square inch. The air vessel in this case could not be placed nearer than 20 feet from the first discharge clack and 35 feet from the other, and still with such a slow speed of pump and such a great distance from the clacks the highest pressure without the air vessel was 55 pounds per square inch greater than with it. The diagrams are shown on Figs. 5 and 6. The column of this pump is 480 yards long and has a vertical height of 40 fathoms. There is also another large air vessel fixed on the discharge column about midway up. This second air vessel was in working order when both No. 5 and No. 6 diagrams were taken. An air vessel is also attached to the suction pipes of this pump, and the same diagrams show the benefit of having an air vessel on the suction pipes, especially where they are long or small in diameter, or where the pump has to lift its water a great vertical height, or where the ram is moving very fast. In the case referred to the suction pipes are only 1 inch less than the ram; the height of them 100 feet. The vertical height the water is lifted is 15 feet. Figure 5 shows the pressure without the air vessel to vary from 8 pounds to nothing below atmosphere, whereas No. 6 shows that the pressure with the air vessel on only varies from 9½ pounds to 9 pounds below atmosphere, and as a consequence of the steady suction the pump is able to pump more water. It was found that after this air vessel was put on to the suction the pump could keep out the growth of water with half a stroke less speed, being reduced from 6 strokes to 5½ per minute.



AIR VESSELS ON PIPES AND PUMPS

FIG. 2.

4. The diagram shown on Fig. 9 is taken from a Kelty 20-inch double-acting plunger pump, with a vertical head of 90 fathoms, and having a large air vessel, which could not be fixed nearer than 90 feet from the clacks. This diagram shows the extra pressure required to lift the valves or clacks. The other diagrams already mentioned do not show this, because the pressure necessary to push the water through the discharge pipes is greater than that required to lift the clack, and so the pressure inside the casing does not fall the moment the clack lifts as it does in this case. The statical pressure is 234 pounds per square inch. The pressure required to lift the clack is 300 pounds, but the moment the clack lid lifts the pressure falls down to 270 pounds, which is the pressure necessary to push the water up the column of pipes, which are 17 inches in diameter. At first there was no air vessel on this pump and there was great difficulty in keeping the joints tight between the rams, which were horizontal, and the delivery pipes, which were vertical. There was no diagram taken before the air vessel was put on, because up to that time we had no instrument but the M'Naught indicator which was insufficient to register these pressures. A hydraulic pressure gauge was, however, put on, and it was found that, although the statical pressure was only 234 pounds, the gauge registered regularly 400 pounds, and occasionally 600 pounds per square inch. The diagram, Fig. 9, taken with the hydraulic indicator sketched at Fig. 10, shows how great is the improvement with the air vessel. Fig. 12 shows the type of engine and pumps referred to in this case; and as I believe it is the only case of the combination of Davey's horizontal compound surface and underground engines in

one, it may be interesting to those who, like Mr. Carlow, whose general design it was, do not like to risk a large engine at the bottom of the pit, where the growth of water is so heavy as to give little standage to prevent drowning in case of accident. The stroke is 7 feet, cylinders 42 inches, and 66 inches in diameter; steam pressure 65 pounds, diameter of ram 20 inches. The bell cranks work 17-inch and 15-inch buckets from the lower seams, which are 20 fathoms and 40 fathoms distant, respectively. The arrangement is found to work very satisfactorily. Before the air vessel was put on the level of the water in the column at the delivery end never fell below the level of the delivery pipe; but since it was put on the water dances up and down the pipes from 3 feet to 5 feet every alternate stroke, having the appearance of a column of water resting on a spring. When it was first put on it was found that this vibration took place, but every day the vibration grew less, until at the end of a week there was no vibration at all. This was owing to the air in the air vessel getting exhausted, the cause of which was a dip in the delivery pipe *a*, Fig. 12. A separate air pipe *b* was found to keep the air vessel always charged, the air being being got either from any leak in the ram stuffing boxes, or when the engine was going on air, or by a small cock on the suction pipes for the purpose when going solid continuously for some days.

AIR VESSELS ON PIPES AND PUMPS

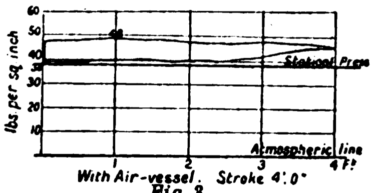


Fig. 3.

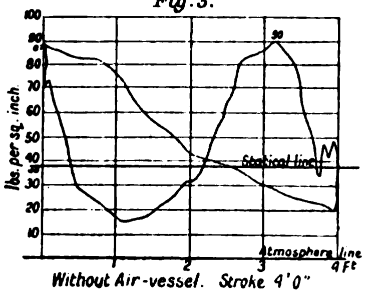


Fig. 4.

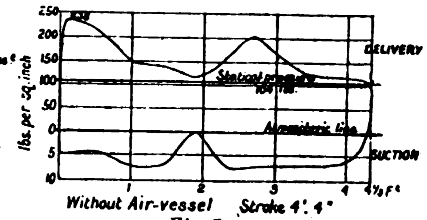


Fig. 5.

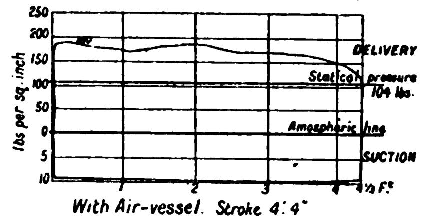


Fig. 6.

Fig. 7 Without Air-Vessel

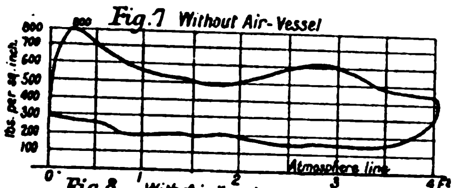


Fig. 8. With Air-Vessel

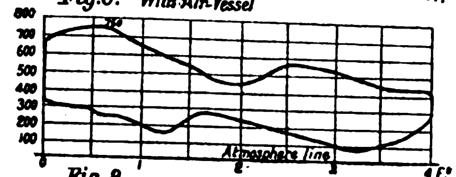


Fig. 9.

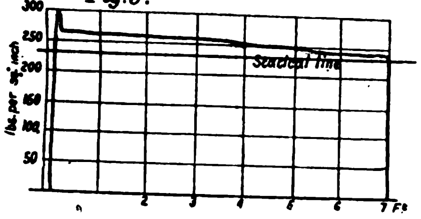


Fig. 10.

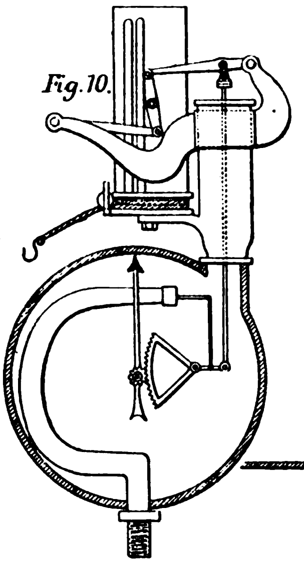
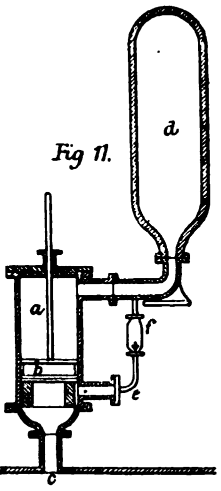


Fig 11.



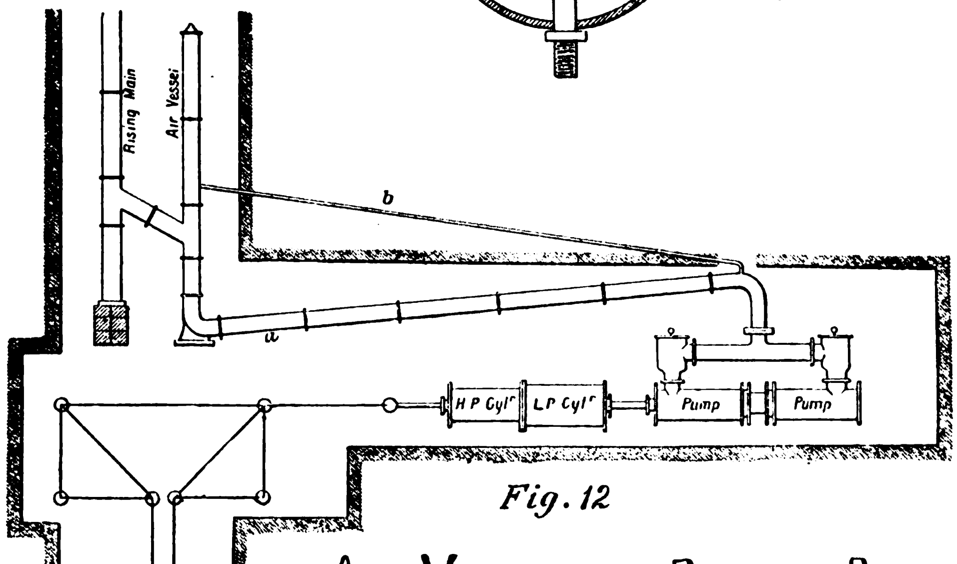


Fig. 12

As already mentioned, Fig. 10 shows the hydraulic indicator used for taking the diagrams under high pressures. It had to be made specially to order by Schäffer & Budenburg, as all our efforts at finding such an instrument were without success. It is simply the usual arrangement for fixing the paper, and the pencil for marking it, as in the Richards indicator, with a hydraulic pressure gauge attached to indicate up to 3,000 pounds per square inch. The mode of attachment will be readily followed from the sketch.

5. The diagrams shown in Figs. 7 and 8 are taken from the ram casing of the surface pump of a Moore hydraulic pump, and show a reduced maximum pressure with a piston air vessel as against its working without an air vessel. This pump is worked by a beam condensing rotary engine, geared 4 to 1, and it was found that the momentum of the flywheel carried on the rams and caused shocks which with a direct-acting Davey engine would not have occurred. It was to relieve the pump from these abnormal shocks that the air vessel was put on, which it does to a great extent when properly charged.

Air vessels to be of any use must be kept constantly charged with air; and, while there are many ways of charging them, there are five which I would recommend, partly from actual experience and partly suggested from that experience: 1, running off the column of water; 2, by means of a pet cock on the suction; 3, by the system shown on Fig. 1, at C; 4, by the system shown on Fig. 1, at D; 5, by means of a small air pump.

The first method is certainly a very clumsy one, but it is, nevertheless, often used. It also makes it necessary to have an air vessel of great capacity, seeing that with a heavy head the air is compressed into such small volume. For example: with a head of 100 fathoms, the air, after the column is full, if let in at atmosphere pressure, would only occupy one-eighteenth of the volume of the air vessel; or, in other words, if the air vessel was 18 feet long, the air would only occupy one foot at the top, which is not sufficient to be effective, unless the sectional area is all the greater.

The second method of charging is a most convenient and effective plan, and, except when the head is over 100 fathoms vertical, is found to serve the purpose well. The air is drawn in in small quantities; either at the pet cock on the suction or at the suction holes of the rattlehead, also any air sucked in at the packing glands is caught. The air passes right through the pump casing and valves, and when the air vessel is fixed in the correct place the air is trapped into it. The objection to this mode is that the pump draws a fraction less water, and the ram or bucket is apt to jump at the beginning of the stroke should there be more than a very small quantity of air in the casing at any one time. This tendency, of course, increases with the vertical height pumped; but I have seen this plan adopted on pumps having 15, 20, 40, 90, and 100 fathoms of vertical head with good results.

Refer to Fig. 1, at C, for the third method. We have there a separate pipe or chamber C, fitted with a common stop-cock *e*, a self-acting inlet valve *f*, a self-acting outlet valve *g*, with the pipe *h* from the column, and the pipe *i* to the air vessel, also an air cock *k*. To give the air vessel one charge of air the following is the process adopted: Shut *f*, open *e* and *k*, and, as soon as the water in C is all run off and C full of air, shut *k* and *e* and open *f*, the water from the column *b* will then enter C, and send all the air out into the air vessel through *g* and *i*. This process must be repeated as often as is necessary. The objection to this process is that it is not automatic, and requires to be done by the man in charge.

The process as shown at D, Fig. 1, is, I consider, the best under all circumstances. The apparatus consists of a small chamber D, a self-acting air valve *l*, opening inwards, a self-acting outlet valve *m*, and a pipe *n*, which leads the air into the air vessel. The chamber D is either fixed direct on to the pump casing *p*, or a pipe may be led from D to *p*, and thus D can be placed in any convenient position out of the way. The valve *l* opens automatically during the suction stroke of the pump, a small quantity of air is thereby drawn into D, and during the forcing stroke of the pump that air is expelled from D through *m* and *n* into the air vessel, and the same takes place every stroke that the pump makes.

The last method is by means of a small air pump, either worked by hand, or, which is much better, by some moving part of the pump. This action is familiar to every one and need not be described.

I will now offer the following observations which readily are suggested by what has been already said. Every pump which has the ram or bucket moving at a greater velocity than 40 feet per minute, and has the area of the pipes not larger than the ram or bucket, will work more smoothly with an air vessel than without one.

Regarding the position of the air vessel, the nearer it is to the casing or barrel the better. If only one is used it should be placed immediately above the discharge clack—that is, on the delivery side of it. Then if the column be extra long, as in pumping up an incline or any other road where a long discharge column is required, a number of air vessels might be fixed; but the number of these and the distance apart will necessarily depend on the velocity of the water inside the pipes. It is quite evident that if a long distance intervenes between the ram or bucket and the air vessel, the shocks which have their origin in the casing or barrel will not be so readily relieved by the air vessel as if a short space intervened; because there will be a greater body of water to move, the inertia of which will be sufficient to create a considerable pressure, though by no means so great as there would be if no air vessel was there at all, unless we imagine some extreme case, as a pump getting suddenly totally fast at the foot, and dropping full stroke, when, of course, nothing could save the casing or barrel. If these conditions presented themselves to a moderate extent I believe a piston air vessel, as shown in Fig. 11, would be of good service. Its action will be described further on.

It is also of vital importance to place the air vessel in such a position that a regular supply of air may find its way into it and thereby replace the air that leaks away with the water, else a few days will be long enough to totally exhaust the air and leave the action of the air vessel *nil*.

The best form of an air vessel for a vertical column is that shown on Fig. 1 at A B, where it can be charged naturally or otherwise. The rising column A B is increased in diameter and an inside pipe A brought down near to the bottom of the chamber, where is fixed a cup *b*, which diverts all the particles of air flowing with the water into the chamber. The simplest way to fix an air vessel on to a horizontal line of pipes is, as shown in Fig. 2, exactly on the top side of the pipes.

Figure 11 shows a piston air vessel, the same principle as that on our Moore's hydraulic surface power pump, but drawn so as to show its applicability to a single-acting pump. I consider it could be placed with much advantage on the casing or barrel of a plunger or bucket pump. It consists of a cylinder *a* in which is a piston *b*, which has direct communication on the underside with the casing or barrel *c*, and on the top side with the air vessel *d*. There is a connecting pipe *e* from below the piston to the top of the piston and in this is fixed a self-acting valve *f*. This valve is constructed with a spiral spring on the top of it, so that it can be screwed down or eased off, so as to give the required pressure in the air vessel. If the normal pressure in the air vessel is required at, say 300 pounds, this valve will be screwed down so that it will not pass any water unless the pressure in the air vessel becomes less than 300 from leakage at the piston, the pressure in the air vessel will thereby be sustained. It is also necessary to attach an air charger on this air vessel, but the leakage of air is very slight. This piston air vessel will act exactly the same as an ordinary one—that is, it will give and take each stroke of the pump and has the great advantage of being close up to the place where, with few exceptions, all the shocks have their origin, that is, between the suction and discharge valves.

Regarding the capacity of an air vessel, I have made no investigations. The air vessel on the Kelty pump shown in Fig. 12, and from which the diagram shown in Fig. 9 was taken, is four times greater than the volume of the ram. The one on the Pernie pump, the diagrams of which are shown in Figs. 3 and 4, is three times that of the ram. The one on the Pernie pump, the diagrams of which are shown in Figs. 5 and 6, is twice that of the ram, the suction air vessel three-quarters that of the ram, and the piston air vessel twice that of the ram. I think, however, that no air vessel should be of less than four times the capacity of the ram or bucket.

WAVE MOTOR AT OCEAN GROVE, N. J.

The new wave motor in operation at Ocean Grove, N. J., during the season just closing, has been an object of interest to many visitors, and differs wholly in design from that erected last year. The latter consisted of a thick wooden blade, strongly built, and measuring about 5 feet wide by 8 feet long. The blade was hung from pivots at its upper corners between two piles of a dock, and was free to be swung to and fro by the waves. Projecting from the upper edge was a rod, so connected as to operate a pump which elevated salt water to a tank, from which it was delivered to carts for sprinkling the streets.

The new motor depends for its action upon the rise and fall of a float acted upon by the waves. A frame, pivoted at one end, between piles, carries at its other end a float, from which a wire rope extends over a set of sheaves having a weight secured to it. Attached to this rope is a second one passing over another sheave and operating the plunger of a pump, the water being delivered by an overhead tank. The float weighs 2,500 pounds, the weight at the end of the wire rope 2,000 pounds, and the tank has a capacity of 12,000 gallons. As the float rises on a wave, the counter-weight descends and lifts the pump plunger, which performs the return stroke by its own weight, as the counterbalance is lifted by the fall of the float. The pump has a bore of six inches and a stroke of six feet, and is single acting. Allowance is made for the rise and fall of the tide by changing the length of the rope leading from the weight to the plunger. Provision is made for lifting the float entirely out of the water when the waves are running unusually high.

A NEW GRINDING MATERIAL.

According to *The Engineering and Mining Journal*, crushed steel is said to be coming into use for cutting stone. It appears to be made by quenching very high carbon steel in cold water from an excessively high temperature, such as would overheat steel for most purposes. This renders it not only hard but rather brittle, so that it is possible to pulverize it; it is crushed in a stampmill, and sifted closely to size. It is said to be not only cheaper, but much more effective than emery, giving a better polish and quicker, and lasting much longer.

The tunneling of the Khojak Mountains marks an important step in advance in the project of building a railroad from the lower Indus Valley to Kandahar, in Afghanistan. The Khojak tunnel, though not yet completed as regards lining, is one of the longest in the world, having a length of 12,456 feet.

The Elmore Patent Copper Depositing Company (Limited), of London, England, are the makers of the electrically deposited copper pipes which, of late, have attracted so much attention. The pipes are made of any size up to 3 feet 4 inches in diameter and 10 feet long.

LOWERING A WATER MAIN AT PRINCETON.

A few months ago it became necessary to lower a water main at Princeton, N. J. The size of the main was 10 inches, and it was lowered, for a distance of 650 feet, from 2 feet 8 inches in the center of the trench, to nothing at the ends, so as to keep 4 feet of earth over it after the grade of the road was straightened at that point.

The method of lowering is shown in Fig. 1. After the pipe was uncovered, a short piece of chain was passed around it in front of each joint, and the ends were brought up and hooked over the lower end of a long screw, which was bent up so as to form a hook.

These screws passed through pieces of timber, placed across the trench, and each of them had a nut with a long handle, by means of which it could be raised or lowered. After the pipes were thus supported, the trench was excavated below them to the required depth, most of the weight of the pipes being taken on blocking, which was built up beneath them to keep them from swinging and to prevent injury from any accident to the chains or screws. In making this excavation much difficulty was experienced from an unexpected ledge of rock, which had to be wedged and sledged out piecemeal, much increasing the time and cost of the work. As shown in the sketch, the trench was wider on one side of the pipes than the other, for convenience of excavation, the total width being about 3½ feet.

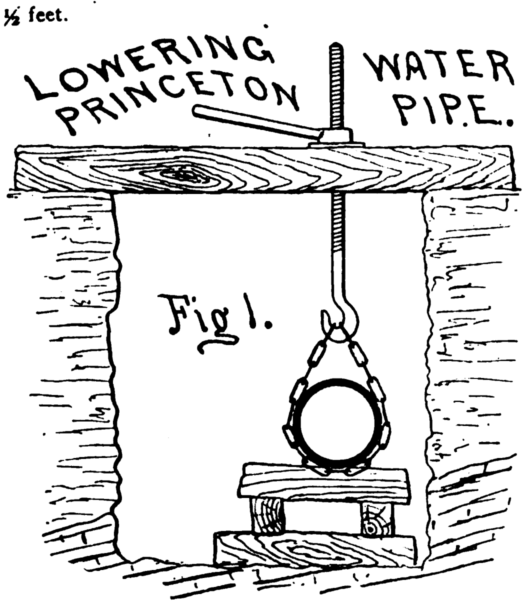


Fig 1.

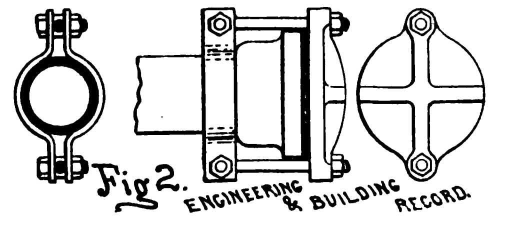


Fig 2.

When everything was ready, a number of men, unwinding the nuts at a speed roughly proportioned to the depth the pipe had to be lowered at each point, gradually settled the pipe to its bed, the blocking being removed as it went down. The pipe thus lowered was the supply main from the stand-pipe to the distributing system, and it was the intention to have lowered it without taking off the pressure, usually about 70 pounds. With that object in view two 4-inch branches were capped, as shown in Fig. 2, and the house services were temporarily connected by short lengths of hose. To keep the pressure on, however, would have involved the simultaneous lowering of an adjacent hydrant and gate, connected by a short branch, and it was finally concluded to take the pressure off the main while lowering, the town being meantime supplied through a 4-inch by-pass.

The pipes were of the usual length, 12 feet each, and were estimated to weigh, with the contained water, 1,100 pounds apiece. The chain was of ⅜-inch iron, made with long links for convenience of hooking on. This would give a stress of at least 2,500 pounds per square inch, and in view of the probability that the rigidity of the joints might cause an unequal distribution of the load, it was thought by those in charge that a ½-inch chain would have been better, although no accident occurred. The screws were 1 inch in diameter and from 1½ to 4½ feet long, and the length of the handle on the nut was 18 inches.

The cost of the work was as follows: 362 feet of chain, $33.80; 40 screws, $42.53; 2 caps for 4-inch pipe, $10.27; lumber, $4.08; total for material, $90.68. Excavating and back filling, $365.51; carting timber, blocking tools, etc., $15; night watch, $34; sharpening tools, etc., $2.65; total for labor, $417.16. To this must be added $5.10 for incidental expenses, and $16.45 for building a manhole (4.50 per mason and $11.95 for brick and cement), bringing the total cost up to $529.39. The blocking was borrowed for the occasion and so cost nothing. The whole operation was planned and successfully carried out by James E. Burke Superintendent of the Princeton Water Company, and Martin Bergen, Chief Engineer of the pumping station.

The 4-inch pipe closer, shown in Fig. 2, consisted of a rubber gasket 8½ inches in diameter and half an inch thick, supported by a ribbed cast-iron plate, drawn up by two ¾-inch bolts, having eyes formed in one end through which passed two other short bolts. These united the two halves of a collar of 2 by ⅜-inch iron which embraced the pipe just below the hub. It answered its purpose very well.

AN EXPERIENCE IN THE CONSTRUCTION OF A GAS-HOLDER TANK.

In a paper on gas-holder tank construction, recently read before the Engineers' Club, of Cleveland, O., and published in the *Journal* of the Association of Engineering Societies, G. A. Hyde gives the following data:

In 1872 he was called to construct a gas-holder tank for the Titusville Gas Company, at Titusville, Pa., under the particular and unusual condition of superabundance of water in the earth. The location was a level piece of ground in the valley adjacent to a creek and the excavation coarse gravel and small boulders. The excavation was made 12 feet below surface of ground, 6 feet of which was below the bed of the creek. To make the excavation and construct the tank wall it was necessary to raise 8,000 to 10,000 barrels of water per day. The method of procedure to accomplish that end was as follows: A well was sunk outside of the space to be occupied by the tank and to a depth sufficient to drain the earth below the required depth of the tank wall. After the excavation had been made to grade of the bottom of the footing a ditch was dug outside of the line of footing deep enough to receive a line of sewer pipe ranging in size from 10 inches to 4 inches in diameter, running both ways from the well to the opposite side of the tank. The joints were left open to permit the free access of the water from the gravel. Then followed the laying of the footing and the building of the tank wall, during which time the pump was kept in constant operation.

A 10-inch iron pipe was laid under the footing at a point opposite the well, through which to convey the water collected on the inside of the tank wall. Another row of sewer pipes, ranging in diameter from 10 inches to 4 inches, was laid along below and near the inner line of the footing, and connected to the iron pipe leading to the well. From a few points inside of the tank, where abundant springs appeared, a line of 4 inch sewer pipe was laid to the larger sewer pipe, by which means all water appearing was safely and surely conveyed to the pump-well.

The whole surface of the bottom of the tank was then covered with cement concrete to the depth of 8 inches, but leaving a vent hole 10 inches in diameter at the junction of the sewer pipes and the iron pipe, to permit the inflow of water into the tank in the event of the stopping of the pumps, and the outflow of the water from the well.

When the concrete was completed and properly set the holder was built, and then a plate was secured to the vent hole and covered with cement mortar. The water from the pump was then turned into the tank until filled to the top, completing the undertaking.

Experiments are being made by the Delaware and Hudson Railroad Company to test the adaptability and superiority of steel ties for railroad uses. On a section of the road leading south of Ballston, N. Y., for nearly half a mile, the wooden sleepers have been removed and the track reconstructed with the steel ties. The test of the safety and adaptability of the steel ties is being made under the supervision of A. J. Swift, chief engineer of the road, and they will be adopted or rejected upon his recommendation.

WORK ON THE NICARAGUA CANAL.

A **Washington** dispatch states that A. J. Menocal and several other gentlemen of the engineering staff of the Nicaragua Canal construction corps have just reached Washington from Greytown on a short leave of absence. They report commendable progress already on the great engineering project. Several million dollars have already been spent and the active work of canal construction is now well under way.

The actual dredging for the canal on the gulf side has begun. The telegraph line from Greytown to Lake Nicaragua, connecting with the lines on the Pacific coast, is completed and the railroad from Greytown to the lake along the line of the canal is well under way.

At present about 1,800 men and a corps of 80 engineers are on the ground and at work. The work preliminary to work on the canal proper was the building of the great pier at Greytown, extending 1.800 feet out toward the deep water. This pier is necessary to protect the entrance to the canal and work on it was begun early last January. Seven hundred feet of the pier has been completed. This pier has proved a lucky enterprise. When work was begun on it the entrance to the harbor was obstructed by a sandbar. The 700 feet of pier already built has so changed the current that this obstructing sandbar has been almost entirely worn away by the action of the water.

VITRIFIED PIPE FOR SEWERS.

In an address on the sewerage of Columbus, O., delivered at the Columbus Board of Trade Auditorium a short time ago, Col. George E. Waring, Jr., said, in discussing the plans for a proposed new intercepting sewer:

"The specifications call for the building of the upper end of the sewer, where it is 24 inches in diameter, with 24-inch pipe. I have myself recommended frequently, in years past, the use of vitrified pipe of as large a diameter as 24 inches. I shall never do it again. Those pipes are not reliable, and I do not know to-day of a 24-inch sewer, nor a 20-inch sewer, nor an 18-inch sewer constructed in that way that I should consider reliable. The material is not a safe one to use in these large diameters, and I shall hereafter use nothing larger than 15 inches. Everything beyond that I shall make either of concrete or of brick work. * * *

"I noticed also that it is provided in the specifications and in the contract that, where the sewer is 3 feet in diameter, it shall be built, as we say, of two rings; that is, that it shall be 8 inches, and a streak of mortar thick, instead of 4 inches. It seems to me that this is a waste of material, and will fail to secure the best results. There is no reason why a 36-inch sewer may not be made of a single ring of brick. Any engineer, contractor or inspector attempting to build a sewer of a single ring, will be very sure to have a good quality of brick, good cement, and good workmanship; whereas, if he is allowed to use two rings, he may put in anything he likes, expecting that the mere bulk of material will carry him through.

"I have had a good deal of experience with sewers of that size, with both 8-inch walls and 4-inch walls, and in my opinion the 4-inch walls are stronger, the joints tighter, the material harder, and the friction of the stream has a great deal less effect in washing out the mortar and leaving it rough, because the mortar is better. I therefore recommend that so far as the sewer is 3 feet in diameter, it be reduced from the double ring to the single ring."

We shall be glad to learn the experience of other of our readers who have used large sized vitrified pipes for sewers.

With regard to the number of courses of brick in a 36-inch sewer we should say the character of the soil should determine that.

According to a Washington dispatch, the Commerce Committee of the House has agreed to a favorable report on the bill introduced by Representative John M. Wiley authorizing the construction of a bridge across the Hudson from Manhattan Island to the New Jersey shore. The bridge has received the sanction of the Legislatures of both States. The bill provides that the structure shall be erected not above Fifty-ninth Street, New York.

Secretary Buchholz, of the Board of Experts of the Brooklyn Bridge, sent out notices recently that the time for the reception of plans for increased terminal facilities would be extended twenty days from September 1. The reason for this is that very few plans have been received.

The 110-ton traveling crane at the gun shops at Washington, D. C., is said to be the largest in the world. Including the frame work on which the crane rests, the cost amounted to $100,000.

THE RIGHTS OF STREET CAR COMPANIES AND OF LOCAL AUTHORITIES.

The relative powers of street car companies and local authorities in those districts traversed by the car lines, so far as the power over the maintenance and construction of the road is concerned, has recently been settled in England in the Court of Appeal, in connection with the Bristol Tramway Company on the one hand and the Corporation on the other. The Tramway Company when laying the lines originally laid between the metals, and to a width of one and a half feet on each side, granite sets, the roadways at that time being to a large extent macadam. The Corporation, having determined later to adopt a system of wood paving, called upon the car company to substitute wood for the granite at their own expense. This demand was subsequently withdrawn, the Corporation announcing their intention of laying down the wood themselves throughout. To this determination the car company took exception, averring that in the Tramways Act of 1870 they had certain rights as to the roads with the power of appealing to the Board of Trade for arbitration. They accordingly obtained an injunction against the Corporation, restraining them from making any change pending such an appeal to the Board of Trade. The Corporation took the question to the Court of Appeal, and obtained judgment on the ground that the powers of reference enjoyed by the various car companies to the Board of Trade did not embrace those of authority over the roadways traversed by their lines. The court called attention to the fact that the act expressly stated that local authorities should not be interfered with so far as their powers of alteration or improvement of the roads was concerned and that the rights of the car companies were limited simply to the question of user.

PETROLEUM ENGINES FOR LIGHTHOUSES.

An interesting application of the Priestman petroleum engine has just been made at the Corsewall Lighthouse, Firth of Clyde, Scotland, where Mr. D. A. Stevenson, the engineer to the Commissioners of Northern Lighthouses, has adopted this motor for working the fog signal apparatus which has just been erected there. The signal, according to *Engineering*, is produced by a siren, and it is to supply compressed air for this that the Priestman engine has been adopted. From the circumstances of the case, steam could not be used, and hot-air engines so frequently used in lighthouses are cumbrous, whilst if gas engines are used it is necessary to fit up a gas-distilling apparatus, which again takes up a good deal of room. The engines at Corsewall are three in number, and of five horse-power each. They use the same heavy petroleum that is used for lighthouse lamps, and hence there is no danger of an explosion occurring as there would if benzoline or naphtha was used. The engines, of which one is a reserve in case of a breakdown, drive a set of compressors through a helical gearing. The air is compressed, at a pressure of 40 pounds above the atmosphere, into the receivers from which the supply for the siren is taken.

BOOK NOTICES,

Academy Architecture and Annual Architectural Review, 1890. Published by Alex. Koch, architect. London, England. Price, $1.50.

The first appearance of Academy Architecture, last year, proved so successful that the London publishers concluded to issue also an American edition for this year. The little volume has just been brought out, and contains 108 pages, given up entirely to illustrations. These represent a selection of the most prominent architectural drawings hung at the Royal Academy Exhibition, and a review of interesting architectural subjects carried out, or designed, during the last few years. While the illustrations are, perhaps, not the most desirable specimens of the engraver's and reproducer's art, there can be little question that the matter presented will prove interesting and valuable to architects, draughtsmen, and designers, as well as to students and lovers of art generally.

The American edition is in the hands of William Mueller, 695 Broadway, New York.

Cleveland, O., claims the lead in the American shipbuilding industry on the lakes. Since January 1, 1890, the vessels built at the different points number 78 steamers, the gross tonnage being 63.922, and 18 barges and sailing ships of 15.315 tons. Last year the vessels built on the great lakes measured 107,080 tons.

Correspondence.

Communications giving information or opinions on matters of general interest to the engineer, the architect, the contractor, or the municipal officer, will be welcomed in this column. Fairness will suggest that when communications are sent simultaneously to this and other journals we should be informed of it at the time. Anonymous letters will not be noticed.

EXPERT ADVICE FOR ARCHITECTS.

New York, September 8, 1890.

To the Editor of The Engineering and Building Record:

Sir: In your issue of September 6, your article entitled "A Lesson For Architects," is very much to the point. Many architects must, however, open their eyes to existing practices, which are unprofessional and contrary to the interest of their employers—viz.: their selection of favorite contractors who will supplement the deficiencies of the architect on points of construction. Some of our architects are known to have their iron construction designed in this way. Can they make themselves believe that this work is done absolutely gratis? Do they not appreciate that their employer is paying an additional fee, hidden, of course, within the bid? Do they understand that such contractors are necessarily looking out for themselves far more than they are for the owner?

Is an architect doing his full professional duty when he thus delegates a large part of the design of his building to such parties? Only one conclusion can possibly be drawn from such a practice, and that is, the architect is not willing to sacrifice any portion of his fee to a consulting engineer, who would have no interests to serve but those of the architect and owner.

The results, as pointed out in your article, will never be obtained until architects realize that they must sacrifice some portion of their fees to competent engineers, or else, that they must frankly state to the owner that it would be greatly to his interest, in getting both better and more economical results, if he would allow an additional professional fee for the employment of competent engineers to advise upon the foundations, structural work, sanitation, etc., of the building under contemplation.

Consulting Engineer.

THE MIDDLESBOROUGH, KY., WATER-WORKS.

Middlesborough Water Company,
Middlesborough, Ky., September 7, 1890.

To the Editor of The Engineering and Building Record:

Sir: I don't know if you have ever received a prospectus of the "Marvelous City" of Middlesborough, Ky., or not. I therefore send you one by this mail, and as soon as the new one, that the association is getting out, is ready, I will forward one of them. About a year ago there were two or three houses in this valley, to-day there are hundreds. The residents are temporarily supplied with water from "Summitts Fork" through a 3-inch pipe by two Davidson No. 3 pumps, located about a mile from the city, pumping to tanks on Arthur Heights, about 100 feet above the main streets.

Work was commenced in July for quite an extensive system. A storage reservoir of some 400,000,000 gallons capacity will be formed by damming up Little Yellow Creek, located about a mile and a quarter from the center of the city, between the main Cumberland range and Mingo mountain. The dam will be of earth embankment with a core of solid masonry, 5 feet thick at flowage line, increasing in thickness to base, which will rest on rock bottom. The pumping station will contain one 6,000,000 vertical pumping engine, with space for others when required, and a 24-inch force main to 1,000,000 gallon tank on summit of Mingo mountain, 275 feet above plain of city.

Contract has been awarded to Anniston Pipe Works, of Anniston, Ala., for all 20 and 24-inch pipe (about 1,000 tons), and to the South Pittsburg Pipe Works, of South Pittsburg, Tenn., for all smaller sizes and all specials. The Cunningham Iron Works, of Boston, will construct the stand-pipe on Mingo Mountain. The city contracts for 50 fire hydrants, at $65 per annum for first 50; $60 for next 50, and $50 for all over 100. The meter system has been adopted, and the National Meter Company of New York, will furnish Crown meters. The Ludlow Valve Company has the contract to furnish all valves and hydrants. Pumps have not yet been ordered, as the engineer is not yet ready with plans. Professor Waller, of New York, has analyzed the water of Little Yellow Creek, and pronounces the quality excellent for domestic and manufacturing purposes. Work will be pushed as fast as possible, and it is expected that water will be turned on in July, 1891.

The dam will be started in a few days.

A. H. Martink,
Chief Engineer and Superintendent.

A **steep** cable railway has lately been built up the slopes of Monte San Salvatore, near the Lake of Lugano, Italy. The power for working is obtained from a stream in the vicinity, and is transmitted electrically to the operating station. The water is led through a long iron pipe to two Girard turbines coupled direct to Oerlikon dynamos. The road is about a mile long and has grades varying from 17 to 60 per cent.

Questions and Answers.

All questions relating to building construction, paving, sewerage, water supply, or kindred subjects, will be welcomed in this column provided they relate to matters of general interest and are not such as should properly be referred to a consulting engineer. Answers will be carefully prepared and a proof of both question and answer mailed to the inquirer as early as proper consideration will permit. They will be published for the benefit of other readers as soon as convenient. The full name and address should be given, not necessarily for publication, but as a guarantee of good faith, and to facilitate further correspondence in case the question is not sufficiently explicit.

Inquiries of the Editor, in order to secure prompt attention, should *not be written on the same piece of paper as a communication* to the *Publishing Department.* Letters renewing subscriptions are sent to a clerk in the publishing office, and matter for the Editor, if in the same enclosure, is likely to be overlooked unless it is on a separate piece of paper, so that it may be promptly sent to the Editor.

FIRE STREAMS.

"G. S.," of Billings, Montana, writes: "How far can a fire stream be thrown under the following conditions? We have two 500,000-gallon pumps (a Dean and a Blake); suction to pumps is 12-inch pipe, 40 feet long; discharge is 8-inch pipe, 7,920 feet long; from 8-inch pipe to hydrant there are 2,240 feet of 4-inch pipe; from hydrant to end of nozzle there are 1,300 feet of hose, nozzle has 1-inch opening. What I want to know is this: How many pounds pressure ought there be at the nozzle when we have 160 pounds pressure at the pumps? Also, how long a stream had we ought to get when the nozzle is held at an angle of 45 degrees? We have four and a half miles of main pipe (Kalamein) with 160 taps (¾ and ½ inch), you can safely figure on one-quarter of them running all the time for sprinkling purposes."

[We know of no formula that could be applied to the above case with anything like satisfactory results. Most of the conditions entering the problem are of a decidedly variable character and cannot be properly taken into account in a calculation. We would refer our correspondent to a paper read by John R. Freeman some months ago before the American Society of Civil Engineers, and, also, in more condensed form before the New England Water-Works Association, in which an exhaustive account is given of experiments relating to fire streams. An abstract of the paper is given in THE ENGINEERING AND BUILDING RECORD, Vol. XXI., pages 71, 137, 183, 214, 325, and 340. Study of what was given of the paper in our columns will prove alike interesting and valuable to G. S.]

BOOKS ON FLUMES.

H. T. KOCH, of the Castle Creek Water Company, Aspen, Col., asks: "Have you any works treating of and describing flumes?"

[So far as we are aware there are no books treating solely of the subject of flumes. The literature of the subject is somewhat scattered in the shape of contributions to engineering societies, chiefly Western, and can be found in their transactions.]

STEEL FOR WATER AND OTHER PIPES.

REFERRING to the article entitled "Steel for Water and Other Pipes," published in our issue of August 2, 1890, The Steel Pipe Company, Limited, of Kirkcaldy, Scotland, write:

"We inclose herewith copy of a letter which we have sent to the Secretary of the American Water-Works Association, and shall be obliged if you will kindly send us any further particulars referring to the uses of steel for water, etc., which may come under your notice."

[The letter addressed to the American Water-Works Association reads as follows:

"We notice in THE ENGINEERING AND BUILDING RECORD of August 2 that reference is made to a discussion upon the uses of steel for water and other pipes, and we shall esteem it a favor if you will kindly send us a copy of the proceedings. We may mention that the managing directors of this company are the pioneers in Great Britain of this industry, and that the steel pipes referred to in the above article were made to the specifications and under the supervision of our managing directors, Messrs. A. & J. Stewart, and The Steel Company, of Scotland, Limited, being sub-contractors, and all the other pipe lines referred to were manufactured by us. This company is a new company organized to carry out steel pipe line contracts, and has been instrumental in introducing steel pipe lines to the British colonies, to South America, Africa, and nearly all countries in the world."]

FIVE years ago the electric light began to be used in Japan. Since then there has been a rapid development in electrical matters in that country, and the capacity of the present electric light stations is 22,300 lights.

DOMESTIC PLUMBING HEATING LIGHTING & VENTILATION ENGINEERING

HEATING AND VENTILATING SCHOOL-HOUSES

(Concluded from page 220)

THE general arrangement for the location of a furnace is shown in Fig. 8. The furnace is placed in the basement, of course, and the flues, which are also shown in Figs. 9 and 10, are placed as near as possible to it, one of them going up to the first story, and the other to the second story, the one going to the second story being the smaller flue, because its greater height gives it a stronger draught power than the shorter one. These areas are about as two to three. One of the special features of this arrangement is this, that the whole space at the front end of the school building is a cold-air box, having three windows on as many sides opening into it, so that the furnace is virtually standing out of doors. It does away with the chief objections to the cold-air box, with its necessarily contracted area and its frictional resistance to flow and the retarding effect of bends, etc., for the access of air through the windows and large chambers is relatively free. These windows are arranged to provide against failure to secure air supply in the case of strong winds.

The exhaust aperture is at the floor, partly underneath and partly above the platform, on the same side with the air inlets. In Figs. 9 and 10 note the relative position of the supply and vent apertures. Manifestly, in such a room as this, with three cold sides, the warm air rising to and floating at the ceiling will be chilled by contact with the walls and windows and thrown down; it will then tend to move across the floor and away from the walls and in directions whose resultant point would be somewhere in front of the platform, and the vent opening might perhaps better be at that point, but convenience in construction and cleanliness also favor the location shown, and efficiency is practically unimpaired. The areas both of vent and of discharge are in all cases large.

The furnace pipe is made to pass around and up through the discharge shaft, as shown in Fig. 11. An 8-inch pipe is fitted to the furnace collar and that pipe is enlarged to a 10-inch within the flue in order to get a larger surface for heating the air in the flue, and also to secure a slower movement and longer retention of the hot gases through it. But there are times when a greater heat will be wanted than can be furnished by this pipe. When, in warm weather, the temperature of the furnace is lowest, we want the highest temperature in the vent flue, and by the arrangement thus far considered we get the reverse of what is actually needed. But if at such times the furnace heat not wanted in the rooms could be diverted into the ventilating flue the desired condition would be realized. The figure shows a 15-inch pipe connecting the ventilating shaft with the hot-air chamber of the furnace, and through which, by the opening of a damper, the heated air may be passed. So that when there is an excess of heat in the furnace for the requirements of warmth, it is possible to open up this damper to admit the heated air to the vent flue, the air passing from the furnace directly into that flue, and so giving the extra warmth required. To be sure, we are then passing fresh air into the flue and in so far displacing foul air, but Professor Woodbridge considers that a better method than putting a stove into the vent flue of a little school-house and trusting to the janitor, who visits the school but once or twice a day, to look after and keep up the fire, or even trusting to the teachers, who have something else to do than to poke fires and feed them with coal.

This vent flue, as well as those for supply, must, of course, be controlled in area. It is done by means of two dampers hinged as shown, and opened to requirement by cords passing over pulleys and brought as one down into the principal's room, with means for securing it at notches, which might be conveniently marked for 0°, 10°, 20°, etc., weather, as indicated by an outside thermometer.

Figure 12 shows a method of arranging the inlet windows so as to prevent loss of air. Ordinarily, if the air is blowing in through a chamber window strongly on one side, it will be, in part, passing out on the other, or leeward side, and to that extent will be lost. Therefore it is desirable to arrange the inlets so that in whichever way the wind blows, the desired quantity shall be passing into the room. Suppose a long, vertical box, covered with wire cloth, through which the air can easily pass, be placed before each window, and that over that wire netting light gossamer strips or valves are hung. With the least air pressure these are thrown out, letting the air in freely. Whenever the wind blows in through the window the valve is open and the air passes through, but the moment the wind takes the opposite direction these valves close. Therefore, if the air blows in strongly on one side it merely closes up all the valves on the other sides and keeps in the chamber all the air that would otherwise escape, and the influence is at once felt in the pressure produced on the furnace. In still weather the air will come in through all these windows gradually, slightly lifting the valves, and whenever the high wind would tend to disturb the action of the furnace, such action is prevented by the closing of the leeward valves.

One thing more in connection with this furnace. It has been said that when the air is warm outside but little heat is wanted in the furnace, and that it would better pass up the ventilating flue. In other words, very little heat is wanted from the furnace in warm weather, and in cold weather the total produced is wanted. It must be said that this furnace is not altogether what could be desired for the transfer of heat from the gases to the air. Although we have large area and intimacy of contact on the outside, we have not a correspondingly large area and provision for intimacy of contact on the inside. The combustion gases may pass off from this furnace pretty hot. What is wanted here is, of course, some means of transferring to the supply air that otherwise waste heat.

Figure 13 shows an arrangement proposed for this purpose. The direct and vertical pipe which goes into the vent flue has a damper which may be closed. The closing of this damper forces the hot gases to pass through the long trombone-formed pipe, shortened in the figure for want of space. The combustion gases make a tortuous course; the current is broken at each turn, and the conditions are favorable for a large transfer of the contained heat.

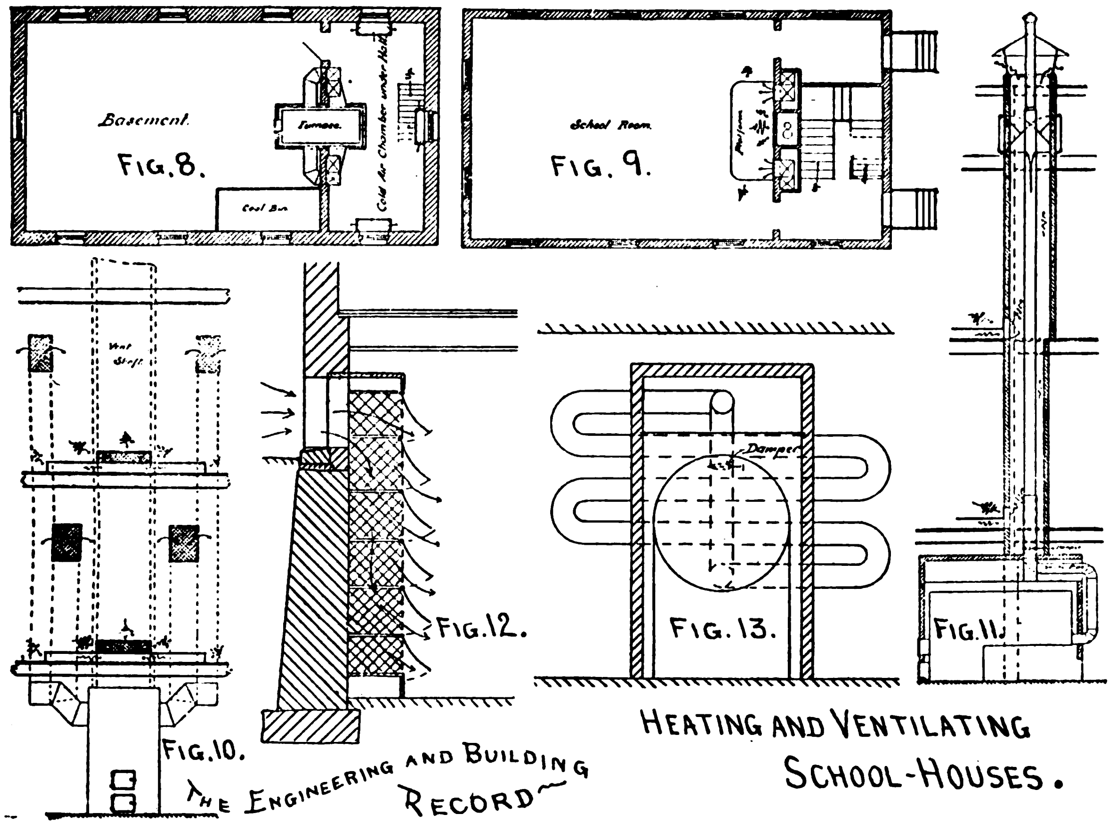
In the resulting discussion, Professor Woodbridge, speaking of the extension rings on the furnace, shown in Fig. 5, page 219, said that these rings are cast in one piece with the parts to which they belong, and are a part of the furnace itself; and these flanges becoming chilled tend to keep the shell to which they are attached much cooler than it would be without them, and the cooler the shell the more perfect the transfer of the heat of the gases inside of that shell; and, further, the effect gotten from so extended a surface moderately warmed is very much to be preferred to the same heat yielded to air by a small surface highly heated. There has been in no case observed any overheating of the air. The question is simply this: Given a certain amount of furnace shell surface exposed on its inside to combustion gases at fixed temperature, and on its outside to cooler air, by which of two ways will that shell transfer the heat most rapidly; by the contact of cool air with a plane outside surface, or by conduction through continuous metal kept cool by the movement of air over an extended surface?

When the extended surface is, in form and exposure, such as to allow as free a movement of air over it as would be had over the corresponding plane surface, the heat transfer is increased, and for these reasons: First, the transfer of heat by convection per unit of surface, varies directly as the temperature difference between that surface and the impinging air. Second, the rate of transfer of heat between two planes represented by one inch of continuous iron is 390 times that yielded by convection when the two planes have the same temperature difference as that existing between the air and the warmer surface. Hence, if the surface next the combustion gases is maintained at a fixed temperature, the temperature difference between an extended surface and the impinging air cannot vary inversely as the ratio of extension, but must be in considerable excess of the ratio, because of the rapid transfer of heat by conduction. Thus, if the temperature difference between the plane surface and the air were 300 degrees, by the extension of that surface to 12 areas, the temperature difference between it and the air would not drop to 25 degrees, but would be maintained at, say, 50 to 75 degrees.

If the objection is made that the rapid cooling of the furnace shell makes its fire-exposed temperature so low that the assumption on which the argument just made is based becomes untenable, that very objection contains all the argument desired in favor of extended surface, since the cooler the furnace shell the more rapid and complete must be the transfer of heat from the combustion gases to it, and from the shell to the air.

As to what happens to overheated air that comes in contact with red-hot iron, Professor Woodbridge continued that the amount of dust floating in the air, the purest air obtainable or found within our buildings, is much larger than is generally supposed. Not until a room is darkened and a sunbeam is "seen" by the reflection of its light from the dust in its path, do we begin to have any idea of the quantity of dust there may be and is in air which has seemed pure. Concentrate that sunbeam by a lens, and the dust seems to become so thick that the vision cannot penetrate it; and one would be loath to take the next breath from that spot to which it would seem that all the dust in the room had betaken itself.

If such air comes in contact with hot surfaces, the organic matter in it is cooked and burnt; it is changed into a charred material, into fumes, into gases, and into smoke, and when ordinary dust-laden air touches surfaces which are overheated, the disagreeable results peculiar to overheating are largely due to the effect of heat on the floating matter which is in the air.



HEATING AND VENTILATING SCHOOL-HOUSES.

Concerning the statement that we need more air in warm weather than we do in cold weather, Professor Woodbridge said that organic matter is always present in the air. Two things are in general required to make that organic matter offensive, if not morbific. One is heat, and the other is moisture. The air is drier as it comes into our houses in the winter than it is in milder weather; in milder weather it is moist, and it is also warm; and because of those two conditions, favorable to the decomposition of organic matter in the air, much more air is required for comfort in warm weather than in cold weather, when it comes into our houses in a much drier condition. The drier the air and the colder the air, the less will be the quantity required for agreeableness and for health. The carbonic acid gas becomes then the principal thing which we have to consider as a test of impurity. But when the weather is mild and moist, other things force themselves on our consideration. An air quantity which would be perfectly satisfactory on a winter's day would not be tolerated in the summer season, when the air is moist as well as warm. It would not only be intolerable, it would be morbific. In the summer we must have open windows and a natural ventilation, compared with which in effective work artificial ventilation is child's play. We must have greater volumes as we increase the moisture of our air.

In answer to a question whether he had ever advised any special means for adding to the humidity of the air, Professor Woodbridge further stated that he had not done so as a rule except where it seemed to be required. The amount of evaporation necessary to effect any considerable change in the humidity of air can easily be figured out. It seems mere child's play to add the little amount by evaporation which we get by the ordinary methods employed for that purpose. If we figure it out we will find that it is very small. Let us do it roughly. We are passing into a school building with 50 pupils in it, 100,000 cubic feet of air an hour; we are taking it in from the outside at a temperature of 30, when its has, say, 1.5 grains of water to a cubic foot of air, we will raise the temperature to 70, say. It would hold about 8 grains of water at that temperature; therefore there would be just about 6.5 grains to be added to saturate or 4 grains to raise the relative humidity to 60. Multiply that by 100,000 and we have 400,000 grains of water to be added to the air in that school-room; that is so say, 400,000 divided by 7,000 equal 57 pounds of water per hour required to effect June humidity. Usually four or five pounds of water per hour is a generous rate of water evaporation in school-house furnaces or about one-third grain per cubic foot of air.

As much coal would be required for water evaporation as for heating the air. And then what have we got? A warm and moist air, and the organic matter in dust, vapor and other form becomes evident by its quicker decomposition, its offensiveness and its unwholesomeness, and, further, we have a humidity within doors which we do not get when we are outside, making the effect of a quick transition the more hazardous. Professor Woodbridge thinks that the conditions are excellent when we get pretty dry air, 20 per cent. or even 15 per cent of moisture. The English require a higher humidity because all their living is in a moister climate. Disease germs and zymotic diseases do not thrive in a perfectly dry state.

ACCORDING to the Peoria, Ill., *Transcript* a corps of Chicago engineers including H. A. Cranwell, A. Rosseau, E. J. Ward and F. W. Weidman, are making a survey of the Mississippi River. They are in the employ of the sanitary department of the city of Chicago, and are sent out preliminary to the construction of the drainage canal from the lakes to the Mississippi River.

THE Society of German Engineers, with its 31 branches, and numbering, in all, nearly 7,000 members, is probably the largest engineering association in the world.

Notes and Queries

on Domestic Engineering.

Communications relating to the practical details of plumbing, heating, lighting and ventilation will be welcomed in this column. The writer's true name and address must always be given, but an assumed name may be used for publication if preferred.

REGARDING DESIRABILITY OF CHANGES IN NORFOLK, VA., PLUMBING REGULATIONS.

W. T. **BROOKE**, City Engineer, of Norfolk, Va., writing on the Norfolk plumbing regulations in a recent letter, says:

"I beg leave to inclose you herewith a copy of our plumbing specifications, and also a copy of a letter from the master plumbers of this city, asking that the same be modified to suit their views. If not trespassing too far on your time, I would like some expression of opinion on your part as to the most prominent changes they desire.

"So far as the first change is concerned, I do not think there should be any change in the regulations where houses belong to different owners, or where there is a probability of their being sold to different parties, even if at present under one ownership.

"As to Section 3, its provisions are sometimes impracticable in very narrow alleys, and the Inspector of Plumbing has had to use discretion in such instances. The main points, however, on which I would like an expression of your opinion are:

"*First.*—Whether it would be good practice on long lateral drains from bath-tubs, basins, or other fixtures, not water-closets, to substitute 1¼-inch lead pipe for 2-inch iron (cast) pipe?

"*Second.*—Whether a wiped lead joint is not as technically correct as a wiped solder joint?

"*Third.*—If it would not be a faulty job to permit several fixtures to connect *straight* with one drain pipe, the latter to be trapped and vented after passing the last fixture?

"*Fourth.*—Whether fixtures on lower floors, emptying over yard traps should be trapped, and if trapped, should these be also vented?

"*Fifth.*—Whether P-traps entering a stack directly above any other fixture are permissible if not vented?

"*Sixth.*—Is it reasonable that bar-rooms should be exempted from regulations governing other houses?

"We have always read your journal with interest, and I, myself, am one of your subscribers. Therefore, having the utmost confidence in your judgment in all matters pertaining to sanitary usage, I would be glad if you can find time to consider the above questions. Of course, I have my firm opinions on the subjects presented, but think yours will be more potent."

The plumbing regulations referred to above are here reproduced for convenience of reference:

Specifications to Govern the Plumbing and Connecting Houses with the Public Sewers of the City of Norfolk Va. Adopted in 1883.

SECTION 1. Every house or building must be separately and individually connected with the nearest sewer.

SEC. 2. The drain and soil pipe must be laid as direct as possible, and to a uniform grade, with a fall of not less than 1 foot in 36, if possible, and all changes in direction must be made with curved pipes, and all connections with Y branches and one-eighth bends. The drain pipe must be laid at a sufficient depth to protect it from breakage or freezing.

SEC. 3. The house drains, when not entering into or underlying a building, may be of salt-glazed vitrified stoneware pipe, laid so as to have a uniform space between each spigot and socket end, the joints to be made with oakum gaskets well calked in, and finished with good strong fresh hydraulic cement mortar, composed of one part of cement and one of clean, sharp sand; the joint to be outwiped carefully and well pointed on the outside. But where drains enter and underlie a building the pipe must be of cast iron, to extend to and form part of the soil pipe, and extend at least 4 feet above the roof, or top of the highest window, of undiminished size, and terminate with a wire basket.

The iron drain pipe must extend at least 5 feet outside of every building, and all terra-cotta pipe inside of the building line of the street must be laid upon a foundation of hydraulic cement concrete, unless otherwise specially permitted by the city engineer.

SEC. 4. When a pipe passes through or under the walls of a building there shall be a relieving arch turned over it to protect it from breakage by the settling of the wall.

SEC. 5. The iron soil and drain pipe must be full 4 inches in interior diameter at every point, to be coated inside and outside with coal tar, applied hot. The horizontal portions of all iron pipes used under ground shall in no case weigh less than:

For 4-inch pipe, 13 pounds per lineal foot.
For 3-inch pipe, 9½ pounds per lineal foot.
For 2-inch pipe, 5½ pounds per lineal foot.

The joints are to be made with gaskets of picked oakum, and hot lead at one pouring, thoroughly calked in so as to render them impermeable to gases.

Waste pipes or lateral drains from bath tubs, basins, or other fixtures, with the exception of water-closets, may be of 2-inch diameter pipe.

SEC. 6. No trap or any manner of obstruction to the complete and perfectly free flow of air throughout the entire course of the drain or soil pipe will be permitted. No brick, sheet metal or earthenware flue shall be used as a sewer ventilator, nor shall any chimney flue be used for this purpose.

Pipes must be concentrated as much as possible, and where placed within walls they should be covered with wood work, fastened with screws, so as to give ready access to the pipes for inspection and repairs.

SEC. 7. All joints in waste-pipes, except where screw joints are used, must be made like those in the soil and drain pipes, with oakum gaskets and lead, well calked so as to render them gas-tight.

All connections of lead with iron pipes must be made with a brass sleeve or ferrule of the same size as the lead pipe; the sleeve to be put into the hub of the iron pipe and thoroughly calked with lead, and the lead pipe to be attached to the sleeve or ferrule by a wiped lead joint.

All connections of lead pipes must be by wiped lead joints.

SEC. 8. Every sink, basin, water-closet, wash tray, bath, safe urinal, and every tub or set of tubs, must be separately and effectively trapped; the traps to be of suitable and approved pattern, and to be placed as near the fixture as practicable.

All exit pipes, except in the case of water-closets, to be provided with strong metallic strainers.

SEC. 9. Every trap must be separately ventilated, and protected from syphonage by a special vent pipe not less than two inches in diameter for water-closets, nor less than 1¼ inches for other fixtures; but if exceeding 15 feet in length, this pipe shall not be less than 1½ inches in diameter.

These vent or air pipes should extend 4 feet above the roof, and terminate with a wire basket, but if they are branched into the soil-pipe, it must be above the inlet pipe of the highest fixture.

They may be continuous by branching together these which serve several traps, provided they are branched into a vent-pipe not less than 2 inches in interior diameter.

These vent or air pipes must always have a continuous slope to avoid collecting water by condensation.

SEC. 10. Every lead safe under a wash basin, bath, urinal, refrigerator or water-closet must be drained by a special pipe not directly connected with any waste-pipe, soil-pipe, drain or sewer, but must be discharged into an open sink or drain outside the house.

SEC. 11. Waste-pipes from wash-tubs, wash-stands and sinks shall not be connected with the trap of a water-closet.

SEC. 12. Water-closets must be of the hopper or approved pattern (pan closets being absolutely prohibited), and should be supplied from a special tank placed over them, in which case the waste or overflow from the tank must discharge into the open air, or the basin of the closet, and not into the soil-pipe directly.

Direct surface of a water-closet is always objectionable, and in case the water-closet is in a second or third story of a building, and above the supply to a kitchen or hydrant, it is absolutely prohibited.

SEC. 13. Wooden wash-trays and sinks are prohibited inside of buildings; they shall be of non-absorbent material.

SEC. 14. Lead, zinc or galvanized iron linings for house cisterns are prohibited, but wood, iron or tinned copper may be used. In every instance the overflow must be trapped into the open air.

SEC. 15. All materials must be of good quality, and free from al defects; the work must be executed in a thorough and workmanlike manner, and subject to the approval of the City Engineer and the Inspector of Plumbing.

SEC. 16. The foregoing regulations and specifications will be altered, amended and added to, whenever it may be deemed by the Board of Street, Sewer and Drain Commissioners proper to do so.

SEC. 17. Prosecution for infringement upon the provisions of these regulations and specifications shall be made by information filed in the Mayor's Court, in the city of Norfolk, Va.

The Norfolk Master Plumbers' letter, asking for modifications, reads as follows.

To the Honorable Board of Street, Sewer and Drain Commissioners:

GENTLEMEN: At a meeting of the master plumbers of this city, held on Saturday evening, August 23, and after carefully considering the specifications governing house plumbing and drainage by sections, we would most respectfully submit the following changes and additions to your notice, and ask the same to be adopted by your Board:

SECTION 1. Insert the word *practical* to make Section 1 read as follows: "Every house or building must, *when practical*, be separately and individually connected, etc."

SECTION 3. Strike out the last paragraph.

SECTION 4. Strike out entirely.

SECTION 5. Add to last paragraph, "and not less than 1¼ inch lead pipe."

SECTION 7. Insert "solder" in place of "lead," next to last word in last two paragraphs.

SECTION 8. After "basin," in first line, insert "and set of basins;" and after "tray," in second line, insert "and set of trays."

SECTION 9 Add "providing that this section shall not apply to fixtures on first floor, and emptying into or over yard traps."

SECTION 17. Make a new section, "P traps entering a stack direct and not more than two feet from same, where there is no fixture above, may not be back vented."

SECTION 18. Make a new section: "The use of traps without ventilating pipes will be permitted to connect direct in bar-rooms, if provided with McClellan Anti-Syphon Vent."

Respectfully submitted,
THE MASTER PLUMBERS OF THE CITY OF NORFOLK,
T. J. CARRY, Secretary.

[SECTION 1. Recommendation not concurred in. Experience has shown the importance of this regulation. Our correspondent cites some of the reasons in its favor.

SECTION 3. If discretion be vested in any one over details to be adopted in special cases, and the City Engineer is the party to exercise that discretion, we see no reason for striking out the clause referred to, except to relieve him from importunities and the embarrassment of refusing requests from acquaintances.

SECTION 4. Recommendation not concurred in, unless provision is made to require that the wall should not rest on the pipe. It is not always practicable to locate, in foundation walls, the opening for the drain. When the hole is cut for it, a good plan is to surround the cast-iron pipe with a wrought-iron pipe of larger diameter, and pack the intervening space with some compressible substance, like mineral wool, so that a small settlement could not break the drain pipe.

SECTION 5. Since the original clause is not mandatory, but simply suggests what may be used, the recommendation for Section 5 seems all right, since it is assumed that there are situations when a lateral pipe, being only a few feet long, may safely be lead pipe for the few feet between the fixture it serves and the vertical soil pipe. This amendment is apparently intended to prevent the using of pipe smaller than 1¼-inch, which is proper. The size of a waste-pipe should, within certain limits of course, be determined by the duty it has to perform in the particular case, and we presume that when a plan of work is submitted to the local authority the various sizes are specified on the plan, and before work is done to be approved by said authority.

SECTION 7. This recommendation is indorsed.

SECTION 8. Recommendation as to wash trays concurred in, but not as to wash basins. The latter should be, in every case, separately trapped.

SECTION 9. This recommendation could be construed to exempt all traps on the first floors of buildings. It is, therefore, not concurred in. There may be special cases where, in a detached building, the only fixture in it may be trapped close to a vertical soil-pipe or discharge, as indicated, over a yard trap, when venting the trap may not be necessary. Discretion should be vested in some one to permit a special construction in such cases adequate for the purpose. Such exemption to be a matter of special permit, on file in the department as a record of the transaction.

SECTION 17. Exemption of this character should be subject to special permission in each particular ease, and it should not be restricted to P traps, since there are other forms that, in the absence of vents, may be more desirable.

SECTION 18. We do not see the reason for exempting bar-rooms from the regulations governing other houses.

In conclusion, we would say that our comments are based on our impression of conditions that may be supposed to exist in a city like Norfolk, where there doubtless are detached houses with plumbing only on a single floor, and that possibly restricted to a single sink. In such cases a system of work might be permitted that could not be safely allowed in other places. The idea of the master plumbers of a city meeting from time to time, and making suggestions based on their experience with regard to existing plumbing regulations, is a most commendable one, and it should be encouraged since the co-operation of the local plumbing associations has been of great assistance in securing and enforcing of plumbing regulations in different cities. It often happens, however, that a recommendation is suggested by a single experience, and the embarrassing effect in the matter of enforcement of having a regulation for every contingency likely to arise is not fully appreciated.

Committees of plumbers, in suggesting changes in plumbing regulations, sometimes fail to realize that though a change for special places might be permissible, yet the greatest good of the greatest number would be best secured by not weakening a good regulation by incorporating a lot of possible exemptions. A conference between those who have to hear and refuse all sorts of requests and be responsible for enforcement, and committees selected to suggest changes always will have a good effect. The problems can then be seen from different points of view.

We shall be glad to have the subject further discussed by our readers.]

PLUMBING IN A KANSAS CITY RESIDENCE

"Two or Three Plumbers," of Kansas City, Mo., write: "In your issue of August 23 the plan of plumbing in a Kansas City residence has caused a great discussion in the shop where we are employed. It is a new scheme to all of us. We fail to see where or how Mr. Grey can have a circulation of air through the system, even with the steam coil. What is to promote circulation in summer, when there is no steam used in the building? With steam on, we think the basement closet will have all the benefit, as that back air pipe is the only direct connection we can trace out from the fresh air inlet, except the soil pipe through roof. And, as air, like water, will take the easiest course, the rest of the system will not be benefited by this way of back airing. Perhaps Mr. Grey or T. H. S. can explain how it is to be done."

Novelties.

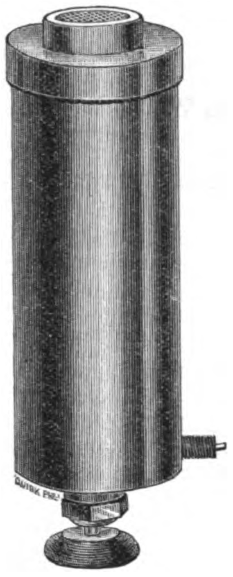
Devices are described under this head purely and strictly as news; because believed to be new and calculated to interest readers.

In no case is pay accepted, directly or indirectly, for publishing a novelty notice.

As the subjects are selected for their supposed novelty and interest merely, it will, of course, be understood that the selection does not imply indorsement.

THE DIMMICK AIR MOISTENER.

THE Philadelphia Exhaust Ventilator Company, 520 Commerce Street, Philadelphia, Pa., are about to put on the market what will be known as the Dimmick Air Moistener, of which an illustration is annexed. It may be made to take the place of an air valve on a radiator, being screwed into the latter, and is operated by a valve. Steam, entering the moistener, is partially condensed and can be brought in contact, within the apparatus, with any desired aromatic substance, and, escaping through the perforated removable cap at the top, imparts the odor to the atmosphere.



The device is said to be useful in preventing cracking and splitting of furniture in steam-heated rooms, and to overcome any objectionable dryness of the atmosphere. It is also claimed to be serviceable in diffusing disinfectants.

DEATH IN A CESSPOOL.

ON Thursday morning, September 4, three men lost their lives in attempting to clean a cesspool at West Brighton, S. I. The cesspool was about 12 feet deep. The first man fell before reaching the bottom, overcome by the gas. The other two were similarly affected in going to his assistance. As far as can be learned no means were adopted to ventilate or purify the air of the cesspool before entering the latter.

ACCORDING to Pittsburg reports, two of the largest gas wells ever developed in that district have been found. One of the wells is located near Bellevernon, and is owned by the Philadelphia Company. The other is the property of the Bridgewater Gas Company, and is in the Wildwood Field. It is estimated that both are good for 800 pounds pressure. The gas from these wells, it is said, would be sufficient to run half the mills in the city, and would seem to dispose of the stories that the gas was giving out.

A FRENCH engineer, M. Decoeur, is said to have under way a project of supplying Paris with electric power to be generated by the change of the tides on the coast.

CONNECTING STEAM PIPES TO BOILERS.

THE August number of *The Locomotive*, published by the Hartford, Conn., Steam Boiler Inspection and Insurance Company, is given up wholly to a series of articles on steam pipe connections to boilers and rotaries, and the support of long lines of pipe. While the matter is not new, experience has shown that it is not so familiar to those usually connected with the work as it ought to be, and it will, therefore, well bear repetition. In the annexed illustrations we have, accordingly, reproduced several diagrams relating to steam pipe connections to boilers.

Concerning these, *The Locomotive* very appropriately says that the points to be considered, but which are very often neglected, are to provide for the effects of expansion, and also to make allowance for any settling of the boilers which may, and generally does, occur after they have been run a short time.

Figure 1 shows a case where two boilers were improperly connected. Cast-iron tees were bolted to the nozzles, and connected by means of a cast-iron pipe, which had an outlet on top, as shown, from which the steam pipe was led. It will be seen at once that the boilers were rigidly bound together by this arrangement. After a short time the tee on No. 2 cracked off as shown at A; this was replaced with a new one, and soon afterward the pipe connecting the two boilers broke off at B. Both these breaks occurred while the boilers were in use, and of course resulted in their stoppage until the broken pieces could be renewed. The only strange thing in connection with the affair was the fact that the breaks did not occur the first time steam was gotten up.

Cast-iron pipe should be used with caution for such purposes, as, from its brittle nature, accidents are liable to occur at any time. Wrought-iron pipe is better every way, and should always be used. But in no case can the use of such connections as that shown in Fig. 1 be justified. Only a very inexperienced engineer would design such a connection, and no steam fitter should put it up without entering a strong protest against it. No provision whatever is made for the motion of the boilers due to expansion, or settling of the foundations or walls.

Figures 2 and 3 show a properly-designed arrangement of steam connections for a battery of boilers. Wrought-iron pipe is used. To the nozzles risers are attached by means of flanges, and from the upper ends of these risers pipes are led horizontally backwards into the main steam pipe. In this horizontal pipe, the stop-valves, one to each boiler, are placed. These valves should have flanged ends, as shown, so that they may be easily removed, if repairs become necessary, without disturbing any other portion of the piping. The main steam pipe may be supported by means of long hangers, from the roof of the boiler house, when practicable, or if this cannot be done, it may be held up by posts which rest on the back wall of the boiler setting, or any other convenient place.

By this arrangement it will be seen that the movements of the boilers and the piping itself are compensated for by the spring of the pipes, and no trouble will ever occur. The height of the risers should never be less than 3 feet, and when there are eight or ten boilers in one battery, they should be, if room permits, 6 to 8 feet high, and the horizontal pipes leading to main steam pipe should be 10 to 12 feet or more.

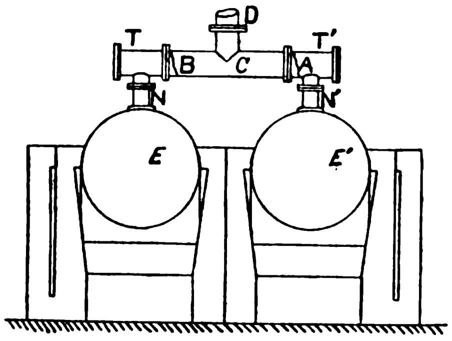


FIG. 1.

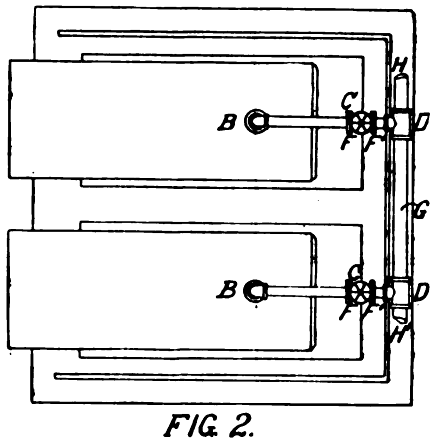


FIG. 2.

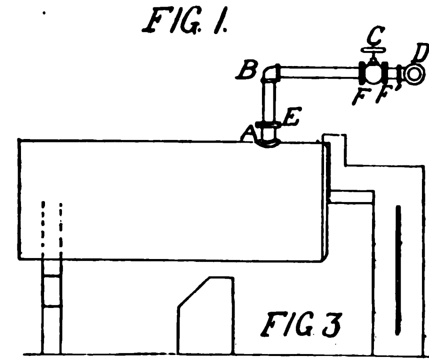


FIG 3

CONNECTING STEAM PIPES TO BOILERS

USES OF ASBESTOS.

WITHIN recent years the practical applications of asbestos have largely multiplied in number, and the material is now being extensively employed for protection purposes in workshops, foundries and mills, to guard against the danger of burning the hands and face, and generally to make working in hot metals a safer and more comfortable occupation. Asbestos mittens to guard the hands are made for firemen, assayers, refiners, etc., and armed with a pair, the artisan or worker can grasp hot irons, crucibles and the like without discomfort. Masks, too, for the face are made of asbestos, which are fire proof, and the heat from the hottest fire is said not to penetrate to the skin. Air is drawn from beneath the mask for breathing, so that the burned or flame and smoke-laden atmosphere is not inhaled. Aprons and insulating coverings for the entire body are also constructed, having like protective qualities, and for firemen complete suits of asbestos fire-proof cloth are made. For domestic use sad-iron holders of asbestos may be had, and with these the grasp of the iron, however hot it may be, never causes pain or burning. Plumbers are likely to welcome asbestos cloths for joint wiping, and large holders, intended for use by smelters, molders and workers in metal generally are among the more recent uses of this mineral. The asbestos thus prepared is very flexible, and even the mittens are said to be sufficiently pliable to permit of small objects being readily picked up and held in the hand wearing them.

BRICK PAVEMENTS IN HOLLAND.

THE brick pavements at the Hague are made of a hard-burned brick, 22 centimeters (8.668 inches) long, 11 (4.33 inches) wide, and 5½ (2.16 inches) thick. They are laid on a sand foundation 20 centimeters (7.88 inches) deep, with very little clay, as otherwise proper drainage is interfered with; joints are laid as close as possible. The Hague being a city of residences, the street traffic is light.

TRADE PUBLICATIONS.

MAHONY STEAM AND HOT-WATER BOILERS.

M. Mahony, Troy, N. Y,, has just issued a new, neatly prepared and attractive catalogue, devoted to his boilers for steam and hot-water heating. The customary price-lists and tables of sizes are given, accompanied by illustrations of the several forms of Mahony boilers, and a large number of views of buildings warmed by them.

Short chapters on estimating the size of heating apparatus required, and on the proportion of radiating surface to space to be heated, together with testimonials, occupy the concluding pages.

A LARGE PIPE CASTING.

THE Newport, Ky., branch of the Addyston Pipe and Steel Company, of Cincinnati, O., recently turned out the largest pipe casting ever attempted in this country, the pipe being 60 inches in diameter. This is about double the size of any heretofore made.

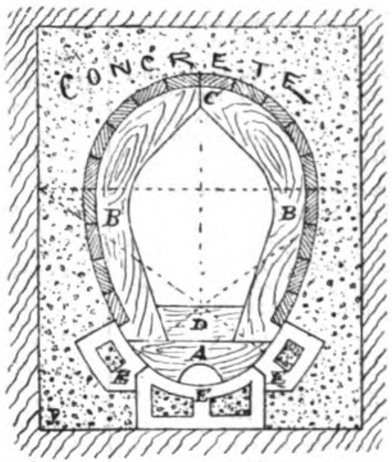
Each section of pipe will be 12 feet 4 inches in length, and will weigh 10,800 pounds; in thickness the pipe will be 1⅜ inch. The patterns, flasks and tools necessary to turn out this monster were made at the foundry, and the casting ladle will hold nine tons of molten iron. The pipe goes to Milwaukee, 800 lengths being contracted for, to be used for bringing water from the lake.

A CONCRETE SEWER.

A RECENT issue of London *Iron* describes a sewer half a mile long, built in 1867 at Sidmouth, Devonshire, by John Standfield, M. Inst., C. E.

It was at first intended to build the sewer of hard brick laid in Portland cement, but the high cost of brick at that place caused a concrete made of fine, medium, and coarse shingle (six parts) and Portland cement (one part) to be used, except the three invert courses of stoneware blocks E E E which were filled with concrete before they were laid.

The centering was formed thus: A was a foot-block of wood and B B wood ribs standing thereon and abutting at the top C against each other. D was a wedge block of wood, keeping the ribs tight against the invert blocks. The wood laggings around the ribs were 12 feet long. These butt-jointed midway on two end ribs, and rested on two intermediate ribs, and thick boards were laid on the blocks D for the bricklayers to stand on to build up the sides, haunches and crown of the sewer with concrete.



A CONCRETE SEWER.

SIZES OF LIGHTNING RODS.

SPEAKING of lightning rods, the *Verkehrs Zeitung* points out the desirability of making them of sufficient diameter to preclude the possibility of excessive heating. Arago has determined that an iron rod or wire of a diameter of 0.5416 inch will meet this requirement even with the heaviest electrical discharges. In view of the fact, however, that copper, zinc, and even lead wire is sometimes used in the manufacture of lightning rods, the appended table is presented, giving the diameter which should be used for wires of different metals and alloys. It was prepared by Dr. Rothen of the Swiss Telegraph Bureau:

	Diameter in inches.
Copper	0.384
Platinum	0.512
Iron	0.494
Zinc	0.592
Brass	0.624
Lead	0.848

PUBLICATIONS RECEIVED.

HYGIENE AND PUBLIC HEALTH. By Louis C. Parkes, M. D. Second edition, with illustrations. Published by P. Blakiston, Son & Co. Price, $2.50.

REPORT ON THE SUBSTITUTION OF METAL FOR WOOD IN RAILROAD TIES. By E. E. Russell Tratman, C. E., together with a Discussion on Practicable Economies in the use of Wood for Railway Purposes. By B. E. Fernow, Chief of Forestry Division, U. S. Department of Agriculture.

CONTRACTING NEWS DEPARTMENT.

A WEEKLY RECORD

OF SPECIAL INTEREST TO CONTRACTORS, BUILDERS AND MANUFACTURERS OF ENGINEERING AND BUILDING SUPPLIES.

CONTRACTING INTELLIGENCE

Our readers will oblige us by notes, clippings, or any information which will put us in the way of obtaining early and reliable news for our "Contracting Intelligence." *Information of importance sent to us exclusively, and not elsewhere published will be liberally paid for.*

For works for which proposals are requested see also the "Proposal Columns,' pages i-ii-239.

WATER.

For Additional Water Items see Proposal Columns.

HENRIETTA, TEXAS.—It is probable that a water-works plant will be established at this place by the Henrietta Improvement and Water Company.

LAKE FOREST, ILL.—The citizens of this place have organized a company for the purpose of establishing at once a complete system of water-works.

CASTLE ROCK, COL.—A complete system of water-works is to be established at this place by the Castle Rock Water Company.

BURLINGTON, COL.—It is probable that immediate steps will be taken to remedy the trouble resulting at this place on account of the scarcity of water. An entire new water-works system is talked of.

OENAVILLE, TEXAS.—Reports say that this place is to establish a system of water-works.

CHAMBERSBURG, GA.—The borough has decided to erect both steam and water pumping machinery and build an additional reservoir of 2,000,000 gallons capacity.

WENHAM, MASS.—This place is to be provided with a water supply.

HAMILTON, MASS.—A water-works system is soon to be established at this place.

SANTA ANA, CAL.—At a recent election held at this place the sum of $6,000 was appropriated with which to establish a system of water-works.

GREELEY CENTER, NEB.—The people of this place have voted in favor of water-works.

ALGONA, IA.—The contract for the construction of a system of water-works at this place has been awarded to Messrs. Harrison & Hawley, of St. Paul, Minn.

DECORAH, IA.—The contract for furnishing, etc , water mains at this city has been awarded to Messrs. Harrison & Hawley, of St. Paul, Minn.

HENDERSON, MINN.—It is proposed to establish a system of water-works at this place. The Town Clerk can furnish particulars,

SAVANNAH, GA.—Water-Works Superintendent Manning is reported as saying that the city needs a new high duty engine.

KALKASKA, MICH.—The question of appropriating the sum of $25,000 for the purpose of establishing a system of water-works is to be decided at a public election to be held at an early day.

CHAMBERSBURG, PA.—Plans just adopted for the proposed additional water supply for this place estimate the cost of the work at $26,000. The engineer in charge is John Birkinbine, C. E., as above.

DOVER, N. J.—Improvements and extensions will soon be made to the water-works plant at this place.

JELLICO, TENN.—The Mayor can furnish particulars of a project to establish a system of water-works at this place.

MANCHESTER, N. H.—Reports say that it has been recommended to construct a reservoir, with a capacity of 3,000,000 gallons, on Oak Hill.

ST. LOUIS, MO.—The Sunset Hill Electric Light, Water and Power Company has been incorporated here. Capital stock, $100,000. Incorporators, Marcus Bernheimer, Herman Tubolske, and others.

WINCHESTER, TENN.—Reports say that this place is to have a system of water-works.

GATESVILLE, TEX.—A system of water-works is to be established at this place by the Gatesville Water Supply Company.

MACON, GA.—At a recent meeting a resolution was passed instructing the Mayor to advertise for bids for building new water-works.

WYOMING, O.—Our correspondent writes: "Mayor R. D. Barney is the chairman of a committee to raise $30,000 for the construction of a system of water-works at this place. It is expected that the full amount will be subscribed."

HELENA, MONT.—The Eureka Reservoir Canal and Irrigation Company has been formed at this place. Capital stock, $200,000. Z. T. Burton is president.

HELENA, ARK.—According to reports St. Louis parties will establish a system of water-works at this place. Surveys, it is said, have already been made.

MORRISTOWN, TENN.—This place is to have a system of water-works.

OXFORD, N. C.—The people will settle the question of bonding this place in the sum of $50,000 for water-works, at a public election.

MOUNT STERLING, KY.—The people of this place voted recently in favor of establishing a water-works system.

SPRINGFIELD, S. D.—It is probable that the water-works proposed for this place will be constructed at once.

COLUMBIA, S. C.—The Water-Works Committee recommends the purchase of water-wheels and pumps to the amount of $25,000, to increase the supply of water.

TARRYTOWN, N. Y.—To increase the village water supply, a contract has been awarded to J. A. Lockwood to sink two new wells, at a cost of $11,000.

LANCASTER, PA.—It is probable that improvements will be made to the local water-works system.

TROY, N. Y.—At a special meeting of the water-board held September, several additional water-mains were recommended. Commissioner Gleason can furnish particulars.

KNOXVILLE, TENN.—It is probable that the proposed improvements to the local water-works system will consist of adding two pumps and building an additional reservoir.

CLEVELAND, O.—Numerous water-main extensions are to be made in this city.

SOUTH ORANGE, N. J.—H. H. Hart, chairman Water Committee, writes: "This village will issue $20,000 of four per cent. water bonds at par, to run for 20 years, with option of village to redeem after five years. This is the only bonded debt of the village, the assessed valuation of the real estate of which is nearly $2,000,000; the annual taxes raised are about $18,000. See Proposal Columns for particulars of projected work on which bids are invited.

BROOKVILLE, IND.—City Clerk J. W. Cates writes: "We have had an engineer to draw up the requisite plans, specifications, costs, etc , for water-works, and we intend to set an election, in this September 8 meeting of Board. We want direct pressure, as we think it the cheaper, and we are limited to $19,500."

ALTOONA, PA.—City Clerk H. T. Heinsling writes: "City Council, by resolution, has directed the City Solicitor to prepare an ordinance, submitting to the citizens of Altoona by vote, whether an additional stream be secured to increase the water supply of the city or whether an impounding reservoir be built, below the present reservoir, at an estimated cost of $200,000, with a capacity of 370,000,000 gallons."

NEWMANSTOWN, PA.—Town Clerk W. W. Stewart writes: "A charter is granted and the survey taken for the introduction of water to Newmanstown and Sheridan, Lebanon County, Pa., from the South Mountain springs. I do not know when the company begins at it."

MERIDEN, CONN.—Numerous water-main extensions are to be made at this place. Mayor Page can furnish information.

BROOKFIELD, MO.—City Clerk D. F. Howard writes: "Nothing has been done in regard to water-works. They vote on bonding the town for that purpose the 23d of this month."

WELLESLEY, MASS.—Town Clerk Fred H. Kingsbury writes: "I know of no improvements to be made this year except the putting in of some two miles of pipe on streets not before piped."

TRENTON, TENN.—Water Commissioner W. B. Stafford writes: "Our city voted $20,000 to put in a water-works system."

MIDDLEBURY, VT.—A. A. Fletcher, the Chairman of the Water Committee, writes: "We have had a survey made and cost estimated. We have had a village meeting, when it was voted to bond the village for water-works for fire and domestic purposes. Expected to have had the work commenced before this time."

JEFFERSONVILLE, IND.—The pumping machinery of the local water-works plant is to be remodeled, after plans made by John W. Hill, C. E., of Cincinnati, O.

EATON, O.—Plans are under way for a system of water-works to be established at this place. Address John W. Hill, C. E., the engineer, at Cincinnati, O., for particulars.

MADISON, IND.—Improvements are to be made to the water-works system at this place. John W. Hill, C. E., of Cincinnati, O., has charge of the work.

MANCHESTER, N. H.—M. M. Tidd, C. E., Boston, has been making an examination with the view of making plans for the construction of a system of high service water-works for this place.

SAN JOSE, CAL.—The Glen Weber Water Company has been formed in this city, to supply San Jose, San Francisco and Oakland with water. For particulars, address John W. Combs, as above.

BUENA VISTA, GA.—The people of this place want water-works.

PATCHOGUE, L. I.—Reports say that the Gerard Farm, near here, is to be turned into a settlement and that it is to be furnished with a private water-works system. Supervisor F. W. Dunton, of Jamaica, L. I., can furnish particulars.

FREEHOLD, N. J.—The contracts for the construction of the water-works, at this place, were awarded September 8. The contract for pipe was given to the Union Hydraulic Company, of Philadelphia, whose bid was $16,452.37; for laying the mains, refilling the trenches, etc., complete, to H. B. Pitcher, Long Branch, who bid $7,592.16; the special castings to the Union Hydraulic Company, at 2½ cents per pound; and the fire hydrants to the Eddy Valve Company, for $23.90 each. Proposals for the stand-pipe, to hold 240,000 gallons, the pump, engine and boilers, will be opened on the 20th inst. There will be over eight miles of mains. The supply will be obtained from artesian wells.

FRANKLIN, IND.—The Secretary of the Franklin Light and Power Company writes: "Will be ready for bids on pumping machinery and boiler in a short while."

WATER-WORKS.—See our Proposal Columns for information regarding water-works and water-works furnishings at the following places: Coldwater, Mich.; Rushville, Ind.; Yoakum, Tex.; Toledo, Iowa; Dallas, Tex.; Allegheny, Pa.; Atlanta, Ga.; Austin, Tex.; South Orange, N. J.

READERS of **THE ENGINEERING AND BUILDING RECORD** interested in the Contracting News Department of that paper are respectfully requested to examine those columns every week, and advise the Editor of any item which they may find that, in their judgment, is of no value to any one other than the person mentioned.

SEWERAGE.

For Additional Sewerage Items see Proposal Columns

WILMINGTON, DEL.—The contract for the construction of certain sewers at this place has been awarded to John Jacoby, of Wilmington, Del., at $43,337.29. The figures in detail were as follows: Brick sewer, 3 feet 3 inches, circular, $6 per foot; brick sewer, 2 feet 6 inches by 3 feet 9 inches, $6; brick sewer, 2 feet 4 inches by 3 feet 6 inches, $5.35; brick sewer, 2 feet 2 inches by 3 feet 3 inches, $4.50; brick sewer, 2 feet by 3 feet, $3.20; brick sewer, 2 feet, circular, 1 ring, $2.64; brick sewer, 2 feet 7 inches by 3 feet 10½ inches, $6; brick sewer, 2 feet 5 inches by 3 feet 7½ inches, $5.73; brick sewer, 2 feet 3 inches by 3 feet 4½ inches, $5.50; 20-inch terra cotta pipe, $1.75; 18-inch terra cotta, $1.60; 15-inch terra cotta, $1.30; 12-inch terra cotta, 90 cents; 10-inch terra cotta, $1; 8-inch terra cotta, 80 cents; inlets and catch basins, $77; manholes in brick sewer, $65; manholes in pipe sewer, $65; vitrified fire brick per 1,000, $20; rock excavation, per cubic yard, $2.

Kennedy, De Law & Co., of Philadelphia, Pa., were the only other bidders, and their total figure was $49,830.21.

BUFFALO, N. Y.—The projected sewer through Ferry Street, in this city, is to be constructed.

WILLIAMSPORT, PA.—Plans have been adopted for a system of sewers for this city.

JERSEY CITY, N. J.—Reports say that it is proposed to expend the sum of $200,000 on the construction of additional sewers in this city.

SCRANTON, PA.—An effort is being made to make sewer improvements at this place at a proposed expenditure of $75,000.

SANTA ANA, CAL.—The question of establishing a system of sewers at this place is now under discussion.

COLUMBUS, GA.—This city will commence at once the construction of the sewerage system. D. P. Dozier, Mayor, can give particulars.

VICKSBURG, MISS.—Plans and specifications for the Vicksburg new sewerage system were accepted by the City Council September 2. They call for 20 miles of mains and laterals at an estimated cost of $192,000. The city was only authorized to expend $100,000, so the matter of building is still under consideration.

HARRIMAN, TENN.—M. M. Tidd, C. E., Boston, has prepared plans for a system of sewerage for this place, and submitted them to the East Tennessee Land Company.

PAWTUCKET, R. I.—A. R. Sweet writes from this place as follows: "This city has, for the Blackstone River water-shed, established a restricted combined system of sewerage, with a view for future disposal by land treatment. At present the sewage is emptied into the Seekonk River, a tidal stream. There has been built for this district 13 out of the 29 miles required. For the Moshassuck River water-shed the same system is proposed and at present under way. About one and one-half miles have been ordered built. The sewage from this district will be treated either by chemical precipitation with filtration or irrigation; probably irrigation."

NEW HAVEN, CONN.—The following bids for the construction of certain sewers on pile foundations in this city were received by A. B. Hill, City Engineer, September 4: M. A. Blakeman, Bridgeport, Conn., per lineal foot, $7.80; C. R. Waterhouse, New Haven, Conn., per lineal foot, $6.39; C. W. Blakeslee & Sons, New Haven, Conn., per lineal foot, $6.29; Robert Lutz, New Haven, Conn., per lineal foot, $6.25.

READING, PA.—An ordinance has been introduced in the Select Council, providing for a $300,000 loan for the construction of underground sewers, the voters to express their assent or dissent at the polls on November 4.

KEY WEST, FLA.—The local sewerage system is to undergo extensive improvements.

HAMILTON, ONT.—About $10,000 is to be expended on improving the sewerage system of this place.

ST. LOUIS, MO.—The following proposals for the construction of about 76,000 feet of sewers, were opened by R. E. McMath, C. E., Sewer Commissioner. The figures given are for the following work in detail: Earth excavation, 98,100 cubic yards; rock excavation, 800 cubic yards; rubble masonry, 10 cubic yards; brick masonry, 14,200 cubic yards; 12-inch pipe sewer, 18,800 feet; 15-inch pipe sewer, 15,450 feet; 18-inch pipe sewer, 10.635 feet; 21-inch pipe sewer, 825 feet; 24-inch pipe sewer, 5,235 feet; inlet stone, 6,804 square feet; cast iron, 188,500 pounds; wrought iron, 22,120 pounds; junctions, 3,825 pieces.

Bidders—A. Heman and J. Fruin, St. Louis, Mo., 40 cents, $3, $4. $8, $1.5, $1.25, $1.70, $2, $2.25, 70 cents, 3 cents, 5 cents; total, $241,254.55. Fruin Bambrick Construction Co., St. Louis, Mo., 45 cents, $350, $5. $8.50, $1,15, $1.35, $1.80, $2.25, $2.75, 80 cents, 3 cents, 6 cents; total, $262,258.90.

WHEELING, W. VA.—Thomas F. Thoner, City Clerk, writes: "We have expended very near $20,000 in sewerage so far this year and expect to spend from $5,000 to $10,000 more during this month."

SEWERS.—See our Proposal Columns for information regarding sewer work at the following places: Para, Brazil; Key West, Fla.; Iron Mountain, Mich.

BRIDGES AND IRON STRUCTURES.

For Additional Bridge Items see Proposal Columns

KNOXVILLE, TENN.—Rumors say that the Cherokee Land Company proposes to construct an iron bridge across the Tennessee River, near this city, at a cost of $100,000.

HUNTERDON COUNTY, N. J.—The Commissioners of this county have decided to make an expenditure of $8,000 in repairing numerous county bridges.

ST. PAUL, MINN.—The city clerk has been authorized to advertise for bids for the bridge across the right of way of the Wisconsin Central Road at Mississippi Street.

ST. PAUL, MINN.—The report of the Council Committee on Ways and Means in favor of allowing $50,000 upon the Selby Avenue Cable Line Bridge has been approved. The report of the same committee in favor of building a bridge across the Wisconsin Central tracks at Mississippi Street, at a cost of not more than $2,400, has been referred to the city attorney.

DULUTH, MINN.—A $2,000 bridge will be built over the railroad tracks.

WASHINGTON, D. C.—The House has passed a bill authorizing the construction of a bridge across the Savannah River, by the Middle Georgia and Atlantic Railroad Co.

AMESBURY, MASS.—The County Commissioners have decided on the plans for a new draw-bridge and approaches for the Powow River. The work will be done under the general supervision of C. A. Putnam, C. E., of Salem, Mass.

PORT ROYAL, TENN.—The estimated cost of the proposed bridge to span the Red River, at this place, is $8,500.

EAST TEXAS, PA.—The County Commissioners will soon ask for bids for the erection of an iron bridge over the Little Lehigh River, at this place.

HAMPTON COUNTY, VA.—The Board of Supervisors of Hampton County has appropriated $16,000 to build an iron bridge across the Hampton River. The bridge will be used by the Old Point and Hampton Street Railroad.

HORNELLSVILLE, N Y.—Kinzua Bridge is to be removed and replaced by a structure much more substantial. The Chief Engineer of the Erie Railroad can furnish information.

SCRANTON, PA.—It is proposed to bond this city for the purpose of erecting four iron bridges.

BRIDGES.—See our Proposal Columns for information regarding bridge construction at the following places: New Gretna, N. J.; Atchison, Kan.; Reading, Pa.; San Antonio, Tex.

NEW DEPOTS.

GRAND FORKS, DAK.—A passenger depot will be built by the Great Northern, formerly the St. Paul, Minneapolis & Manitoba Road, to cost $20,000. Kettle River sandstone will be used.

AMBLER, PA.—The Reading Railroad Company's officials have been negotiating for a piece of ground on which to erect a large freight station.

STREET-WORK AND PAVING.

MOUNT VERNON, N. Y.—The Board of Trustees has decided to go ahead with macadamizing the village streets, with $100,000 recently voted for the purpose at a public meeting of taxpayers.

DANVILLE, ILL.—T. W. Marshall & Co., general contractors, of Chicago and Peoria, have been awarded the contract for paving, with small brick, 40,000 yards.

SALT LAKE CITY, UTAH.—Considerable street paving is to be done in this city.

SIOUX CITY, IOWA.—Considerable road work is to be done in the vicinity of this city.

ASBURY PARK, N. J.—The Long Branch Commissioners have decided to have Ocean Avenue, from North Long Branch to Brighton Avenue, near the West End Hotel, surveyed so as to get a uniform width of roadway and then advertise for bids for the repairing of the same.

KEY WEST, FLA.—Extensive paving operations are to be commenced in this city at an early day. The estimated expenditure of the work is $200,000.

SAVANNAH, GA.—Estimates are being made for the paving of numerous streets with asphalt.

GAS AND ELECTRIC LIGHTING.

DOYLESTOWN, PA.—This place has decided to do away with gas illumination in favor of the electric light.

SEATTLE, WASH.—The Seattle Gas and Electric Light Company has been incorporated. Capital stock, $600,000. Incorporators, Dexter Horton, A A Denny, and others. The objects of the corporation are to establish and maintain gas and electric light plants in this city.

GRAND RAPIDS, MICH.—All bids for public lighting have been rejected by the Council, and the City Clerk has been directed to readvertise for proposals.

JAMAICA, N. Y.—At a recent meeting of the Board of Trustees of this place, all the bids for public lighting were rejected, and the Clerk of the Board was directed to readvertise for bids for lighting the streets all night and every night for a period of three years; that the candle-power bid for electric light must not be less than 32 candle power, and not less than 20 candle power for 4-foot gas burners.

PITTSBURG, PA.—The Pittsburg *Dispatch*, of September 6, says: "There is talk of an electric light company being formed in the West End for the purpose of supplying private residences and business houses. A meeting of those interested in the enterprise has already been held, and all that remains to complete arrangements for organization is the subscription for stock. It is not known yet what the capital stock is to be, but it is said the plant will be large enough to supply all of the West End and the thickly settled portions of Chartiers township.

CLIFTON, PA.—An electric lighting plant is to be established at this place.

WETUMPKA, ALA.—Reports say that an electric light plant is to be established at this place.

WINCHESTER, TENN.—An electric lighting plant is to be established at this place.

SANTA FE, N. M.—It is proposed to establish an electric light plant at this place at an estimated cost of $25,000. C. F. A. Fischer, of this city, can furnish particulars.

MOUNT STERLING.—The Mt. Sterling Electric Light Company has made the city a proposition to erect an electric light plant.

PHILADELPHIA, PA.—The Suburban Electric Co., has been incorporated at this place with a capital of $200,000. The directors are T. W. South, H. A. Mullin and others.

QUINCY, MASS.—Improvements are to be made to the local electric light plant.

ELGIN, ILL.—Improvements are soon to be made to the plant of the American Gas Light Company.

BUENA VISTA, GA.—Efforts are being made to establish an electric light plant here.

HOWELL, MICH.—It is probable that the projected electric light plant for this place will be established at once by the Howell Electric Light and Power Company.

BIRMINGHAM, ALA.—The Consolidated Electric Light Company has been incorporated here. Address J. F. B. Jackson for details.

SAN FRANCISCO, CAL.—Reports say that extensive works will be erected on the property of the San Francisco Gas Lighting Company.

PORT JERVIS, N. Y.—The Deer Park Electric Light Company has been awarded the contract for lighting this city for a period of two years from June 1, 1890, at a cost of $105 each for the first 83 lights, and $90 for each additional light.

MIDDLETOWN, DEL.—The electric lighting plant at this place is to undergo extensive improvements. Among the improvements is included a new engine, also new boilers and dynamos. Address J. B. Brattan for particulars.

DAYTON, KY.—The Citizens' Electric Co. is a new concern at this place. The capital stock is $25,000, and the secretary is Charles Bird.

SANDWICH, ILL.—This place will soon establish an electric light plant.

FRACKVILLE, PA.—The Frackville and Gilberton Light, Heat and Power Company, has been incorporated here. Capital stock, $40,000.

BAY CITY, MICH.—An electric lighting plant is to be established at this place.

SANGER, CAL.—This place is to have electric lights.

TACOMA, WASH.—The Commercial Electric Light and Power Company has been incorporated at this place with a capital stock of $250,000.

HAWKINSVILLE, GA.—The people of this place are discussing the electric light question. Captain O. A. Horne can be addressed.

SELMA, ALA.—Reports say that the Selma Electric Light and Gas Company will, at an early date, put in an incandescent plant.

DOVER, PA.—Improvements are to be made to the local electric light plant.

MONROE, N. C.—The electric light question is to be settled at a public election, to be held at an early date.

ELECTRIC RAILWAYS.—New electric railways are to be constructed and improvements are to be made to those already established at the following places: Maysville, Ky.; Hollidaysburg, Pa.; Allentown, Pa.; Wakefield, Mass.; Chicago, Ill.; Newport, Ky.; Hartford, Conn.; Wethersfield, Conn.; Houston, Tex.; Lykens, Pa.; Trenton, N. J.; Seattle, Wash; Passaic, N. J.; Long Island City, L. I.; Ogden, Utah; Chilhowee, Tenn.; Flushing, N. Y.

THE Editor of THE ENGINEERING AND BUILDING RECORD is always glad to receive items of news for the Contracting News Department. But such items are not considered news except when the prices and particulars of the award of a contract are given.

The announcement that ——— has sold ——— to ——— without giving the *prices* and particulars concerns only the buyer and seller. Such notices are always excluded, except in the case where a certain firm is stated to have taken a certain contract, the execution of which would require that they should buy certain materials. Such an item would be used if deemed of more than local interest, because it would suggest to some readers the possibility of their making a sale or securing a sub-contract.

BIDS OPENED.

MINNEAPOLIS, MINN.—By telegraph to THE ENGINEERING AND BUILDING RECORD, September 10, 1890:

"The Commission has rejected all bids for the construction of the superstructure of the court house and city hall, at this city, recently published. The architects have been instructed to prepare new estimates, the total cost not to exceed the sum of $2,500,000."

BOSTON, MASS.—The following bids for the construction of a wharf at Deer Island, were received by the Metropolitan Sewerage Commission, September 10: F G. Whitcomb, $11,736; Geo. H. Cavanagh, $13,900; John Cavanagh & Co., $14,200; Nay, Ellis & Kenrick, $14,430; Shaw & Miller, $16,300; C. T. Derry & Co., $16,980; J. N. Hayes & Co, $18,000

TACOMA, WASH.—Bids for the construction of the Pierce County Court House have been opened and the contract awarded to John T. Long, of Tacoma, for $270,000. There were eight other bids, the highest being $373,800. The contract includes all work except lighting and elevators.

GOVERNMENT WORK.

SACRAMENTO, CAL.—The following proposals for excavation, concrete foundations, stone and brick work of the basement area walls of the United States Post Office and Court House, at this place, have been opened by the Supervising Architect of the Treasury Department: Carlow Bros., Sacramento, Cal., $42,114; $42,804. Krenz, Berger & Harire, Sacramento, Cal., $40,251; M. J. Healy & Co., Loomis, Cal., $46,875; A. McElvoy & Co., San Francisco, Cal., $52,412; Frank Reid Forotcher, Lincoln, Cal., $59,600; Bassett & Towhey, Sacramento, Cal., $52,490; B. Krenzerbery, Sacramento, Cal., $49,000.

INDUSTRIAL.

WATERBURY, CONN.—The New England Engineering Company, of Waterbury, Conn., has been incorporated, to build, equip and operate electric light plants, railways, telegraph lines, etc.; capital stock, $40,000. A. M. Young can furnish details.

KANSAS CITY, MO.—The Kansas City Packing and Chase Refrigerator Company, of Kansas City, Kan., has decided to locate car shops in this city. The buildings will cover three acres of land. Plans and specifications are now being prepared for the new buildings, and as soon as they are completed and approved by the company ground will be broken for the foundations for the plant. It is proposed to expend the sum of $500,000 on the undertaking.

PEORIA, ILL.—Alderman Woolner can give information of a proposed 300-acre park for this city.

PROPOSALS.

(Continued from page ii.)

SEPTEMBER 1, 1800.

SEALED PROPOSALS WILL BE RECEIVED at the office of the Supervising Architect, Treasury Department, Washington, D. C., until 2 o'clock P. M., on the 30th day of September, 1890, for all the **LABOR AND MATERIALS** and putting in place complete the iron columns, iron floor and iron and wood roof construction, terra cotta arches, etc., for the U. S. Custom House, Post-Office, etc., building at PORT TOWNSEND, WASH., in accordance with the drawings and specification, copies of which may be had on application at this office or the office of the Superintendent. Each bid must be accompanied by a certified check for $200. The Department will reject all bids received after the time herein stated for the opening of the same; also, bids which do not comply strictly with all the requirements of this invitation. Proposals must be inclosed in an envelope, sealed and marked, "Proposal for the Iron Columns, Iron Floor and Iron and Wood Roof Construction, Terra Cotta Arches, etc., for the U. S. Custom-House, Post-Office, etc., at Port Townsend, Wash.," and addressed to JAS. H. WINDRIM, Supervising Architect. 15

SEPTEMBER 11, 1890.

SEALED PROPOSALS WILL BE RECEIVED at the office of the Supervising Architect, Treasury Department, Washington, D. C., until 2 o'clock P. M., on the 6th day of October, 1890, for all the **LABOR AND MATERIALS** required for furring, lathing, plastering, floor arches and concrete floors for the U. S. Post Office, etc., building at DAYTON, OHIO, in accordance with the drawings and specification, copies of which may be had on application at this office or the office of the Superintendent. Each bid must be accompanied by a certified check for $200. The Department will reject all bids received after the time herein stated for the opening of the same; also, bids which do not comply strictly with all the requirements of this invitation. Proposals must be inclosed in an envelope, sealed and marked, "Proposal for Furring, Lathing, Plastering, Concrete Floors, etc., at Dayton, Ohio, and addressed to JAS. H. WINDRIM, Supervising Architect. 16

PROPOSALS.

TO CONTRACTORS.

SEALED PROPOSALS WILL BE RECEIVED by the Committee on Buildings and Repairs of the Board of State Charities and Corrections for **BUILDING** the Male Wing of the new State Alms House at the State Institutions, CRANSTON, R. I., until 12 M., September 30, 1800.

The plans and specifications for the work can be seen at the office of Stone, Carpenter & Willson, Architects, 65 Westminster Street, Providence, R. I.

The Committee will receive bids for the Mason Work, Carpenter Work, Steam Heating, Plumbing, and Gas Piping, in one bid or in separate bids, and reserve the right to reject any and all bids as they may deem for the best interest of the State.

Per order of the Committee on Buildings and Repairs.

STONE, CARPENTER & WILLSON,
Architects.

17

BRIDGES, Atchison, Kan.—Proposals are wanted until September 16, for the construction of two iron span bridges. Address W. S. Parcell, Chairman County Commissioners, as above.

SCHOOL, Helena, Mont.—Proposals are wanted until September 20, for the erection of a school building at this place. Address F. W. Ellis, Clerk School District, No. 1, as above.

PIER, New York City.—Proposals are wanted until September 24, for preparing for and building a new crib bulkhead at Charity Hospital, Blackwell's Island, East River, and for removing the existing platform and crib bulkhead thereat. Address the Department of Docks, Pier A, North River, as above.

CITY HALL, North Bend, Neb.—Proposals are wanted until September 22 for the erection of a city hall building at this place. Address J. E. Newson, City Clerk, as above.

PUMPING ENGINE, Dallas, Tex.—Proposals are wanted until September 24, for furnishing one 10 000,000-gallon pumping engine, vertical compounding pattern. Address W. McGraine, City Secretary, as above.

BRIDGE, San Antonio, Tex.—Proposals are wanted until October 4, for the construction of a through truss, class "A," bridge, on the San Antonio River. Address Mayor Bryan Callaghan, as above.

WATER-WORKS, Toledo, Iowa.—Proposals are wanted until September 23, for the construction of a complete system of water-works at this place. Address Mayor A. M. Beal, as above.

WATER-WORKS, Rushville, Ind.—Proposals are wanted until September 16, for the construction of a complete system of water-works. Address Mayor Wilson T. Jackson, as above.

BRIDGE WORK, Reading, Pa. —Proposals are wanted until September 22, for the masonry abutments and wing walls for an iron truss bridge over Swatara Creek, in Tulpehocken and Bethel Townships. Address W. H. Fisher, County Commissioners' Clerk, Court House, as above.

BUILDING, Bridgeport, Conn. — Proposals are wanted until September 17, for the erection of a County Home building at Norwalk, Conn. Address Albert H. Beers, Architect, opposite depot, as above.

Building Intelligence.

We solicit from each and every one of our readers information relating to projected buildings in their locality, and should be glad to receive newspaper clippings and other items of interest.

ABBREVIATIONS.—*b s*, brown stone; *br*, brick; *br st*, brick store; *b s dwell*, brown-stone dwelling; *apart house*, apartment-house; *ten*, tenement; *e*, each; *o*, owner; *a*, architect; *b*, builder; *fr*, frame.

NEW YORK.

214 Eldridge st, br factory; cost, $25,000; o, Fayerweather & Ladew, a, Romeyn & Stever; m and c, R L Darragh.

36 Market st, br flat; cost, $19,000; o, E O'Halloran; a, M V B Ferdon; m and c, E Mallon.

Amsterdam av, n w cor 99th st, s church; cost, $135,000; o, S. Michael's Church; a, R W Gibson.

158 126th st, br and st flat; cost, $20,000; o, F Hollender; a, H Kafka.

Irving pl, n w cor 19th st, extension; cost, $7,000; o, C C Rice; a, G Keister; m and c, P Galligar.

15th st, n s, 40 w 7th av, extension; cost, $20,000; o, St. Joseph's Home for the Aged; a, Schickel & Co.

175 E 78th st, br flat; cost, $10,000; o, R & O Goelet; a, Thorn & Bilson.

11th and 12th avs, 34th and 35th sts, br public bldg; cost, $7000; o, N Y & H R R Co; a, W Katte.

N E cor, West and Bethune sts, br factory; cost, $9,000; o, American Biscuit and Mfg Co; a, G Vigaut.

N W av and 115th st, br flat; cost, $25,000; o, M Walter; a, not given.

232–38 E 33d st, 3 br flats; cost, $75,000 all; o, A C Zabriskie; a, J E Ware.

BUILDING INTELLIGENCE.

NEW YORK.—Continued.

N e cor Wall st and Broadway, br office bldg; cost, $75,000; o, First National Bank; a, Peabody & Stearns.

479–83 West st, br factory; cost, $40,000; o, American Biscuit Manufacturing Co; a, G Vigeaut.

77th st, 225 W 8th av, 2 br dwells; cost, $50,000 all; o, R Anna Carey; a, A Carey.

N s and s s 155th st, 185 E 8th av, br factory; cost, $24,000; o, Haskin Wood Vulcanizing Co; a, D & J Jardine.

N s 154th st, 145 Elton av, br ten; cost, $9,000; o, E Gluchmann; a, T L Blom.

N s 15th st, 153 Fifth w av, br meat house; cost, $15,000; o, Society N Y Hospital; a, G B Post.

BROOKLYN.

Putnam av, n s, 100 e Reid av, 5 br and brown stone dwells; cost, $5,000 each; o, a and b, William O. Forrester.

45th st, s s, 200 e 3d av, 5 fr dwells; cost, $2,500 each; o and b, James G Carroll; a, J L Quesenberg.

Montgomery pl, n s, 353 e 8th av, 4 brick, terra cotta and limestone dwells; cost, $7,000 each; o, Messrs Ford & Hagen; a, G P Chappell.

Carroll st, n s, 200 e 3d av, br bakery, stable and loft; cost, $20,000; o, Hildebrand Bros; a, C Werner; b, W L Roundtree and W J Conway.

N s cor 4th av and 7th st, br dwell; cost, $12,000; o, C Collins; a, J G Glover.

W s Classon av, 10 n Lexington av, br dwell; cost, $27,000; o, Eliza K Logan; a, Cady & Brewer.

W s 3d av, 40 s 45th st, 2 fr dwells; cost, $7,000 all; o, H Buck; a, J D Bogert.

N s 17th st, 140 w 8th av, 3 fr dwells; cost, $10,000 all; o, Mr. Henzel; a, C Braun.

S s Bergen st, 225 w Tompkins av, br dwell; cost, $8,000; o, F Kuckuk; a, F Holmberg.

S s 4th st, 27 e 6th av, 5 br dwells; cost, $50,000 all; o, Moses & Tauton; a, R L Daus.

435–43 Atlantic av, br factory; cost, $50,000; o, Anheuser Bursch Brewery; a, C Werner.

435–43 Atlantic av, rear, br stables; cost, $50,000; o and a, same as above.

S s McDougal st, 200 e Stone av; 4 br dwells; cost, $16,000 all; o, A S Walsh: a, A Hill & Son.

S s Provost av, 180 w 8th av, 2 fr dwells; cost, $8,500 all; o, Mr Henzel; a, C Braun.

N s Madison st, 90 e Evergreen av; 2 br dwells; cost, $7,000 all; o, J H Fort; a, A J Lamb.

S s Pacific st, 200 e Brooklyn av, 5 br dwells; cost, $32,500 all; o, G Phillips; a, G R Chappell.

ALTERATIONS—BROOKLYN.

Forrest st, s s, 80 e Central av, extension; cost, $7,000; o, L Neebe; a, F Holmberg; b, not selected.

MISCELLANEOUS.

BAYONNE, N. J.—The City Council has adopted plans for a new City Hall, subject to revision. Three architects competed, and L H Broome, of Jersey City, was successful. About $40,000 will be expended by the city for the purpose.

BRIDGEPORT, CONN.—Cor William and Barnum sts, br block of 7 tens; cost, $30,000; o, F Armstrong; a, M A Jenks; b, Jones & Hoffman.

Noble av, bet Maple and Arctic sts, br and stone school bldg; cost, $75,000; o, city of Bridgeport; a, Longstaff & Hurd; b, H M Purdy.

BOSTON, MASS.—590–94 E 7th st, 3 fr dwells; cost, $11,000; o, o, John R Cushing; a and b, W T Eaton.

Homes av nr Topliff st, 2 fr dwells; cost, $9,000; o, a and b, Andrew Crawford.

544–46 Commercial st, 2 br tens; cost, $12,000; o, Andrew Burnett; a, W H McGinty; b, John Kelley.

Blue Hill av, junction Walk Hill st, 2 fr dwells; cost, $9,000; o, Geo W Parker; a, J F Ober; b, R McDonald.

43 Charter st, and "rear of," 6 br tens; cost, $35,000; o, Nora Donahoe; a, J F Kelley; b, K Driscoll.

BUILDING INTELLIGENCE.

BOSTON, MASS.—95 Boylston st, br addn and alteration; cost, $8,000; o, F Haven, trustee; b, H McLaughlin.

Dorchester st and Vinton st, fr church; cost, $7,500; o, J H Storey and others; a, W H Besarick; b, not let.

100 Crawford st, fr dwell; cost, $7,500; o, F M Babcock; a, Brigham & Spofford; b, J A Corkham.

22 Victoria st, fr dwell; cost, $7,000; o and b, E McKechnie; a, E H Boyden.

Westville st nr Ditson st; 2 fr dwells; cost, $7,800; o, John Yates and others; a and b, H A Verge.

Topliff st nr Bowdoin st, 2 fr dwells; cost, $7,500; o, R Simpson and others; a, John H Keller.

Marmion st, nr Cornwall st, 6 fr dwells; cost, $9,000; o, Peter Barr; a, L W Bryant.

CANTON, O.—219 W Tuscarawas st, 4-story br business block; cost, $10,000; o, a and b, W L Davis.

N w cor 4th and Court sts, 3-story br business block; cost, $8,000; o, a and b, as above.

CINCINNATI, O.—The Fruit and Vegetable Commission men of Front and 6th sts have combined and will build a cold storage warehouse to cost $200,000. No plans have been made. John O'Moore & Co, of W 6th st, are interested in the project.

DULUTH, MINN.—A large flour mill will be erected at St. Louis, a small town just started a few miles above this city. It will cost $300,000. T A Bean, of Fairbault, Minn, is interested. An elevator, to hold a year's supply of grain, will be built near at hand.

NEWPORT, KY.—The old "Swift" rolling mills at this place have been purchased by capitalists, who will spend $250,000 in new buildings and machinery for a complete steel plate mill. Col A L Berry, Newport, Ky., can give particulars.

POTTSVILLE, PA.—1108 Mahvetonga, fr dwell; cost, $8,500; o, W W Foster; a, W P Hill; b, not let.

QUINCY, ILL.—Col W T Dowdall will rebuild his residence, destroyed by fire last week. It will be fitted up with modern improvements. The cost will probably be $50,000 or more.

ST. PAUL, MINN.—Dayton, nr Fish, 2 story fr dwell; cost, $8,000; o, R C Fish.

Summit, nr College, 2 story br ten; cost, $10,000; o, C S Carman.

BUILDING INTELLIGENCE.

SCRANTON, PA.—Br and fr school bldg; cost, $28,000; o, Scranton Board of Control; a, I J Williams; b, E G Hughes.

ST. LOUIS, MO.—Sidney and Liberty sts, br dwell; cost, $8,700; o, T Lang; b, E Paulus.

Westminister pl and Sarah st, br dwell; cost, $14,000; o, J J Philips; b, A Bauer.

3d st and Chouteau av, br warehouse; cost, $7,000; o and b, Cox & Gordon.

10th and Spruce sts, br warehouse; cost, $100,000; o, Tiffany R E Co; b, F C Bonsack.

Washington and Compton avs; br dwell; cost, $11,000; o, J Steer; b, sublet.

WASHINGTON, D. C.—1801–3 12th st, 2 2-story br bldgs; cost, $14,000; o, C W Handy; a, C V Trote.

615–21 22d st, 4 2-story br bldgs; cost, $12,000; o and a, R Sherman; b, W E Brown.

13th st, extended, 3-story br bldg; cost, $9,500; o, Wm Holoncad; a, H G Bonner; b, W T Garrison.

28–34 C st, 4 2-story br bldgs; cost, $16,000; o and a, same as above.

238–40 Dolan st, 2 2-story br bldgs; cost, $17,000; o and a, same as above; b, W T Garrison.

308–12 E st, 3 2-story br bldgs; cost, $9,000; o, E S Kennedy; a, same as above.

612–20 15th st, 5 2-story br bldgs; cost, $12,500; o, K Waloson; a, same as above.

615–19 Florida av, 3 2-story br bldg; cost, $15,000; o and b, W R Coon; a, N T Bealler.

1825 13th st, 3-story br bldg; cost, $11,000; o, J R McAsh; a, Pitney & Bradford; b, H F Getz.

1776 Q st, 3-story br bldg; cost, $60,000; o and a, T F Schneider; b, Emmet & Hinsley.

D st, bet 13th and 14th sts, 3-story br bldg; cost, $75,000; o, Albert Carey; a, A C Wagner; b, Wm Rothwell.

M st, bet 4½ and 6th st, 1-story br bldg; cost, $9,000; o, Chas Bailey; a, Glenn Brown; b, A J Fisher.

185 permiss less than $7,000 in value.

BUILDINGS.—There is nothing over $7,000 in value to report at the following places: Braintree, Mass.; Worcester, Mass.; Chester, Pa.; Ogdensburg, N. Y.; Allegheny, Pa.; Harrisburg, Pa.; Waltham, Mass.; Poughkeepsie, N. Y.; Easton, Pa.; Wheeling, W. Va.; Sioux City, Iowa; Topeka, Kan.; Denison, O.; Pottstown, Pa.; South Bethlehem, Pa.; Charleston, S. C.; Wilkes Barre, Pa.; Dayton, O.; Lancaster, Pa.; Savannah, Ga.; Fitchburg, Mass.

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THEIR
CONSTRUCTION AND MAINTENANCE.
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SOME PRESS COMMENTS:

A most creditable and seasonable compilation. It is decidedly the best collection of data on this important subject that has yet appeared in book form. —*Engineering News*, *June* 21, 1890.

* * * It should have a place, especially, in the offices of street and county commissioners, where its suggestions might soon contribute greatly to the commercial welfare, safety and convenience of thousands of communities in our land.—*Iron Age*, *June* 19, 1890.

A valuable manual.—*San Francisco Chronicle*, *July* 13, 1890.

The volume is one which has a practical value, and should be studied by all interested in road improvements.—*Troy Times*, *July* 21, 1890.

This book is very comprehensive in its scope and certainly supplies a long felt and pressing want. It ought to be studied by all who have to do with the construction of highways whether in city or country, as well as by councilmen, legislators, public writers and such as have a part directly or indirectly in the making of road laws, pavement ordinances, etc.—*Indianapolis Sentinel*.

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THE ENGINEERING & BUILDING RECORD

AND

THE SANITARY ENGINEER.

A JOURNAL FOR THE ARCHITECT, ENGINEER, MECHANIC, AND MUNICIPAL OFFICER.

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COUNTY ROADS.

IN view of the rapid progress that has been made in the improvement of county roads throughout the country during the past two years, it will be well to look over the field, and see whether any mistakes have been made and what can be done towards insuring the best results for the money expended.

Road making has been practiced from time immemorial, and the average road-master, or county legislator in the country, or street commissioner in the town has been so long looked up to as the one who knows all about it that he resents the idea that he can be taught anything, and considers the employment of an engineer an insult to his intelligence and a useless expense. Where provision has been made for the employment of county engineers, it has been in some cases considered as fully carried out by the employment of a land surveyor. In such cases an experienced eye at once detects a lack of proper regard to the topographical features of the country by an attempt to make the roads too level, resulting in defective drainage and often in a greater expense for grading than would otherwise be required. This shows itself also in the provision of very rigid specifications, followed by very poor inspection, of which latter the contractors are never slow to take advantage. Again, an inexperienced engineer, instead of leading the Board of Supervisors, or other body to whom he is responsible, is led by them. The contractor also soon sees with whom he has to deal, and easily convinces them that the best roads are to be made by an increased use of clay, and by the use of light rollers, and in various other ways obtains release from work he has contracted to perform. In such cases it seems to be forgotten that if the specifications were not to be insisted upon, then all other bidders for the work should have been furnished with such knowledge in advance of the letting, as it would often result in a substantial saving in cost.

We presume that under our system of government a town or county authority can spend and waste on road making money raised each year by taxes without any State control. But since a great many communities are likely in the future to incur indebtedness, that is, issue bonds the avails of which are to be spent in building roads, it is high time that legislation provided for some competent engineering tribunal to have at least advisory power, and who should be required to make periodical inspections and reports.

CHICAGO'S SMOKE TROUBLE.

CHICAGO is making a vigorous fight against the smoke nuisance. Judgment was rendered a few weeks ago against the Louisville and New Albany Railroad in seven cases for violating the smoke ordinance, and a fine of $50 was imposed in each case. The Pennsylvania and the Pan Handle roads were assessed $50 each in twenty-seven cases. The campaign of Chief Inspector A. Young, of the Chicago Health Department, against the offenders is based on three sections of the municipal code which declare as a public nuisance the emission of dense volumes of smoke from chimneys and smoke stacks, and provide a penalty of $50 on those responsible.

The smoke ordinance has been in effect for several years, but no strong effort has hitherto been made to enforce it. Now, however, that the World's Fair is to be held at Chicago, the measures are to be vigorously prosecuted. Since the beginning of April of this year a marked improvement is said to have already been effected in the condition of Chicago's atmosphere, and much better things are yet expected from the determined action of the authorities. No special smoke preventing appliance is insisted upon by the Health Department. All that it demands is that the smoke nuisance be abated, and owners of factories, tugs, locomotives, etc., are permitted to seek their own salvation. This, as THE ENGINEERING AND BUILDING RECORD has on several occasions pointed out, is the only proper way of obtaining relief from the smoke trouble. Rigidly enforce the law, and ways and means to comply with it will quickly suggest themselves.

IRRATIONAL BUILDING PLANS.

OAKLAND, CAL., proposes to build a fire engine-house, for which an appropriation has been made of $18,000. According to *The Tribune* of that city the Mayor recommends that this engine-house should be so planned that it may be enlarged from time to time to suit the purposes of a municipal building for the city. *The Tribune* seems to think that this is a very clever idea, and that it should commend itself to the people for its "practical good sense." It says that an engine-house is needed now. Before long some other department will need a new building and it can be added to the engine-house. If, therefore, proper plans be ordered and adhered to a "splendid city building will grow almost insensibly—a building which will not only be useful and convenient but possessed of architectural beauty, an honor and ornament to the city."

The Tribune should know that this is contrary to all past experiences, and, consequently, the reverse of practical common sense. It would be very much like having a suit of clothes made for the Mayor's small boy, if he has one, and then having them altered when a baby girl grows up so that they will suit her. If it is proposed to have an engine-house occupying a portion of a public building, the plans of the public building should be ordered now, and that portion of it intended to house the steam engine can be finished. This, however, is evidently impracticable in view of the amount of the appropriation. It will be much more sensible, therefore, to have the city build as good an engine-house as it can for the money at command, and when it needs another building have it designed by a skilled architect with sole reference to the use to which it is to be put.

WALTER HOWE AND JAMES GALLATIN.

NEW YORK CITY and the cause of sanitary reform has suffered a real loss in the recent death of two men in the prime of life—Walter Howe and James Gallatin. The former by his intelligent and earnest efforts in the Legislature secured important legislation for New York affecting the tenement house and street cleaning problems of the city, and since gave valuable services as one of the New Aqueduct Commissioners. James Gallatin, who died suddenly on the 17th inst. of heart disease, has of recent years been little before the public, but in the period from 1879 to 1882 he was the active member of the New York Sanitary Reform Society, spending a good deal of his time in Albany in the public spirited service of securing the passage of the Tenement House Act of 1879 and the Plumbing Law of 1881, which so largely increased the powers of the Board of Health. The early readers of THE ENGINEERING AND BUILDING RECORD will remember how the architectural competition instituted by it in 1878, for improved tenement houses, resulted in a popular agitation in the winter of 1879. Mass meetings at the Cooper Institute were held, and the tenement house evil was the subject for discourse in many churches of the city on a certain Sunday. It was then that the Sanitary Reform Society was formed, and Mr. Gallatin made its president and active officer. His private means enabled him to devote his time to the work of promoting that important legislation. Illness prevented his remaining at Albany at the critical stages of the plumbing law, but his services in the introduction of the measure and in enlisting influential support should not be forgotten.

PAYMENT FOR THE USE OF CITY STREETS.

THE joint special committee of the Boston City Council, composed of Aldermen William Power Wilson, John A. McLaughlin and Wesley A. Gove, Councilmen Bowdoin S. Parker, S. Edward Shaw, Isaac Rosnosky, Albert H. Hall and John F. Kinney, appointed to consider and report upon the advisability and method of securing some return to the city for the use of its streets by private corporations, having considered the subject, recently submitted a report to the Board of Aldermen.

In considering the subject, it was naturally deemed advisable to ascertain the experience and practice of other cities, and application was accordingly made to all the leading cities in this country and many of the cities of Europe, for such information upon the subject as might be of value to the committee. The particulars thus gathered would seem to show that Boston is much behind other cities in the United States in respect to solving the question of securing a return for the use of her streets afforded to private corporations, for in almost every one of the cities the corporations are required to make some direct return to the city for the privileges they enjoy in the public streets. This custom is so general that the claim that it would impose a burden upon corporations so serious as to impair their usefulness does not seem to have any force.

The local telephone companies of Amsterdam pay to the city, annually, 21½ per cent. of their gross receipts; in St. Louis, 5 per cent. of gross receipts, and in Philadelphia, $1 annually for each old pole and $5 for each new pole, used for the support of wires. Street railway companies also pay for their locations. In Amsterdam they pay 5 per cent. of gross receipts annually; in Baltimore, 9 per cent. of gross receipts, with an additional tax on each car; in Newark, 2½ per cent. of capital stock; in Providence, a certain fixed sum; in St. Louis, a percentage of gross receipts on a sliding scale; while in New York State all street railway franchises are now sold at auction for the highest offer above a certain fixed percentage of gross receipts.

The method most generally adopted is to require the payment to the city of a percentage of the gross receipts. This method may work to advantage in many instances, but in the case of a street railway, telephone or electric light company, having its tracks or lines in different municipalities, it would be difficult to adjust the rate proportionately. In addition to this, it is not always possible to ascertain what a company's receipts actually are. The special tax upon each car of a street railway company, such as is levied in Baltimore, might tend to deter the company from furnishing adequate and proper accommodations for the community, especially if the fee, as in Baltimore, is greater for a new car than for an old one. The system is also open to objection as not being applicable to all corporations.

As regards the auction system, which has been adopted in New York, the committee is of the opinion that it would not operate satisfactorily in Boston under the present state of affairs, particularly in reference to granting street railway locations. If a street railway extension became necessary, and the proposed new location was offered at auction, a system of competition would at once be introduced in opposition to the present system of monopoly, which has received the sanction of the Legislature. A further objection to the system appears to be that it would tend to prevent a judicious and necessary railroad extension, on account of the reluctance which a corporation would evince to risk its rights upon the uncertainty of a public auction. The committee is, however, favorably impressed with the method adopted in the city of Philadelphia, whereby a special annual fee is paid to the city for each pole belonging to the telegraph and telephone companies. The principle which underlies this system requires each corporation to pay a fixed sum for their special use of the public streets, and this sum is precisely proportionate to the extent of such use. The chief advantage of this system arises from the fact that it can be applied with equal fairness to each and every corporation enjoying the privileges granted them by the city. Thus a street railway company might be required to pay the city a fixed sum for each mile of track located in the streets; telephone and other companies, operating lines of electric wires, to pay so much for each pole erected; and companies making use of pipes and conduits, underground, a fixed sum per mile of pipe, etc.

The committee did not recommend any specific method of securing a return from corporations for the use of streets, but was instrumental in securing the passage of an order by which the Mayor is requested to petition the General Court at its next session for the passage of an act authorizing cities and towns to prescribe terms and conditions for the use of their streets by private corporations.

REPORT OF THE MISSISSIPPI RIVER COMMISSION.

THE annual report of the Mississippi River Commission for the fiscal year ending June 30, 1890, was received at the War Department at Washington a few days ago. It is dated June 30, but it has been delayed, probably owing to the fact that it is the largest and most exhaustive report yet made by the commission. It states that the work has been vigorously prosecuted during the year, and that the appropriations for the various localities are now practically exhausted. Complaint is made that funds for the expenses of the commission have been insufficient and personal inspection of the work by the Commissioners has necessarily been neglected. The flood on the Lower Mississippi interrupted the work in April, although the maximum discharge, including crevasse escape, was not so great as in 1882.

The lesson taught by the flood, says the report, is the same as that of other great floods—namely, the necessity of raising and strengthening the levees.

The survey of the river has been continued during the year. In general, the commission reports that the work of the year has been successful and the results satisfactory. Detailed reports as to the improvements in the several districts are transmitted from the engineers in charge, and there are also reports of the damages to levees and other improvements caused by the flood. The total expenditures for the fiscal year ending June 30, 1890, were $1,496,128, and there remained on hand July 1 a balance of $375,618. The estimates for the fiscal year ending June 30, 1891, are: For the commission, $35,000; continuing survey of the river, $150,000; improving river from head of passes to the mouth of the Ohio, $4,000,000; work at Hickman, Ky., $111,250; work at Greenville, Miss., $350,000; work at Vicksburg, Miss., $175,000; work at Natchez, Miss., $250,000; work at New Orleans, La., $200,000; improving Red and Atchafalaya Rivers, $350,000; total, $5.621,250.

Considerable space is devoted to the recent flood, and in this connection is presented a memorandum on the question whether building levees along a river causes its bed to rise. Various authorities are quoted to show that levees do not raise the bed of a river, and the history of several leveed rivers is cited in evidence. Among those are the Po, the Hoang Ho and the Yellow River. "The statement is often made," concludes the memorandum, "that leveed rivers raise their beds higher and higher as levees are raised, and hence that levees will give no permanent relief against overflow. These statements are usually made from theoretical opinions, and without a thorough knowledge of the theoretical side of the subject, and probably without any knowledge of the facts of experience, which alone can lead to conclusions entirely safe."

On the subject of outlets which have been proposed as a method of reducing flood heights on the Mississippi, the President of the Commission, Col. C. B. Comstock, says: "The immediate results on flood heights are so evident and so beneficial, when a large crevice is formed and the good results of an opening far larger than ever occurs, naturally seem so immediate and apparent that it is not strange that many persons look on them as the true remedy for great floods." He holds that the outlet system proposed would be not only useless, but in the end damaging, and as to the Lake Borgne outlet scheme in particular he concludes: "The reduction by any large amount of the flow of the Mississippi at Lake Borgne will be ultimately followed by a rise in the flood heights at that place, and a shoaling of the river at its mouth until the levees below Red River are much higher than they are now. About 600,000 cubic feet per second in the greatest floods should be allowed to go into the Atchafalaya basin, thus relieving the river below * * * A large diversion of flow from the Mississippi to Lake Borgne would also seriously diminish the depth of the present mouths of the river. For the following reasons, then, no important outlet as Lake Borgne should be either undertaken or permitted:

"1. It would for some years lower the floods at the outlet, accelerate velocities above it, and increase caving and the consequent destruction of levees.

"2. It would cause shoaling at the present mouth of the river.

"3. If both the new outlet and the main river below it remained important streams—that is, if neither of them closed itself under the action of natural causes—the flood heights of Lake Borgne and New Orleans would, after some years, be greater than they are now."

AN English contemporary says that the town with the cheapest public supply of electric light in Europe is Trente, in Austria. The station is owned by the municipality, and has at its disposal a large motive force from a waterfall under excellent conditions. The light is furnished to private consumers at the rate of 50 kreutzers (about 20 cents) per year per candle power, no regulation being made as to the number of hours. To put the electric light within reach of the poorer inhabitants, the house wiring, done by the town, may be paid for in annual payments. The station also supplies motive power.

CHARLES L. JUNGERMAN, City Engineer of Newport, Ky., was killed in an altercation with Thomas L. Reilly, a reporter for the Covington *Commonwealth*. Mr. Jungerman was 32 years old, a graduate of Vanderbilt University, and formerly employed on the construction of the Chesapeake and Ohio Railroad. Offensive articles in the paper were at the bottom of the difficulty.

PERSONAL.

MILLS G. VORIS, County Surveyor of Galesburg, Ill., was recently elected Assistant City Engineer.

THOMAS DUTCHER, of Far Rockaway, L. I., has been appointed superintendent of the Queens County Water-Works.

MR. A. KAHN, architect, with Messrs. Mason & Rice, Detroit, Mich., leaves shortly for an extended sketching tour in Europe.

R. W. EVANS, a graduate of the University of Illinois, at Champaign, has established himself as an architect at 511 North Center Street, Bloomington, Ill.

COLONEL R. T. SCOWDEN, City Engineer, of Louisville, Ky., has resigned his office and accepted a new position at Chicago, as engineer of the Chicago Refrigerator Company.

SIR BENJAMIN BAKER and Sir William Arrol, the well known English engineers, prominently identified with the building of the famous Forth Bridge, arrived at New York on the 14th inst.

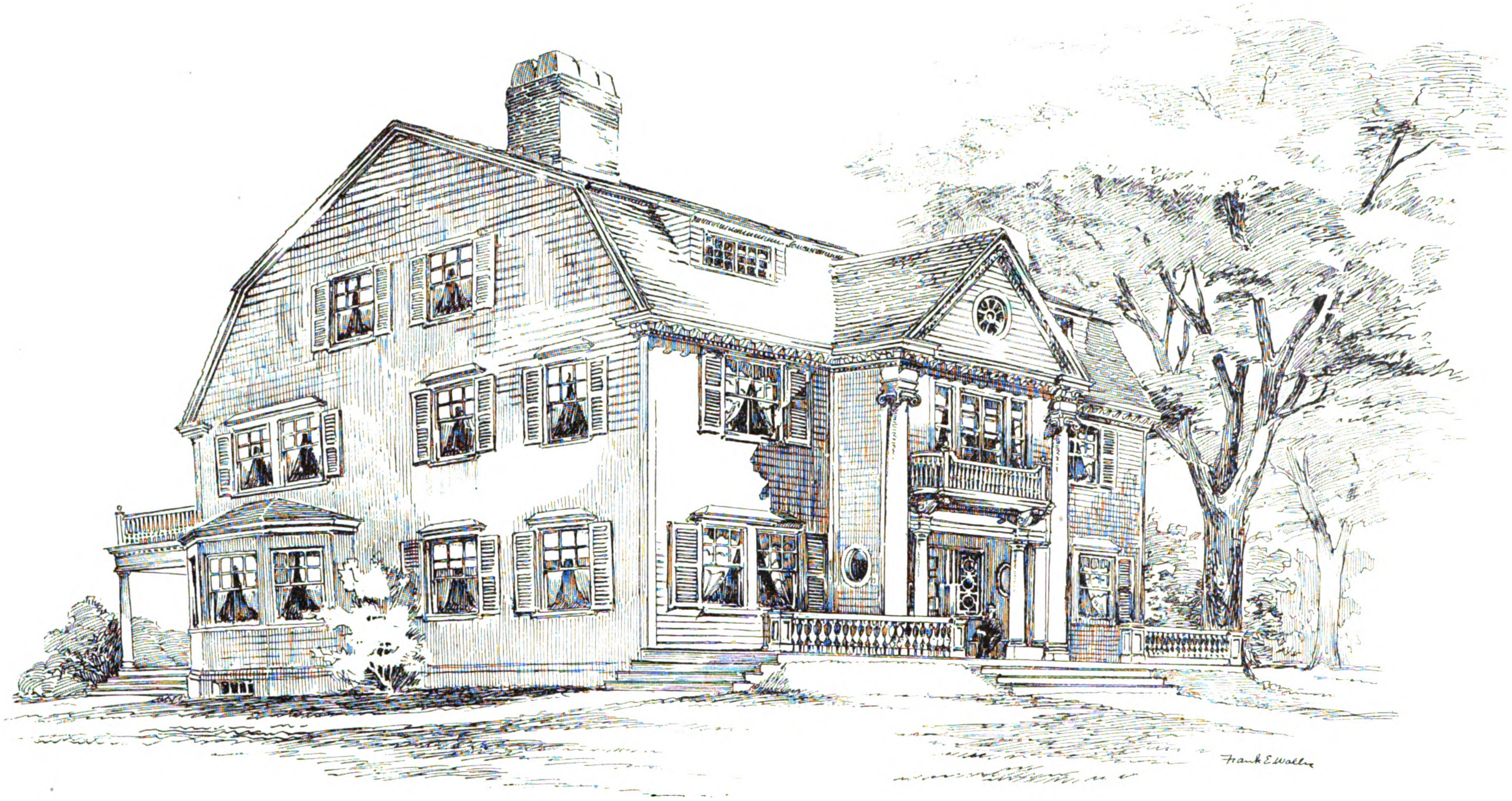
ALLAN MACDOUGALL, of Toronto, Can., has been appointed to succeed the late City Engineer Charles J. Harvey, in the work of completing the sewer system of St. Johns, Newfoundland.

A. LOWTHER FORREST, recently Hon. Secretary United Arts Club, London, and in charge of the Adelphi Drawing Office, Charing Cross, has just opened a drawing office at 53 Devonshire Street, Boston, for the purpose of rendering drawings for architects.

OUR ARCHITECTURAL ILLUSTRATIONS.

HOUSE OF W. C. TABER, NEW BEDFORD, MASS.
ANDREWS, JAQUES & RANTOUL, ARCHITECTS, BOSTON, MASS.

HOUSE AT PORTSMOUTH, N. H.
LONGFELLOW, ALDEN & HARLOW, ARCHITECTS, BOSTON, MASS.



THE ENGINEERING AND BUILDING RECORD ILLUSTRATED SERIES.

HOUSE OF W. C. TABER, NEW BEDFORD, MASS.

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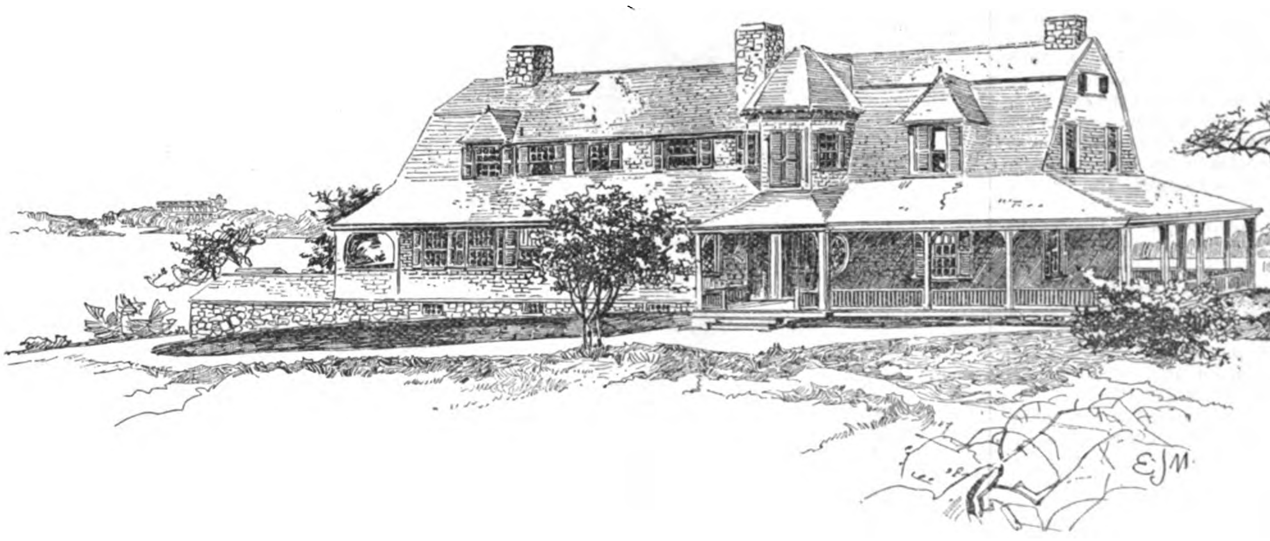
ENGINEERING SOCIETIES.

A REGULAR meeting of the American Society of Civil Engineers was held on September 17, Vice-President A. Fteley in the chair. Mr. C. B. Brush, as a member of the Local Committee of Reception, stated that arrangements were being made for the entertainment of the members of the British Iron and Steel Institute, who are expected to visit this country during September and October. The preparations are in the hands of the American Institute of Mining Engineers, and a bureau of information and general headquarters will be established at the Park Avenue Hotel, New York, on the last of this month. The programme will comprise meetings and local excursions in New York, a trip to Pittsburg, Chicago, Alabama and the Lake Superior region, and a banquet and reception after their return to New York.

Acting Secretary J. F. Crowell read a discussion, by Max O. E. Schmidt, on the recent paper by W. Barclay Parsons on "Railways in Mexico." Mr. Parsons replied to the discussion, and some further remarks were made by P. F. Brendlinger and J. F. Flagg. The Secretary read a discussion by O. F. Nichols on the paper by F. W. Watkins on "Tunnel Surveying on Division No. 6, New Croton Aqueduct." Mr. Watkins replied to the discussion, and, at his request, A. Fteley described and illustrated, by blackboard diagrams, an instrument that he had devised and used for graphically recording the cross-sections of the Croton Aqueduct, and for detecting settlements and distortions of the masonry. The instrument consisted essentially of a slotted radial arm pivoted on the face of a board which was set at the center of the required cross-section and in its plane. A printed diagram of the correct required cross section to about $\frac{1}{10}$th scale was placed on the board, concentric with the pivot of the arm and the center of the arch. The outer end of the arm carried a small contact wheel, and a pencil was attached to the arm where it should intersect the arch line on the printed diagram. When the contact wheel was passed around the arch soffit, the pencil traced a corresponding line on the diagram, and as its irregularities were to the natural scale radially and diminished laterally, while the diagram was at a reduced scale, it gave the effect of greatly magnifying distortions that would be imperceptible to the eye. It proved very convenient and valuable, an assistant and two laborers being able to take 50 or 100 cross section diagrams in one day with it.



HOUSE AT PORTSMOUTH, N. H.—LONGFELLOW, ALDEN & HARLOW, ARCHITECTS, BOSTON, MASS.

Mr. Fteley also related some experiences of the cracking of the invert from settlement, and the construction of a section on a long 50-foot embankment which was crowned 1 inch at the center. After the aqueduct had been constructed a long time over it, the settlement was not more than $\frac{5}{8}$ of an inch and the masonry was intact. In discussing the wonderful endurance sometimes secured in thin masonry, Mr. Fteley referred to a well-known example of an elliptical brick sewer between Boston and Charlestown, Mass. It was about 8 inches thick and 6½x5½ feet, set in a concrete cradle that rested on the caps of a double row of piles, driven pretty closely together, within the width of the sewer. The sewer was built for a special purpose, and usually ran full to within perhaps 6 inches of the top. After many years a careful examination was made of some bad breaks that were known to exist in the invert. It was found that the overhanging ends of the timber caps had broken at the piles, and that the dislocation had broken the sewer ring in three places, at the center of the top and at the bottom, each side of the center. The settlement and distortion had produced a reversed curve at the bottom and a pointed arch at the top, so that the cross-section resembled a heart, apex up, with cracks open 4 or 5 inches in the bottom loops; yet the sewer performed its duty, and after equilibrium was destroyed by emptying it, it held together to be repaired. Mr. Fteley's description was briefly discussed by L. L. Buck and F. S. Washburn.

MR. CHARLES PAINE, as chairman of the nominating committee of the American Society of Civil Engineers, has issued a circular letter to the members of the society, requesting them to propose, before October 1, on an inclosed blank form, the names of three members for each of the elective officers—viz.: President, vice-presidents, secretary, treasurer and directors. The committee will be materially assisted in their efforts to ascertain the wishes of the society at large, if all members will make careful responses to the invitation.

THE BOSTON SOCIETY OF CIVIL ENGINEERS held a regular meeting on Wednesday evening September 17, at 7.45o'clock, with President Clemens Herschel in the chair, S. E. Tinkham, Secretary, and about 35 members and visitors present. The following were elected members: Fred Vincent Fuller and James H. Stanwood, both of Boston, and Edward L. Ross, of Indian Orchard, Mass. A communication from the Western Society of Engineers in relation to the International Engineering Congress to be held in Chicago in 1893 was presented, and it was voted that the question of sending a delegate from the Boston Society be referred to the Board of Direction of the society.

John R. Freeman gave some interesting "Notes on English Mill Construction," illustrated with black board drawings, showing some details of different forms of floor construction, etc. M. M. Tidd gave some particulars of floating stone bridge piers into position by means of caissons. Both papers were informally discussed.

THE WESTERN SOCIETY OF CIVIL ENGINEERS contemplate the holding of an international congress of civil engineers in connection with the World's Fair at Chicago. A committee of the Western Society appointed to consider the question recommends that the engineering societies of other countries be asked to send delegates, and that the governments of the world should send representatives. It was proposed that delegates from the engineering societies of this country and Canada should meet in Chicago about October 1 of this year for the purpose of formulating plans for holding an international congress.

GEORGE KOPP, an employee of the United States Electric Light Company, at New York, was killed on the night of the 15th inst., by coming in contact with a poorly insulated wire while putting new carbons in an arc lamp.

NEW ENGLAND WATER-WORKS ASSOCIATION.

THE fall meeting of the New England Water-Works Association included an excursion to the White Mountains, in which the Boston Society of Civil Engineers also participated. The party, numbering 56, including members and friends with ladies, left Boston Saturday morning, September 13, arrived at Wolfeboro Junction in time for lunch, and reached the Crawford House that evening. Here Sunday was passed, the feature of the day being a ride up Mount Willard. On Monday the party went to the Profile House, enjoyed a carriage ride to the Flume in the afternoon, and on the next day proceeded by stages to North Woodstock, where the train was taken for Boston.

PROTECTION OF MINE TIMBERS FROM DECAY.

THE German Government mine Altenwald, near Saarbrucken, has, since 1888, conducted a series of experiments to ascertain the most effective means to prevent from decaying the pine timbering, which is subject to great pressure in the airways. Lime, coal tar, tar and carbolineum were tried in such a manner as to enable a comparison of their relative protective value. The results, as published in *Ztsch. f. d. Berg, Hutten u. Salinenwesen*, show lime to be the weakest. Coal tar preserved the outside of the timber, while the core was found completely decayed. Carbolineum proved by far the best, and is now being used on much of the timbering in that mine. The mine timbers, made of wood peeled and dried, are twice painted over with the carbolineum above ground, and require each, when 2.5 meters long and 0.25 meter in diameter, in the first application 4.5 kilogramme, and in the second 3 5 kilogramme, so that, at a price of 34 5 pf. per one kilogramme, the total cost was: For material, 48.3 pf., and for labor, 14 pf., or altogether about 15 cents.

THE case of Architect E. V. Koch, of Milwaukee, Wis., against Dr. T. W. Williams was decided in favor of the plaintiff last week. The plaintiff had furnished defendant with plans and specifications for a block of flats. The building was afterwards erected, but entirely different plans than those submitted by the plaintiff were used. Plaintiff thereupon sued for remuneration for his work, and also applied to have his claim made a mechanics' lien on the building. The judge found that plaintiff was entitled to remuneration, the amount to be ascertained later, but that he was not entitled to a mechanics' lien.

THE subject of coal waste is to be investigated by a Pennsylvania State Commission. The waste arising from producing and marketing coal, also the utilization of all kinds of wastes, come within the scope of the inquiry.

A RATHER extraordinary project for power distribution is at present under consideration in Saxony, Germany. It is proposed to establish near the city of Dresden an immense electric central station to furnish high-tension currents for lighting and power to 168 small towns and villages in the territory circumscribed by the towns Meissen, Freiberg, Pirna, Schandau, Sebnitz and Radeberg,

CORROSION OF CAST-IRON WATER PIPES.

In a paper on the Sheffield, England, water works, read a few weeks ago before the British Institution of Mechanical Engineers, Edward M. Eaton, the chief engineer of the works, stated that he had been troubled by the formation, on the interior of the pipes, of "tubercles," the origin of which was obscure. Writing to *Engineering* on this subject, Charles King, of Winterthur, Switzerland, says:

"Speaking before the Institution of German Engineers in Berlin, Herr Oesten, the chief engineer of the water works of that city, referred to the same matter, and put forth the following theory in explanation of the same: The knotty substances are built up in layers, and in every case the outermost layer is the hardest and strongest, while those towards the inside are much softer, and the interior is generally filled with a pasty mass. By taking up oxygen from the water the inside skin of the pipe increases in volume and forms into buckles in order to make room for the increased area, and the outer layer is that which is most highly oxidized. This layer takes up then primarily the oxygen, but because behind it there are layers not so fully oxidized, the latter again extract the oxygen from the former, so that the oxygen gradually travels from the outside to the inside of the 'tubercles.' For this reason the outer layer is compelled to remain at a lower grade of oxidation than those on the inside, and so it comes to pass that the rust on a fresh cut-out piece of pipe has always on the exterior a brackish and never a red-brown color, which latter it, however, assumes after exposure to the atmosphere when the process of oxidation completes itself.

"In proof of the above theory Herr Oeston proposes the following simple experiment: If freshly chipped off iron rust is washed out of a pipe, and, in the condition of mud, is put into a bottle which is quite full and air-tight, then in a short time the dirty-colored matter adheres to the sides and bottom of the flask. If we now allow air to enter, the rust on the sides of the bottle will assume a reddish tint, and if the operation goes on long enough the upper layer at the bottom will do the same. If we then close the bottle again and let it stand the red color will gradually disappear, and by a retrograde process the red oxide deteriorates to a lower stage of oxidation once more. The oxygen has been taken up by the lower layers without having been able to complete the process of oxidation.

"By coating the pipes on the interior surface in the usual manner the process is delayed but not prevented. The coating is never perfect, and in the course of time becomes brittle and cracks, exposing the cast-iron surface to corrosion in different parts, and here the formation of the knotty substances begins. Blind pipes, which have no through current, often suffer much less from corrosion than those which have a constant circulation, and consequently receive a greater supply of oxygen.

"In order to clean the pipes Herr Oesten cuts out a short length at two different points sufficient to allow the introduction of mechanical scrapers which travel from one opening to the other. In this way he has during the last three years cleaned out over 40,000 meters of piping, which was laid down from 25 to 34 years ago, at a gross expense ranging between 8½d. to 1s. per meter, the diameter of the mains being mostly 3 inches and 4 inches."

DEFECTS IN WOOD STAVES OF WATER PIPES.

In a recent report on the destruction of pine staves in the clear water pipe of the Ottawa water-works system, and of oak slats in a rack through which the water passes before entering the turbines, James Fletcher gives the following particulars:

"The condition of these specimens is, briefly, as follows:

"1. The wood of the pine staves is almost uniformly one inch and a half in thickness, in a few places possibly one-eighth of an inch less, and perhaps a little thicker where knots occur. At the original point of contact, where the staves touched on each side those next to them, the edges, particularly of the inner surface of the pipe (but also to a much less extent of the outside as well) are much eroded between the staves for some distance towards the exterior of the pipe, causing a deep groove varying between one-quarter and three-quarters of an inch across at its greatest width. In depth this groove varies in most places between one quarter of an inch and one inch; but at many points it has extended right through the wood to the outside, causing large holes from four to six inches in length by one wide, thus entirely defeating the ends for which this pipe was originally intended.

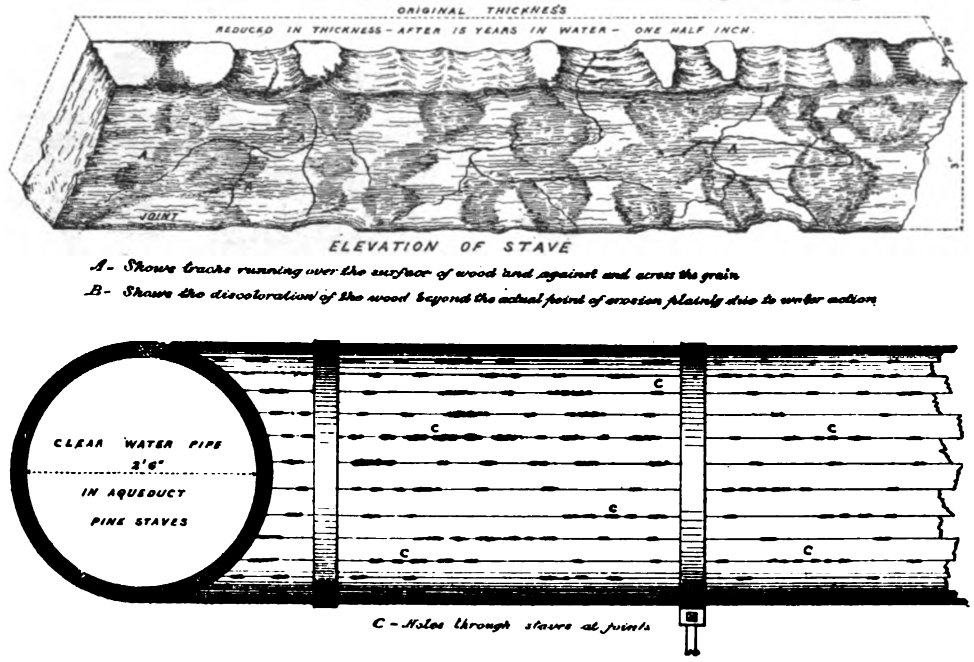
"If these staves were, as stated, two inches in thickness when put down, it is evident that by some means about half an inch of the wood has been removed during the 15 years which have elapsed since the pipe was laid down in the aqueduct.

"In answer to your inquiry as to the probable cause of this diminution in the substance of the pipe and the probability of its being due to the operations of aquatic insects, I take the liberty of drawing your attention to the following points.

"The condition of the wood of the staves is as follows: The wood itself below the surface and between the staves where these were in close contact, is perfectly sound, of good color, and not injured in any way. On the other hand, all surfaces which have been exposed to the action of the water, whether inside or outside the pipe or in the grooves eroded between the staves, are discolored and in a semi-decayed condition—*i. e.*, the wood is so soft and rotten that it can be easily removed with the finger nail to a depth of at least one-sixteenth of an inch. In and upon this thin layer of half-decayed wood, the larvæ of various kinds of aquatic insects have taken up their abode and some have made use of it as food, as is plainly seen by the numerous tracks which have been eaten out all over the surface. These tracks are irregular and winding in their course, going in all directions, as often across the grain of the wood as with it. They do not penetrate the solid wood, but frequently reach down to it and run along on the surface. The same track sometimes runs in one direction for some distance and then doubles back on itself and runs the other way: a fact which entirely disproves the suggestions which have been offered by some that the whole of the injuries to the pipe, as well as these tracks, are the effects of friction, current or suction. One particular track was observed to start on the inside of the water pipe and work its way through one of the large holes out on to the outside surface. It is a notable fact that these tracks run over the whole surface of the wood even to the bottom of every little depression. I believe that the softened condition of the surface of the wood is due to the action of the river water and I find that, in some places, where the eroded groove stretches out in points from the inside towards the outer surface of the pipe, there is generally a discoloration of the wood beyond the point where the surface is actually eaten away, as if decay had already begun although the tissues of the wood are still unbroken, but showing plainly that the water had effected an entrance between these discolored surfaces. It is generally perceptible that there is in such spots a slight inequality of the exposed surfaces of the two contiguous staves which may have been caused either by some slight unevenness in the planing of the wood at the time of building the pipe, or possibly from the wood having swollen unequally when it was placed in the water.

OTTAWA WATER WORKS

SKETCH SHOWING DEFECTS IN WOOD STAVES OF CLEAR WATER PIPE



A- Shows tracks running over the surface of wood and against and across the grain

B- Shows the discoloration of the wood beyond the actual point of erosion plainly due to water action

C - Holes through staves at joints

"I am informed that at the time the pipe was constructed the edges of the staves were flush both inside and outside this pipe, which was built like a barrel, with the staves slightly beveled at the edges, so as to procure the tubular shape, and that the whole was held together by strong iron hoops. This being the case I can only suggest as a reason for the eroded groove being so much wider and deeper on the inside of the pipe, that unless the angle of the beveling were perfectly true, the outer edges of the staves would be much tighter clamped together by reason of the iron hoops outside.

"I would suggest then, as the cause of the destruction of the clear water pipe—first of all—the decaying of a very thin layer of the surface of the wood through the chemical action of the river water; and, secondly, the breaking up and removal of this decayed surface by aquatic insects, so as to constantly expose a new surface of the wood to the action of the water.

"It is probable that both of these operations were assisted by the strong current in which the pipe was situated, in the first place, by forcing the water into every minute crack or crevice, and then by carrying away fragments of the surface loosened or undermined by insects.

"I am aware that it is held by many that sound pine wood kept constantly submerged beneath the surface of water is practically indestructible, and I have no doubt that under some circumstances and for some purposes this might be the case. It must, however, be remembered that more or less air, varying with the circumstances, is always dissolved in water. I am under the impression that water containing a large quantity of air, as the water of the Ottawa River necessarily does, after passing down the Deschenes rapids, would be more destructive to wood submerged in it than water containing less oxygen.

"With regard to the insects found upon the staves submitted to me they were for the most part predaceous larvæ of beetles and dragon flies or allied insects. I might mention that none of these insects have ever been known to bore into sound wood, but feed exclusively upon decaying vegetable tissues in water, and their occurring in large numbers upon the clear water pipe may possibly be due to the unusual quantity of decaying bark which I am informed lies in the Ottawa River near the inlet of this pipe, and which would attract these insects as a suitable breeding ground. They are in no way related to the ordinary timber boring beetles which are so destructive to standing timber and manufactured lumber in all parts of the world.

"2. The oak slat taken from the rack near the pump house, and which had only been in the rack for ten years, was proportionately much more destroyed than the pine staves. The slats were half an inch in thickness by four inches in width when put in the rack; but many of them are now so seriously injured that it is necessary to replace them. In most of the slats the greater part of the wood has been entirely consumed."

NOVIA SCOTIA'S SHIP RAILROAD.

Sir Benjamin Baker, one of the engineers of the Forth Bridge, is paying a flying visit to this country as chief engineer of the English syndicate which bought the Hudson River Tunnel. He is here also for the purpose of inspecting the work on the new ship railway from the Bay of Fundy to the Gulf of St. Lawrence, which is now in course of construction at Amherst, Novia Scotia. He is chief engineer of the railway, and represents the syndicate of English and American capitalists who control the scheme. The New York *Tribune* reports him as having said:

"The project of a ship railway is by no means new. It has been mooted any time within the last thirty years. Captain Eads, of Mississippi jetty fame, proposed it many years ago as an alternative to the Panama Canal. M. Eiffel, who built the great exhibition tower, and has contracts for locks on the Panama Canal, lately consulted with me as to the feasibility of converting the Panama Canal into a ship railway. Thus the works now going on at Amherst is exciting profound interest.

"The earthworks and masonry of the docks of this ship canal are being constructed by an American firm of contractors, Messrs. Dawson, Symes & Usher. The machinery, including powerful hydraulic lifts, each capable of hoisting to a height of 40 feet the total weight—3,500 tons—of a ship and cradle, is being manufactured by Easton & Anderson, of London. About two-thirds of the railway and docks are finished. Nearly the whole of the machinery has been made and the greater part of it shipped to this country.

"The railroad will be about 17 miles in length. The locomotives for hauling the ship over the railroad are exceptionally powerful, being 8-wheeled tank engines, each weighing 80 tons. The saving of time in transit will be enormous when you consider that it now takes a ship three days to go from the Bay to the Gulf, while the time occupied on our road will be about two and a half hours. We have now 1,400 men at work and hope that the railway will be opened in the spring of 1892, if not earlier. The Canadian Government has guaranteed the company $170,000 a year for twenty years."

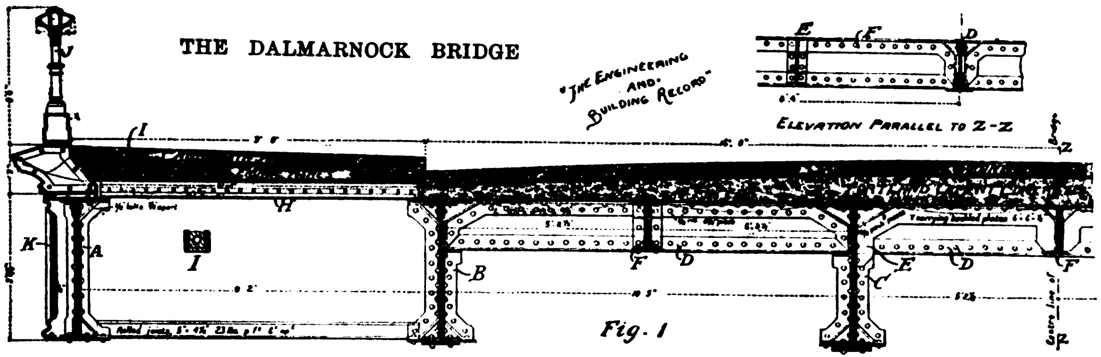
An electrical paper points out that in Europe bronze has, in a great measure, superseded iron and copper in electrical appliances.

THE DALMARNOCK BRIDGE, GLASGOW.

In a recent issue of London *Engineering* considerable space is devoted to the illustration of the permanent structure and air locks of the Dalmarnock Bridge. There are some features of interest shown by the figures here reproduced—viz., the heavy ballasted paved roadway and the high iron caissons.

The Dalmarnock Bridge is a steel girder road bridge over the River Clyde, at Glasgow, and consist of five spans of 54 feet 8 inches each. Figure 1 shows a half cross section of the bridge which is symmetrical about its center line; A B and C are main girders; D D are floor joists alternating with T bar beams E E that help carry the 3/8-inch buckle plates G; H is a Lindsay's patent flooring, and I is a 1¼-inch gas pipe drain; J is an ornamental cast-iron balustrade, and K is an ornamental paneled cast screen concealing the face of the outside girder.

The bed of the river consists of fine running sand and muddy clay, extending down to the carboniferous sandstone at a depth of from 50 feet to 60 feet below low water. The permanent caissons are shown in Figs. 7 to 10, and are made of sufficient height to reach from the rock up to low water, and above this temporary lengths of caisson are fixed to allow of the masonry of the piers being built above high water. There are two shafts in each caisson communicating with the working chamber, one for men and the other for materials, on which the airlocks are fixed.


THE DALMARNOCK BRIDGE

"The Engineering and Building Record"
E
F
D
Elevation parallel to Z-Z
Z
J
H
K
A
I
B
F
D
C
E
D
F

Fig. 1

The sides of the working chamber and enough of the caisson above it to give sufficient weight, are filled with Portland cement concrete when the sinking is commenced, and more concrete is added as it proceeds. The excavation is carried on until the cutting edge of the caisson has a fair bearing on the rock all round, and the area inside is then leveled and concrete filled into the chamber, rammed hard up to the roof, and finally grouted through the shafts. The remainder of the caisson up to low water is also filled with concrete, and the masonry of the piers commenced upon it.

Messrs. Crouch and Hogg, MM. Inst. C. E., are the engineers of the bridge, and the contractor is Mr. A. H. Boyle. The cost of the work will be about £30,000.

Up to the present time the sinking of two of the caissons has been completed, and that of the other two is in progress. The masonry of the abutments and of one of the piers is completed, and the girders laid over one span. It is expected that the bridge will be completed during the ensuing summer.

MAGNETIC IRON OXIDE FILTERS.

A process of manufacturing filtering material is described by *The Engineering and Mining Journal* as consisting essentially in reducing ferric oxide by heating it in contact with gaseous fuel. Small pieces of iron ore, preferably hematite, are packed into a retort heated externally, preferably by producer gas. When the charge is at a cherry-red heat, gaseous fuel is admitted into the retort and brought into thorough contact with the ore. At the end of four or five hours, if the exit gas be inflammable, the process is finished, and the charge raked out and allowed to cool. Ordinary coal-gas or other gaseous fuel may be used instead of producer gas. The magnetic oxide so produced is available for filtering water, sewage, sugar syrups, alcoholic liquors, etc.

The extraordinary scheme of bridging the channel between France and England does not seem to have altogether died away, and soundings have been recently taken at Folkestone, England, with a view to ascertaining what kind of foundations would be available, the results being, it is stated, satisfactory.

A SYSTEM OF INCLINED PLANES FOR BOATS.

In a paper on the above subject, presented by M. A. Flamant at the Fourth International Congress on Inland Navigation, recently held at Manchester, England, it was pointed out that among the apparatus for transferring boats engaged in inland navigation from one level to another, the inclined plane possesses an advantage over the vertical hoist, inasmuch as it is applicable to much greater differences in height.

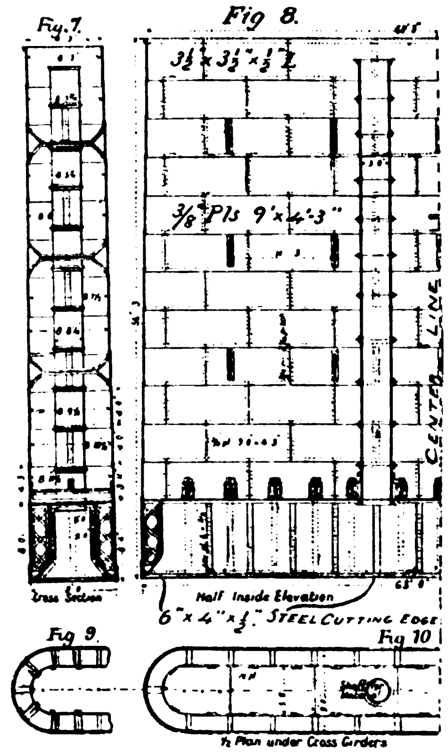
All inclined planes employed or proposed up to the present time are so arranged that the boat is conveyed lengthwise. This prevents the gradient being greater than one in eight, or one in ten, for if it is, and the chamber for receiving the boat is somewhat lengthy, its hinder portion is raised high above the ground, and the stability of the whole is considerably reduced. The inclined plane equaling in length eight or ten times the vertical height to be attained, calls for the exertion of considerable power to overcome the passive force of the chamber and necessitates the use of powerful machines. This difficulty, however, is avoided by placing the chamber crosswise, that is to say, by making its greatest dimension parallel with the horizontal of the inclined plane. Under these circumstances we may have a much steeper incline and at the same times reduce the length and lessen to a very great extent the passive force, which is decreased partly by the diminution of the component force of the weight to be raised, and partly by the diminution of the distance to be covered. The increased gradient of the plane reduces in a large measure the time occupied in the maneuver, and thus augments the traffic capacity of the apparatus.

The transversal disposition of the chamber also offers another improvement, which, so far as regards the rapidity and facility of the maneuvers, is of very great importance. In inclined planes arranged longitudinally, as also in vertical hoists, the movable chamber, having arrived at one extremity of its course, can only be opened and put into communication with the canal at one of its ends. The boat which it contains has to leave it entirely and pass out of the way before the one waiting to replace it can enter. A loaded boat entering the chamber can only do so by forcing the water round its sides and out at the entrance, and consequently the maneuver always occupies considerable time in spite of any mechanical means of traction we may apply.

When the position of the chamber is transversal, the way of procedure is to place it, at either end of its course, against the side of the canal, and it is only necessary to have the canal prolonged for the length of a boat on each side of the inclined plane, to enable the chamber, opened at both ends, to communicate freely with the canal and allow one boat to leave at one end whilst a second enters at the other without any repelling of the water and with the greatest facility. The time occupied at either extremity is lessened by more than one-half, and thus the traffic capacity is increased in a very high degree.

The Fives-Lille Company have had under consideration a complete project for an inclined plane on these lines, for the purpose of overcoming a difference in level of 30 meters. The gradient of the plane has been fixed at 1 in 2. This gradient might be increased so as to diminish the passive force to be overcome, but it would be requisite then to increase also the strength and the weight of the chains used in moving the chambers, and it would be very difficult to provide an efficient safeguard against their rupture. With the gradient adopted, however, the chains are restricted to moderate proportions, and a toothed rack, solidly fixed in the inclined plane and supplied with a catch which only comes into operation in case of a chain breaking, is sufficient to maintain the chamber at any height and prevent disaster.

The inclined plane under the consideration of the Fives-Lille Company is double, and is intended for a waterway over which there is a great amount of traffic; it has two chambers, each sufficiently large to receive the boats navigating the network of waterways in France. These boats are 38.50 meters long and 5 meters broad, and they draw 1.80 meters of water with a cargo of about 300 tons. The two chambers are in equilibrium, that is to say, they are suspended by chains running through pulleys fixed on the upper portion of the plane. In order to provide for the varying weight of the chains and for preserving the equilibrium of the chambers in any position, the idea occurred to M. Bassères, engineer to the Fives-Lille Company, of adopting for the profile of the inclined plane not a straight line, but a concave arc, the span of which has a gradient of 1 in 2, and the pitch, necessary for the height and for the weight of chain to be compensated, does not exceed 45 centimeters. The result is that at the two extremities of the chamber's course the sides are not strictly vertical, nor is the bottom quite horizontal, but the incline of the sides does not exceed one-fiftieth and the boat is not prevented from floating freely. Under these conditions, the system being statically in equilibrium in all positions, the resistance to be overcome in putting it in motion is constant, and the necessary power can be obtained by the addition in the higher chamber of a volume of 120 cubic meters of water, which corresponds to a height of about 50 centimeters in the chamber.



DALMARNOCK BRIDGE

The working of the inclined plane is thus accomplished in the same way as the vertical hoist without the introduction of any special machine. The simultaneous movement of the chambers can be effected, without the addition of water, by means of a steam engine and a special traction chain. A machine of 180 or 200 horse-power would be necessary.

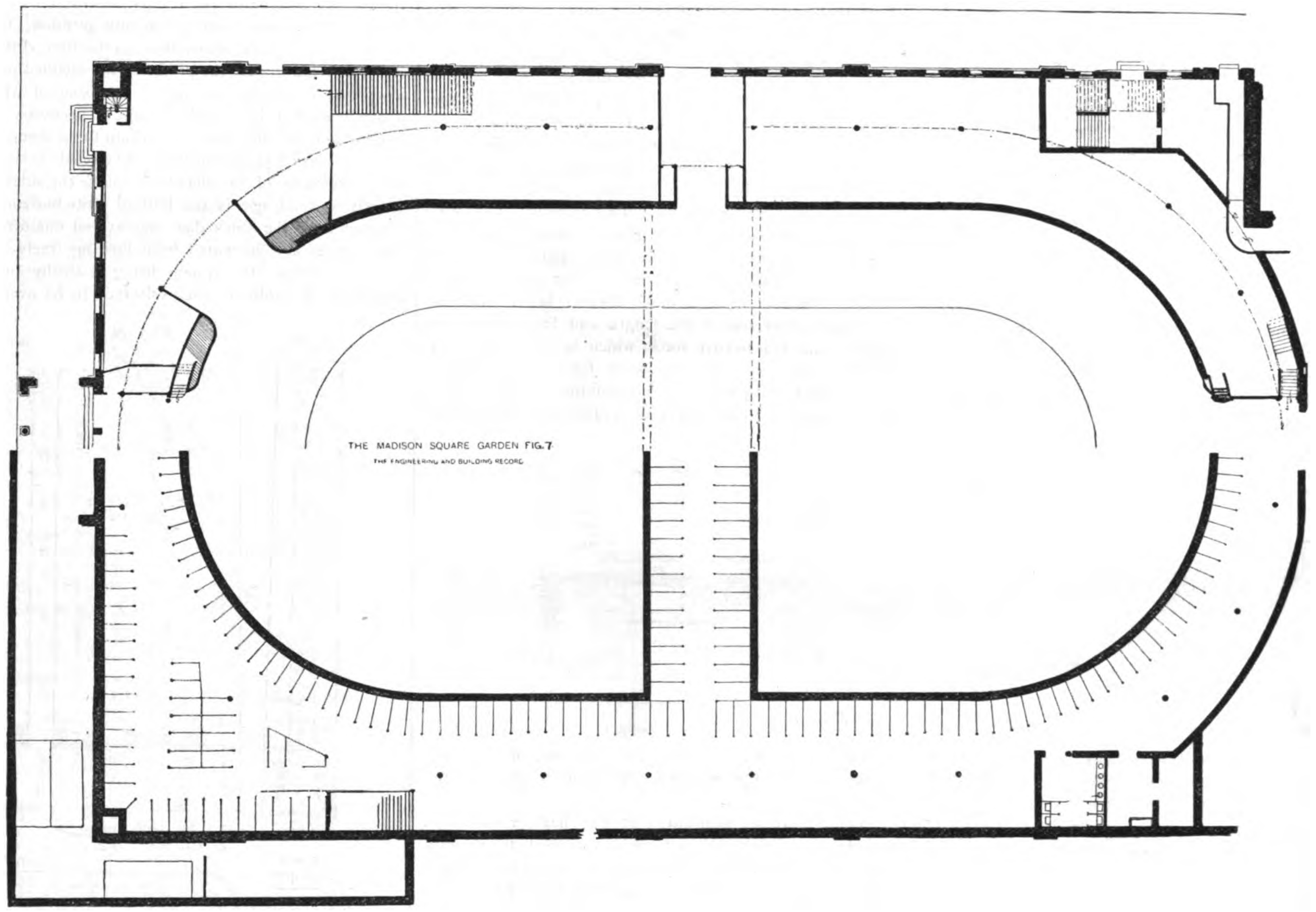
NOTABLE APPLICATION OF WATER POWER.

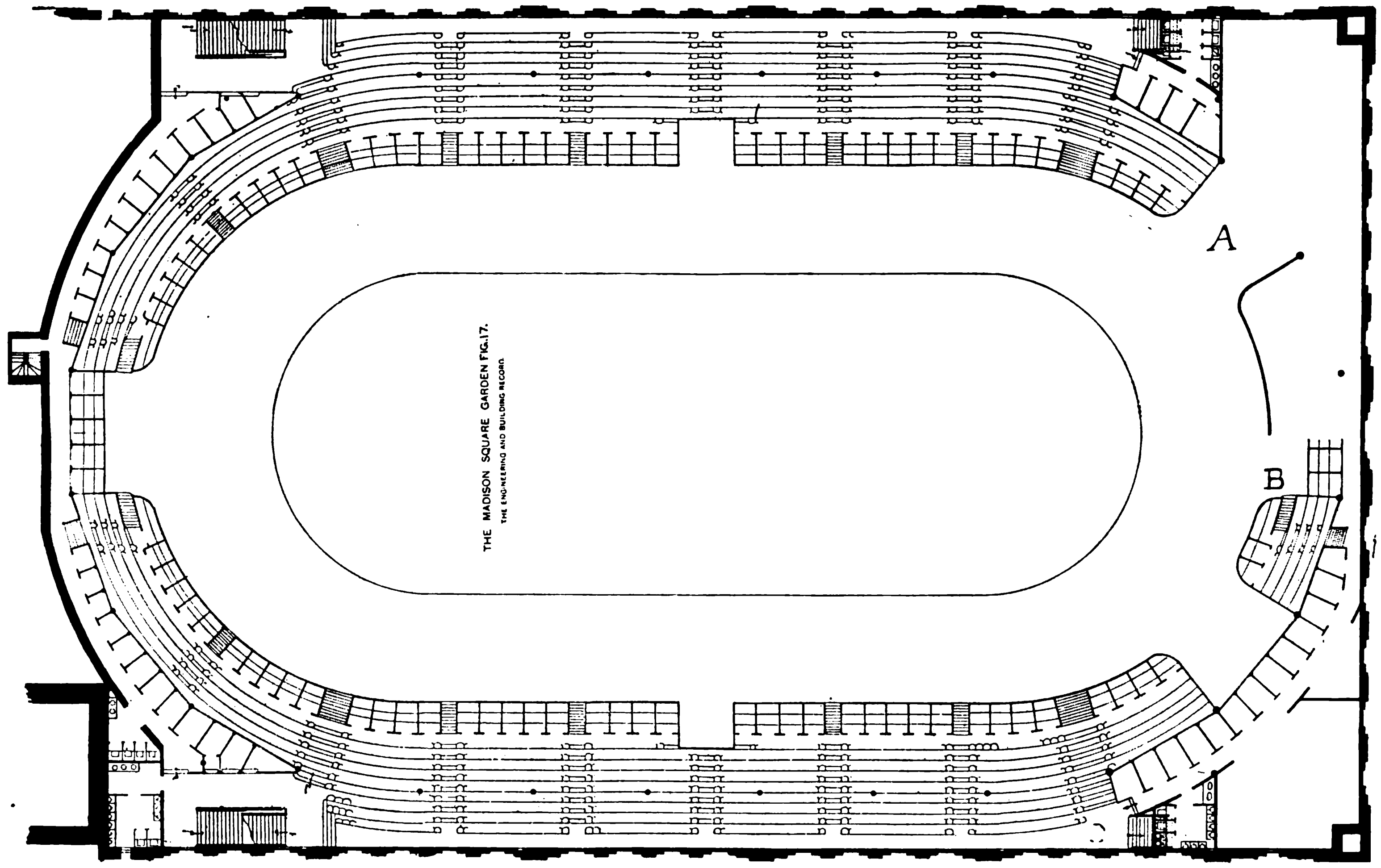
Some interesting features, says the San Francisco *Mining and Scientific Press*, are noted in the power equipment of the Treadwell Mill, Alaska—the largest quartz mill in the world, consisting of 240 stamps, 96 concentrators, 12 ore crushers, etc., and requiring about 500 horse power. All of this machinery, covering several acres of ground, is run by a single wheel 7 feet in diameter, operating under a head of 490 feet, making 235 revolutions, and using 630 cubic feet of water per minute, this being discharged through a nozzle 3.31 inches in diameter; with a 4-inch nozzle this wheel will work up to 735 horse-power. Regulation is afforded by the use of a deflecting nozzle operated by a hydraulic governor; the nozzle is about 4 feet long with a ball joint at the butt end, and to the discharge end is attached by lever connections an automatic hydraulic regulator, which varies the amount of water applied to the wheel as may be needed to adapt it to varying loads—a device which affords a peculiarly simple, sensitive and satisfactory regulation. With such an arrangement, and in such a location, the advantage of water power is conspicuous. Thus the wheel above mentioned weighs but 800 pounds, and the entire equipment, embracing shafts, boxes, driving pulley, etc., only about 4,000 pounds; on the other hand, a steam machinery plant, to give the maximum capacity of such a wheel, would not weigh less than 200 tons, and the expense of running such a plant would be almost immeasurably greater.

A FRENCH BRIDGE-TESTING DEVICE.

THE June number of *Les Annales des Ponts et Chaussées* contains an interesting description and illustrations of a simple instrument for measuring distortion, especially intended for use in testing iron and steel bridges. The machine is screwed to small holes in the members to be tested in the structure, and magnifies the change of distance between two points by the action of a piston, or diaphragm, of large cross section, whose movement forces a liquid into a glass tube of very small caliber. The record and description of some tests and experiments made with the instrument are given.

LAFAYETTE COLLEGE, Easton, Pa., has established a new department for highway construction. Tuition is free to residents of Pennsylvania, who are nominated by county officials of that State.


THE MADISON SQUARE GARDEN FIG. 7
THE ENGINEERING AND BUILDING RECORD



THE MADISON SQUARE GARDEN FIG. 17.
THE ENGINEERING AND BUILDING RECORD

THE MADISON SQUARE GARDEN.

PART II.—BASEMENT, HORSE STALLS, ARENA AND AUDITORIUM OF AMPHITHEATER. RESTAURANT, BALL ROOM AND CONCERT HALL, GALLERY AND FOYER.*

FIGURE 7 shows half plans of the basement horse stalls and of the arena of the amphitheater, immediately above. Both plans are substantially symmetrical about their longitudinal axes.

Figure 17 is a general plan of the amphitheater, arena and auditorium, showing the arrangement of the lower seats and boxes. Ordinarily the performers enter the arena at A, and a tier of seats and boxes is placed at A B, but these are movable, and the whole space may be opened and left unobstructed except by two columns. The audience enters on each of the four sides of the building. Above the seats, shown in Fig. 17, on all sides of the amphitheater, is a continuous gallery, having four rows of seats, and carried on floor beams whose outer ends are built into the walls, and whose inner ends project cantilever wise over the columns. Above this gallery is a promenade gallery, also continuous around the amphitheater, and having one row of seats around its inner edge.

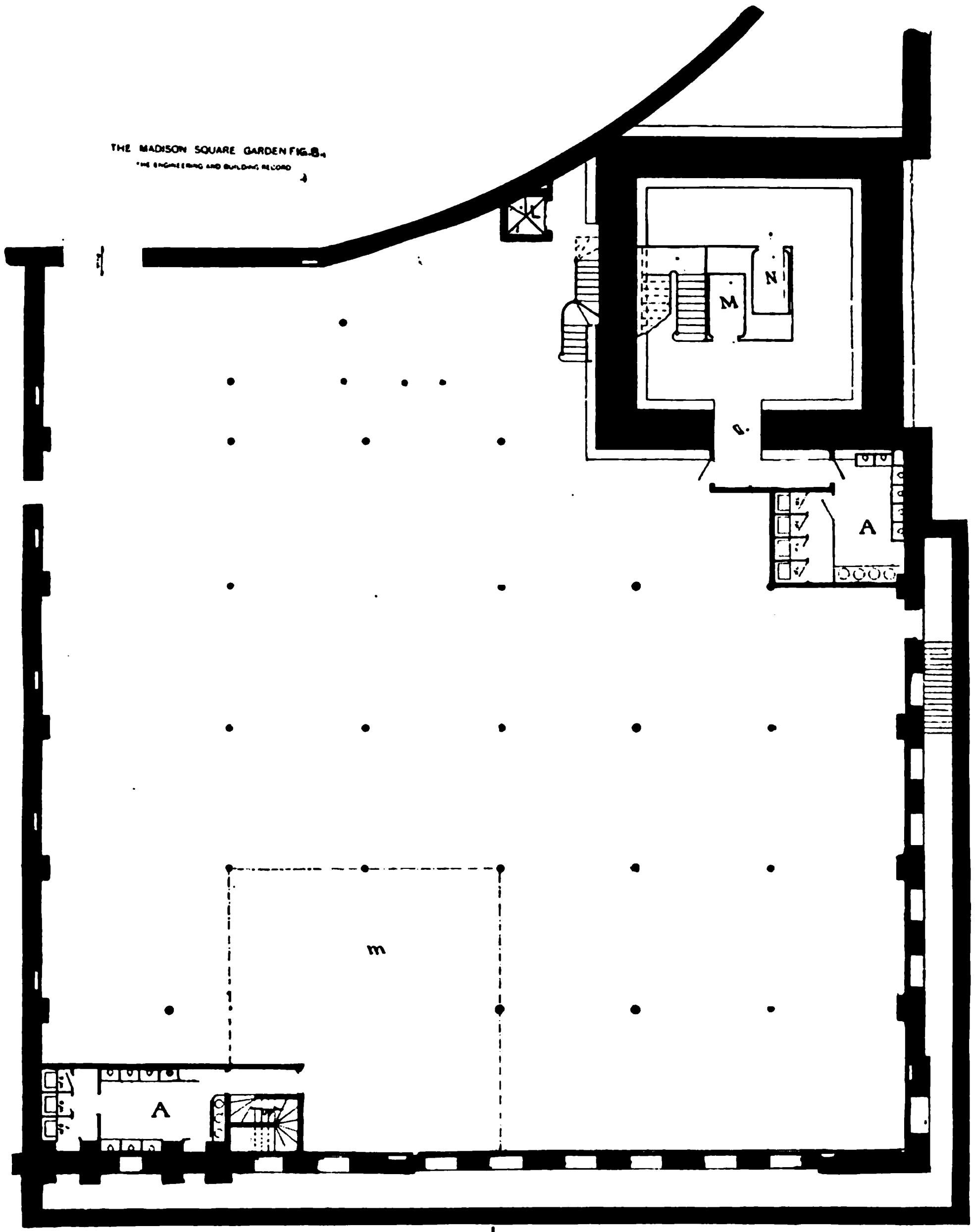

THE MADISON SQUARE GARDEN FIG. 8.
THE ENGINEERING AND BUILDING RECORD

Figure 8 shows the basement plan of the concert hall. L is a freight elevator; M and N are concert hall and roof garden elevations; A A are men's toilet rooms; M is the location of the ventilating blowers.

Figure 11 is a plan of the restaurant on the ground floor. The reference letters A, L, M and N have the same meaning here and in Figs. 9 and 10 as in Fig. 8. B is an employees' water-closet; D, W, etc., are dumb-waiters; Z and O are ticket offices; I is the pantry; W is the stairway to the roof garden and supper room; C is a ladies' room; S is the restaurant.

Figure 10 is a plan of the ball room, or concert hall. Above the restaurant K K are lobbies; H is the hall; E, the stage; F, refreshment lobby; G, gentlemen's room; D, waiting lobby; C C, ladies' rooms.

Figure 9 is a horizontal section above the concert hall floor, showing the gallery in plan; room *l* is intended for a parlor or reception-room when the hall is used for a concert, and for a supper room when it is used as a ball-room.

(TO BE CONTINUED.)

FOUNDATIONS.

IN a paper on "Engineering Features of the Operating Department of Railroads," read a few months ago before the Illinois Society of Engineers and Surveyors, E. L. Morse said:

"On good solid ground the subject of preparation for foundation is not a difficult one. Where the soil is wet clay, soft and yielding, or marshy and inclined to quicksand, it becomes a question sometimes of going deep enough to get solid ground, or to devise some means of getting a solid bearing surface. This may often be accomplished by going below the base of foundation, and filling in with gravel, thoroughly tamped and pounded till quite solid. A better plan, I think, if the soil will remain wet, is to use plank under the masonry, making the foundation pit larger than the intended masonry, so as to give a larger bearing surface, first having the bottom of the pit thoroughly tamped before putting the plank in place.

"I lately had occasion to put plank under stone foundation piers for water tanks. The soil in these cases was wet clay, quite soft, and in rather low ground where it would not be likely to dry out. The piers were 4 feet in height, increased, in one case, to 6 feet to get a greater depth, 5 feet square at base, and supported a load of about twenty tons. The pit was made 6 feet square, and prepared, as described, by tamping, and pounding the earth down solid, then putting in two layers of 2 inch oak planks upon which the masonry was built. The same plan has been used under post foundations, and also under walls for buildings.

"Earth should be filled and tamped around all masonry, and in the case of walls that have an earth pressure on one side only should be filled and tamped first next the wall and then away from it to lessen the danger of overthrow from the earth pressure."

NATURAL AND ARTIFICIAL STONE COMPARED.

A WRITER in the London *Builder*, who is credited with having carefully studied the comparative merits of natural and artificial stone for the various purposes to which they are applied, states that for many of those purposes well-made artificial stone, composed of granite, sand and hydraulic lime, Portland cement or blue lias cement, mixed in due proportion and formed into flagstone, ashlar, steps, copings, window sills, and, indeed, all forms for which stone is used, molded or plain, is, beyond all comparison, the cheapest and best. Contrasted with ordinary flagstone, with its characteristic property of separating naturally in flakes or layers, artificial stone possesses the advantage of homogeneousness, that is, a substance all of one kind throughout. In some well-known cases bridges in parks have been constructed of Portland cement, beton coignet, the result proving how lasting such material can be made when proper care and knowledge are used in proportioning and mixing the materials. The fact is stated that, as a trial and test of comparative wear between natural Portland stone and artificial Portland cement stone, there were placed at a bank in London two doors, one each of these two materials, and the artificial stone door wore out three of the natural stone.

ELECTRIC POWER TRANSMISSION IN FRANCE.

AT a recent meeting of the Société des Ingénieurs Civils, M. Hillairet gave the following particulars of the electric transmission at Domène. The electric service which he established last year at the small town of Domène in Isère sets in motion the works of Chevrant. Domène is situated in the valley of Grésivandau on the left bank of the Isère, at the foot of the western slope of the mountain of Beldonne, which dominates the Dauphiné Alps. The railway line from Grenoble to Chambery serves this locality, and has contributed to the development of its industrial power for more than 20 years. The hamlet of Montier is situated at about 500 m. from Domène, surrounding the paper works of Chevrant, which supply the greater part of the neighboring population with work.

The increasing development of this factory, which had necessitated the establishment of auxiliary steam engines in aid of the primitive turbines which work under a fall of 50 horse-power, found itself obliged to modify its steam apparatus and to endeavor to utilize the power of a fresh fall; this would have been impracticable with steam engines on account of the expense of combustibles in this region, where most of the works owe their prosperity to the utilization of natural forces. The employment of electric transmission was decided upon, and two falls had to be examined with this view—one situated near the railway, and the other on the mountain falling from the turbulent stream which crosses the town of Domène lower down before discharging itself into the Isère. M. Hillairet rejected the first as better fitted to supply an ordinary factory on the spot, and chose the second. This rejection was opportune for a company to whom the fall was conceded some months later, and by whom it is now utilized. The latter fall is about 1 kilom. from the village of Revel; its lower level terminates at the hamlet of Eaux. At this point, 5 kiloms. from the Montier Mill, he has erected the factory of La Force, where the generating turbine and dynamo are installed, which transform the greater part of the hydraulic power now used into electric power. The water source is 700 m. above the factory of La Force, with which it is connected by a leaden pipe having a fall of 10 per cent., which gives a difference of level of 70 m. between the extremities. This turbine, with a horizontal axis, is attached directly to the generating dynamo, from whence start the two wires of the overhead line which unites this machine to the receptor of the Montier paper mill. This receptor acts directly on a groove pulley, over which ten wires of 0.050 m. run and communicate the power derived from La Force to the principal transmitter of the mill.

The principal records of this transmission are as follows: Generator: Maximum power, 300-horse; maximum speed, 240 revolutions per minute. Receptor: Maximum power, 200-horse; maximum speed, 300 revolutions per minute. Length of line 5 kiloms.; maximum electro-motive force, 2,850 volts; maximum current, 70 amperes. Resistances: Line, 3.474; generator, 0.950; field, 0.690; total resistance of the circuit, 6.829. Electric yield calculated according to the resistances, 83 per cent.; gross average mechanical yield, 63 per cent. The calculations of the mechanical yield have been made by substitution; the stopping of the turbine has been effected with a brake, which afterwards serves to test the power of the receptor.

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*Part I.—General Description and Perspective, Front and Side Elevations, Longitudinal and Transverse Sections, and General Plan, and Plan of Roof Garden, was published August 30, 1890.

This transmission has been in use since the 1st of November, and from that time it has not ceased to work for a single instant, either during the winter or during the storms which have lately prevailed. The service has been continuous from the first moment, and no interruption has occurred since it was first established. The work of the factory has considerably increased with the increased power at its disposal. The results have been so satisfactory that La Force is likely to become a central station, distributing 2,000 horse-power in four different directions to a maximum distance of about 15 kiloms.

COST OF REPAIRS OF PILE BRIDGES.

In discussing the subject of cost of repairs of railroad pile bridges before the Illinois Society of Engineers and Surveyors, A. N. Talbot gave the following particulars:

On the Chicago, Burlington and Northern Railroad, 331 miles contain an average of 320 feet of pile and trestle bridges per mile—an unusually large amount. The cost of repairs per lineal foot, in 1888, was 23 cents. On the Western Division (in Colorado) of the Atchison, Topeka and Santa Fe Railroad, pile and trestle bridges with oak piles will last from ten to twelve years, and their renewal costs from $6 to $7 per foot.

Through the courtesy of Mr. W. H. Earl, Mr. Talbot was enabled to present the following summary of the cost of pile bridge repairs, excluding renewals, on the A. T. & S. F. R. R. in Central Kansas.

Cost of Pile Bridge Repairs for 1889.

Subdivision.	Miles.	Total feet of Bridges.	Feet per Mile.	Total Cost.		Cost per Foot.	
				Labor.	Material.	Lab.	Mat'l.
Main Line....	168	2,639	15.71	$593.62	$185.08	.225	.07
Branch Line..	99	6,655	67.22	361.92	127.73	054	.019
Branch Line..	30	3,225	107.50	28.77	......	.009	.....
Branch Line..	233	28,660	123.00	920 01	195.67	.03	.2006
Branch Line.	84	5,250	62.50	503.20	91.55	.096	.012
Branch Line..	156	10,180	65.26	754 19	164.16	.074	.915
Branch Line..	46	2,892	62.87	162.50	40.10	.050	.014
Totals. .	816	59,501	72.9	$3,324.31	$804.29	.056	.0135

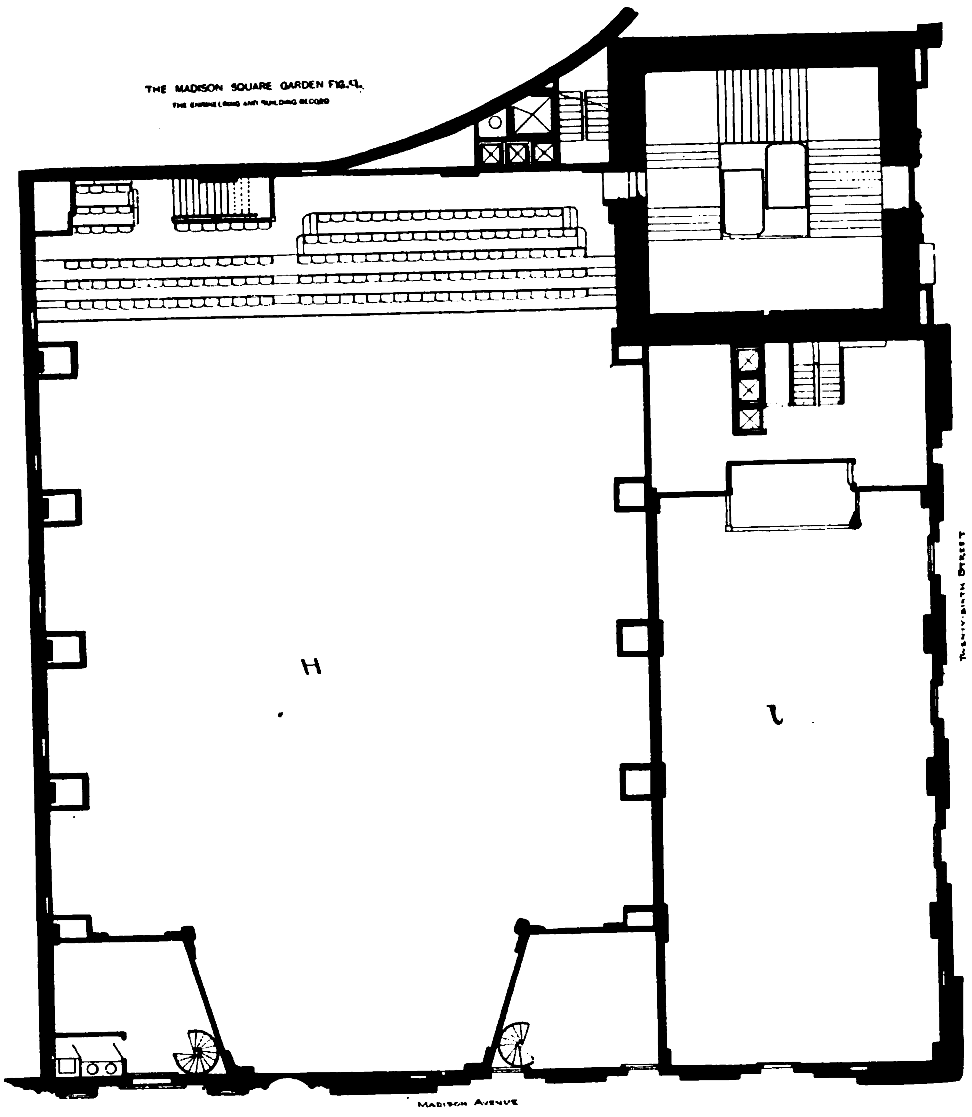
The above does not include some repairs from wrecks and fire; supervision included except engineering; second-hand material largely used; estimated at $10 per M. In connection with this he says:

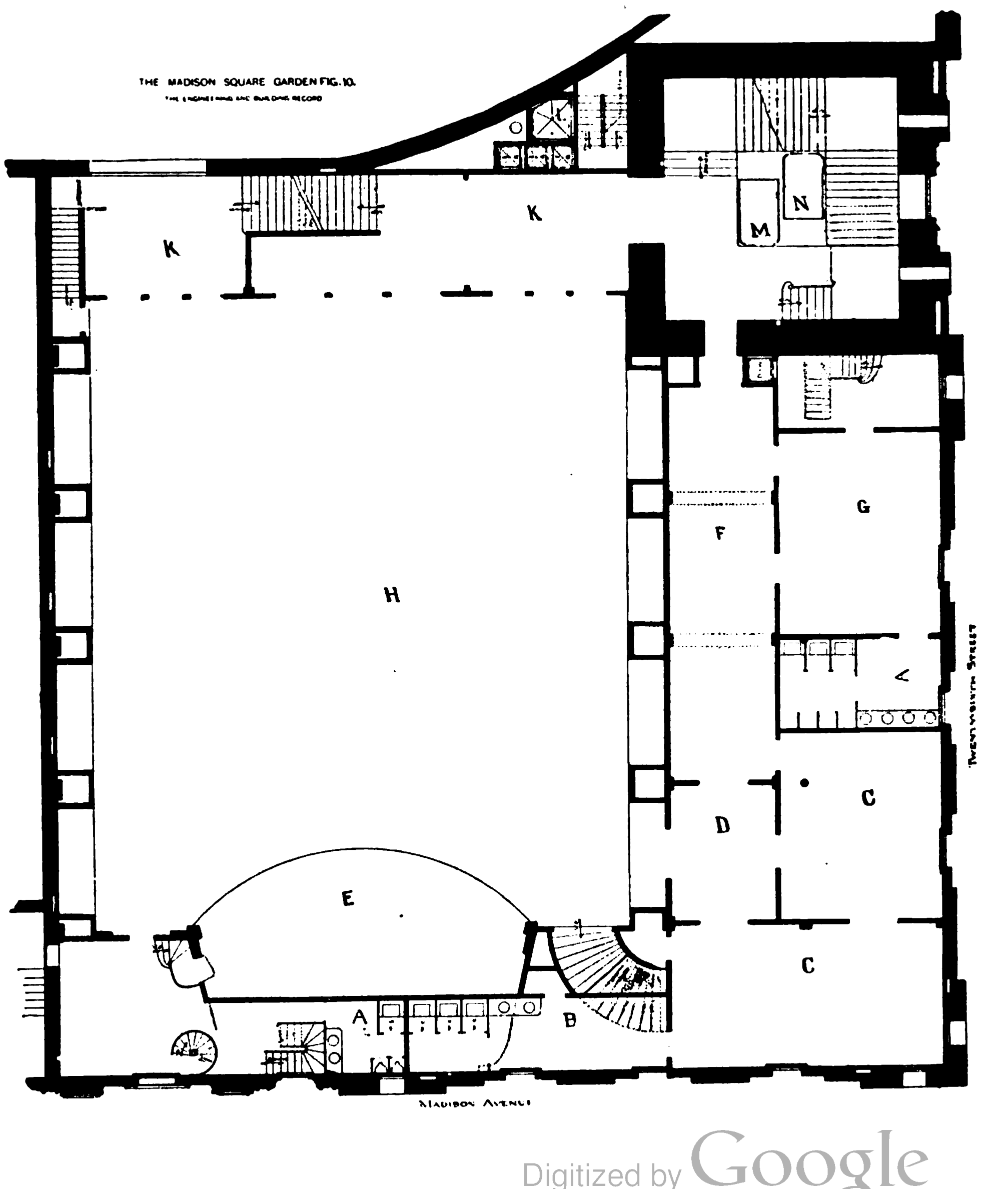
"Whenever a bridge needs extensive repairs I renew it using the old material elsewhere; none of the material is wasted; it is all worn out in one way or another. The best of it goes to repair other old bridges, then when they are renewed all the material is old together. Of course if we had no use for the material this plan would not be economical; but we are oftener short of second-hand bridge stuff than we have a surplus. We estimate the value generally at $10 per M. We renew our pile bridges when seven to ten years old, mostly from eight to nine years. Piles generally go first, and there are generally helpers alongside of piles by the time we renew. Sometimes where a bridge has a good top and not over 60 feet long we put in new piles and caps, then move the entire top to fit. Longer than 60 feet top has to be taken to pieces.

"I now require a systematic inspection of every bridge in all its parts as often as once in 30 days. The inspector enters in a book each bridge number, date and condition, noting in detail any defects; signs book at end of trip, sends it to the general foreman, who in turn sends it to me. I copy the notes and date of inspection in my office bridge books. I have two general foremen, and it takes a man under each about 20 days to get over the division. In addition, section foremen have track walkers examine bridges daily for broken stringers, that being the only thing liable to give out suddenly. We still have a good many stringers split from the shoulder; generally a bolt put through makes them all right again."

According to *Practical Electricity*, a storage battery street car was tried at Providence, R. I., recently, with good results. The car is described as being similar to those on Fourth Avenue, New York, and is very comfortable. Power is applied by two Thomson-Houston motors, and the car floor is one step above the platform. There are two iron folding gates at each end of the car. The car is lighted by 16-candle incandescent lamps, and weighs seven tons with all its appurtenances.

A telpher railroad is one of the interesting features of the exhibition recently held at Edinburgh, Scotland.


THE MADISON SQUARE GARDEN FIG. 9.
THE ENGINEERING AND BUILDING RECORD
H
I
TWENTY-SIXTH STREET
MADISON AVENUE


THE MADISON SQUARE GARDEN FIG. 10.
THE ENGINEERING AND BUILDING RECORD
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TWENTY-SIXTH STREET
MADISON AVENUE

FALSE RUMOR ABOUT THE KINZUA VIADUCT.

REFERRING to the recently circulated newspaper item that the famous Kinzua Viaduct, on the line of the New York, Lake Erie and Western Railroad, was to be replaced by a heavier structure, Adolphus Bonzano has addressed the following letter to the New York *Tribune:*

SIR: The report having been widely circulated by the press that the great Kinzua Viaduct, on the line of the New York, Lake Erie and Western Railroad is to be removed on account of its not being strong enough, and that a new line is contemplated, I addressed the following letter to Mr. Charles W. Buchholz, the engineer of bridges and buildings for this company:

PHOENIXVILLE, PENN., September 4, 1890.

MY DEAR MR. BUCHHOLZ:

I heard that the Kinzua Viaduct was to be either abandoned or removed and a new line was contemplated to be built. I write to ask you whether this rumor is correct, and if so, would ask the reason why the viaduct is to be removed. Has the structure shown any signs of weakness in any part, such as loose rivets, or any excessive defection or lateral motion? All of which I doubt very much. Kindly let me hear from you at your earliest convenience.

I remain, yours very truly,
A. BONZANO.

To which Mr. Buchholz replied as follows:

NEW YORK, September 5, 1890.

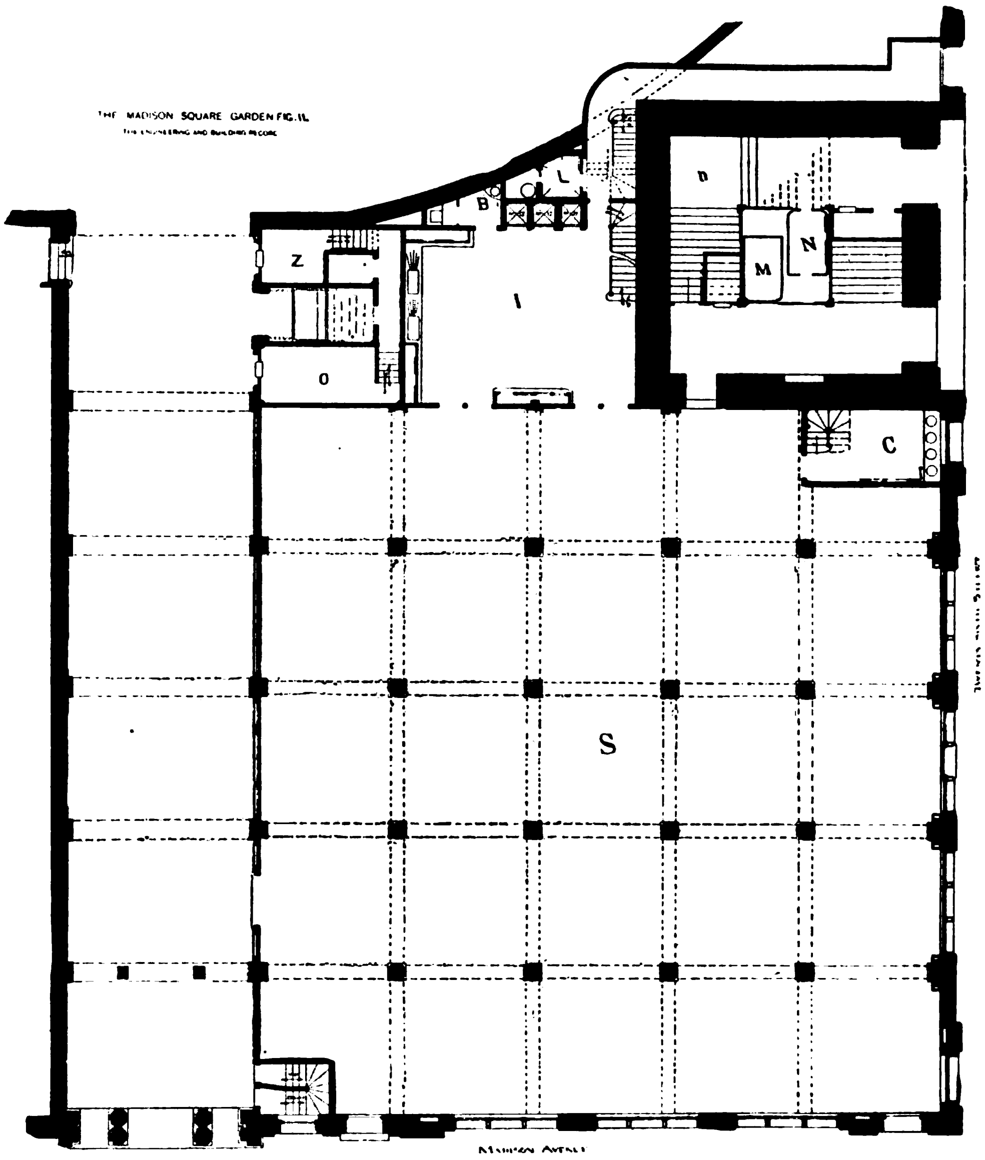
DEAR SIR: In answer to your favor of the 4th inst., I beg to say that the announcement that the Kinzua Viaduct is to be abandoned is a mere newspaper rumor. I heard nothing of it until last week, while I was in Chicago.

The structure has shown no signs of weakness of any kind, and maintains its full efficiency for the loads it was designed to carry.

Respectfully yours,
CHARLES W. BUCHHOLZ, Civil Engineer.

This viaduct is one of the most important railway structures in the world and is of recent construction, having been built in 1882. It is 2,052 feet long, 301 feet at its greatest height, and divided into groups of spans of 40 and 60 feet alternately. It is designed for carrying trains of coupled consolidation engines, each engine weighing 161,340 pounds on a wheel base of 45 feet 3 inches, and 88,000 pounds on a wheel base of 14 feet 9 inches. It is proportioned to resist a wind pressure of 50 pounds per square foot on the unloaded structure and 30 pounds per square foot on the loaded structure. Under the above loads no part of the structure is strained more than one-fifth of its ultimate strength. The viaduct is as safe and as strong as 90 per cent. of all the railroad bridges now in daily use.

ADOLPHUS BONZANO.
Vice-President and Chief Engineer.
Phoenixville, Penn., September 11, 1890.


THE MADISON SQUARE GARDEN FIG. 11.

Correspondence.

Communications giving information or opinions on matters of general interest to the engineer, the architect, the contractor, or the municipal officer, will be welcomed in this column. Fairness will suggest that when communications are sent simultaneously to this and other journals we should be informed of it at the time. Anonymous letters will not be noticed.

A LARGE PIPE CASTING.

THE CLARENDON WATER-WORKS COMPANY,
WILMINGTON, N. C., September 15, 1890.

To the Editor of THE ENGINEERING AND BUILDING RECORD:

SIR: The item in THE ENGINEERING AND BUILDING RECORD of the 13th inst. headed "A Large Pipe Casting" must have been penned by one who was not posted. Pipe 48 inches in diameter has been used by a number of cities in the past 37 years. New York City used 60-inch pipe in 1861 and 72-inch in 1865, and Boston laid 60-inch in 1877. Hub and spigot pipes 96 inches in diameter were made by the Amoskeag Manufacturing Company, of Manchester, N. H., in 1873, and flanged pipes still greater in diameter are in common use for turbine wheel penstocks.

JOHN C. CHASE.

VITRIFIED PIPE FOR SEWERS.

NEW YORK, September 15, 1890.

To the Editor of THE ENGINEERING AND BUILDING RECORD:

SIR: A quotation from a published address on the above subject matter contained in your issue of September 13 deprecates the use of the vitrified pipe for sewers of larger diameter than 15 inches. Since you ask for the experience of other engineers I would say that this conclusion is not borne out by my own experience and I regret to see such an opinion advanced unaccompanied by good reasons, because the sanitary advantages of smooth surfaced pipe over common brick, *cæteris paribus*, are certainly worth utilizing. Large pipes can be and are made strong enough to withstand heavy earth pressure; they can be and are burned so as to form, if not true circles, then ellipses with an eccentricity not exceeding one-half an inch. If the author of the above notes practices his former method of laying pipes *concentric* by a peculiar device, I think patented by him, his failure of making large pipes do for sewerage purposes may be explained. Sewer pipes should never be laid concentric, but so that the inside bottom forms an even surface, leaving the entire projection due to eccentricity entirely at the top where it is comparatively harmless. The larger pipes, when culled and measured, should be marked so that the larger axis in every pipe can be placed vertically instead of haphazard, and further diminish the projections at the joints. In pipes over 18 inches in diameter and not over 2 feet long, it is, moreover, quite feasible to smooth off the inside joint by pointing with cement, if this be considered desirable.

Regarding the use of but a 4-inch ring for brick sewers, 3 feet in diameter, your editorial comment is quite to the point. In hard ground a single ring suffices for this diameter. But ordinarily it is not good practice to go beyond 2½ feet. In New York, even in rock, two rings are used. In New England, in good ground, one ring is generally used up to 2½ feet. In Europe even smaller sewers are rarely built with less than two rings. In Philadelphia all the old branch sewers (3 feet in diameter) were built with a single ring and are reported to be generally out of true form. Many of them have here and there collapsed.

RUDOLPH HERING.

THE SUBWAY PROBLEM IN NEW YORK.

OSAWATOMIE, KAN., September 10, 1890.

To the Editor of THE ENGINEERING AND BUILDING RECORD:

SIR: I have read your columns with deep interest in regard to the inconvenience to travel caused by tearing up the principal streets in your city to construct and repair sewers, water pipes, gas mains, telephone conduits, and all other pipes and their connections to the houses.

That these sewers, water, gas, electric and power mains and their connections must be constructed no one questions. To make a subway and all the connections necessary in Broadway would cost money and be an inconvenience.

Would it not be better to construct the subway referred to on page 193 of your publication between the streets in the alley, so as to supply the stores or houses with gas, water, telephone, power, heat, etc., without in any way disturbing the front streets? Where the elevation is suitable the sewer could be below and the pipe duct above. Light and air could be admitted from skylights, ventilating towers erected that could move all foul air and gas and prevent accident, thus doing away with mechanical ventilation. All connections can be made from rear of houses or stores with sewers, etc., etc., easier than in front.

Please excuse this presumption on my part from my humble station, but for 30 years I have watched this trouble continually increasing, and believe, with you, something must be done.

H. PARKER.

[Unfortunately for our correspondent's plan, New York has no alleyways in the rear of houses. Land is so valuable that practically the entire blocks are built over. In the case of tenement and apartment houses the law at one time permitted 90 per cent of the lot to be covered. The amendments to the Tenement Act of 1879 restricted covered space to from 65 to 78 per cent. at discretion of the Health Department. This is only for tenement or apartment houses. Business structures may, and usually do, cover the entire depth of the block. Blocks are 200 feet deep by 400 feet long, and streets 60 feet wide in residential portion of the city.]

BOOK NOTICES.

HANDY LISTS OF TECHNICAL LITERATURE. PART III. ENGINEERING AND MECHANICS. Compiled by H. E. Haferkorn and Paul Heise.

Any one who has had occasion to hunt, in the usual tedious manner, through scattered lists of reference books for any particular volume, will at once appreciate the convenience of the lists issued by Messrs. Heise and Haferkorn. Part III., which has just become available, is devoted to books on engineering and mechanics, and comprises over 2,100 works. The main entry of each work is found under the author's name, giving full title, year of issue, publisher's or agent's name, editions and price. The publisher or agent of each book is indicated by a system of abbreviations which are explained by an accompanying key. The subject headings are entered in the same alphabetical series as the authors, but are distinguished by being printed in italics. Considerable attention has been given to the preparation of cross references. A list of new books and editions, published in 1889 and 1890, makes the entries practically complete up to date. A separate list of newspapers, periodicals and annuals has also been furnished.

TRACING PAPER.

ACCORDING to *The Railroad Gazette* the Austrian hydrographic bureau adopts the following method of making paper transparent for copying drawings. The sheet of paper being placed over the drawing to be copied, it is lightly rubbed with a ball of cotton saturated with pure benzine. The tracing can then be readily made, owing to the resulting transparency, and the benzine, on evaporating, leaves the paper opaque as before, and without any trace of odor. Absolute purity of the benzine, however, must be insisted upon to secure good results.

Questions and Answers.

All questions relating to building construction, paving, sewerage, water supply, or kindred subjects, will be welcomed in this column provided they relate to matters of general interest and are not such as should properly be referred to a consulting engineer. Answers will be carefully prepared and a proof of both question and answer mailed to the inquirer as early as proper consideration will permit. They will be published for the benefit of other readers as soon as convenient. The full name and address should be given, not necessarily for publication, but as a guarantee of good faith, and to facilitate further correspondence in case the question is not sufficiently explicit.

Inquiries of the Editor, in order to secure prompt attention, should *not be written on the same piece of paper as a communication* to the *Publishing Department*. Letters renewing subscriptions are sent to a clerk in the publishing office, and matter for the Editor, if in the same enclosure, is likely to be overlooked unless it is on a separate piece of paper, so that it may be promptly sent to the Editor.

CANDLE POWER OF ELECTRIC LIGHTS.

Samuel C. Lancaster, City Engineer, of Jackson, Tenn., writes: "Can you tell me how I may ascertain the actual duty, or candle-power, of a Brush electric light? There is a controversy between our city fathers and the manager of our electric lighting plant as to the candle-power furnished, their contract requiring 2,000 candle-power to the lamp, which, the city believes, they fail to furnish. How can we test this, and is there not some gauge made for the purpose?"

[The intensities of all lights are measured by comparison with the lighting power of standard sperm candles; hence the term candle-power. Probably the simplest form of apparatus, or photometer, for making the necessary measurements is that devised by Bunsen. It consists of a paper screen, on which is a grease spot, making that particular part translucent. The principle of the device may be briefly outlined as follows: If the paper be illuminated by a light placed in front, the spot appears darker than the surrounding space. If, on the contrary, it be illuminated from behind, the spot appears light on a dark ground. If the greased part and the rest appear unchanged, the intensity of illumination on both sides is the same. In applying the apparatus the standard light is placed on one side of the screen; the light to be tested is on the other side and is moved in a straight line to such a distance from the screen that there is no difference in brightness between the greased part and the rest of the screen. By then measuring the distances of the lights from the screen their relative illuminating powers can be determined, being respectively as the squares of their distances from the screen. Several other forms of photometer have been designed, such as Rumford's and Wheatstone's, but the one just described is probably most extensively used.

The standard sperm candle, of which there are six to the pound, burns 120 grains an hour, and is the light standard in this country and in England. Argand gas burners are sometimes used, as may be suggested by any particular case, in place of standard candles, having first, however, been compared with the standard candle, so as to obtain for them a definite measure of lighting power. The standard in France is the Carcel lamp, which equals 7.4 standard candles. The difficulty of getting carefully made candles to give a light sufficiently uniform for standard purposes has led, in some cases, to the adoption of special units consisting of lights formed by burning certain mixtures of gas and air, at certain rates of combustion, in specially constructed burners so as to produce flames of definite height. These have been found to answer well in practice.

As regards the actual lighting powers of any of the electric arc or incandescent lamps on the market it is no secret that they fall far below the commercial ratings. There seems to be a tacit understanding that a 2,000 candle-power arc lamp does not develop anything approaching the light of 2,000 standard candles, nor that the much-used 16 candle power incandescent lamps really equal 16 standard candles in illuminating power, and the same is true of all intermediate ratings. Just why it should be so is past finding out. As a matter of fact a so-called 2,000 candle-power arc lamp generally falls short of even 1,000 candles in lighting power, and 16 candle-power incandescent lamps rarely give a light of more than from 12 to 14 candles. The claim of the electric lighting plant manager at Jackson, that his 2,000 candle lights are 2,000 candle lights *actually* is certainly exceptional, and would probably not be substantiated by actual test.

In classifying lamps as regards lighting power it must also be borne in mind that the intensities vary at different angles. Experiments recently made in Germany to determine the candle-power of arc lamps showed that in a Siemens differential lamp, supplied with a current of 14 to 15 amperes at from 48 to 52 volts, the horizontal intensity was about 196 candles (German, very nearly the same as the English): it increased rapidly to about 20 degrees below the horizontal, where it was 1,150 candles, then more slowly until it reached a maximum at about 42 degrees below the horizontal plane, where the light was 2,014 candles; it then began to sink rapidly until below 60 degrees there was no light but only shadow. The average intensity was 1,228 candles, with the globes on; the actual light obtained ranged from 510 candles downward to 1,183 in a direction inclined 40 degrees below the horizontal, with an average illuminating power of 834 candles when freshly whitened reflectors were used.

The fact that electric light men themselves admit the shortcomings of the present system of lamp classification was very strikingly brought out at the recent Cape May, N. J., convention of the National Electric Light Association. Dr. Louis Bell, of New York, in there discussing the shortcomings of the adopted ratings, with special reference to incandescent lamps, added: "With the arc lamp we unfortunately know that the case is even worse. * * * We know only too well that the nominal candle powers of arc lamps are quite different from the real. The whole subject is in a tangle which at first seems almost hopeless. Heretofore it has not been specially important in the early stages of electric lighting, because people did not look so closely then into the exact conditions under which the light which they purchased shall be given; but as the electric lighting business comes more and more down to close competition and hard commercial lines it becomes more and more necessary to look after these things, and to define just what we mean by the lights which we contract to furnish, and to arrange some way by which there shall be general consent as to the meaning of the terms which we use."

Mr. Alexander, in speaking on the same subject, called to mind a measurement, made three or four years ago, by which it appeared that a 2,000 candle-power arc lamp varied from 134 to 1,386 candles, according to the measurements made then; but still they were all called 2,000 candle-power lamps. These and many other similar points brought out at the Cape May meeting would seem to show very conclusively that, in general, users of electric lights are paying for something which they do not receive.

In the case of our correspondent we can suggest only that the question might be settled satisfactorily to all concerned by having photometric tests made of the lamps in dispute by some electric expert. The average candle-power would be the result to be determined and on which, no doubt, the claims of the electric light company are based.]

HOW TO KILL GRASS AND WEEDS IN GUTTERS AND SIDEWALKS.

John W. Howard, City Engineer, Savannah, Ga., writes: "Will you, or some of your readers, inform me as to the best and most appropriate method for killing grass and weeds that grow up in our gutters and sidewalks, frequently forcing themselves up between the brick and stone? I am informed that some kind of chemical is being used, in some cities, for the purpose of destroying such grass and weeds. If this be the case, would you give me the name of the manufacturer?"

[We shall be pleased to hear from any one who has had experience in this matter. The question asked by our correspondent comes up for consideration every now and then, and is of interest in all places where light street traffic is apt to permit such growths of grass and weeds.]

MAKERS OF WROUGHT-IRON CEMENT-LINED PIPE.

Thomas J. Callahan, of Renovo, Pa., asks: "Could you give me address of parties that make wrought-iron cement-lined pipe?"

[On inquiry, we have been able to obtain the name of but one company making such pipe—viz., the New Haven Patent Water Pipe Company, of New Haven, Conn. We would be pleased, however, to hear from any of our readers who know of other makers.]

The Reading, Pa., Board of Health Committee on Epidemics has made an investigation into the prevalence of typhoid fever at East Reading, and reports that it is due to the use of water from springs and wells in the neighborhood.

DOMESTIC PLVMBING HEATING LIGHTING & VENTILATION ENGINEERING

DOMESTIC MOTORS.

The rapidly extending uses of power in the various branches of domestic engineering have stimulatd, in a remarkable degree, the design and construction of what have become popularly, and with some reason, known as domestic motors—a class of engines which require little, if any, skilled attendance, and are consequently well adapted to places where the care and attention necessary to the general type of steam engines are not available, or where the employment of special engine and boiler attendants would not be justified.

For the driving of ventilating fans, small pumps for the water supply of houses, laundry machinery, printing presses, and a variety of other apparatus which will readily suggest itself, these motors have deservedly come into favor and have shown themselves capable of doing excellent service, so much so, that their sale has gradually been extended to a large number of users of comparatively heavy power, such as small machine shops for example. Besides dispensing with skilled attendance, motors of this class have the obvious advantage over the ordinary steam boiler and engine plant, of usually involving expense for power only while power is actually being furnished. There is no delay and expense, as in the steam boiler, in getting up steam, nor is there, as in the case of the steam boiler again, a needless and consequently wasteful surplus of power after the actual demand for power has stopped. The expense begins and ends with the motion of the motor.

Ten or twelve years ago probably the only motor of this general type was the gas engine and, at the present time, it is still the most widely used. In many instances it has shown itself to be a formidable rival of the steam engine, successfully driving machinery for which, in its earlier days, it was considered not at all well adapted. To the original small sizes of fractional horse-power, and of one, two and five horse-power, have been added sizes rated at 10, 20, and even 50 horse-power—ample evidence of the growing popularity and fitness of the engine for heavy duty. The early forms of gas engines were all of the single cylinder class. The first noteworthy change in design, therefore, was naturally found in the adoption of two cylinders. The two-cylinder engines, in turn, were followed by quadruple engines, the larger number of cylinders being calculated to secure greater regularity in motion and higher efficiency, or, what amounts to the same thing, greater economy in the consumption of gas. For general work, however, the single cylinder engines have maintained their degree of favor, appealing to the larger class of small power users by their simplicity of construction and consequent immunity from derangement of delicate parts of mechanism. Gas engine builders, moreover, have not been unmindful of the fact that this simplicity of construction is of the first importance in any engine which is to suffer the abuse of untrained handling. Hence it is not surprising that, even in the later forms of gas engines, the multi-cylinder principle has received but limited application. The power of all engines of this class is derived from the explosion of mixtures of gas and air in various proportions.

Intimately related to the gas engine is the petroleum engine, or oil engine, as it is sometimes called. In this engine a mixture of air and petroleum, in the form of spray, is introduced into the cylinder and is fired by suitable igniting apparatus. Where a supply of gas is not available the engine offers important and readily apparent advantages. Its development has received special attention in England where a number of different designs are now on the market. One of its latest applications is found in the English lighthouse service for compressing air for operating foghorns, as noted in The Engineering and Building Record of September 13, 1890.

A similar duty is performed in both the English and the United States lighthouse service by hot-air engines, of which there are several well tried forms on the market. The principal use of the hot-air engine in this country, however, has been found in the pumping of water in buildings. The engine and pump are made in combined form and have been widely adopted, constituting a pumping outfit at once simple and economical. As a motor for general small power purposes, however, the hot-air engine has not found so much favor, its main drawback being that, compared with other motors of equal power, it is a large and cumbersome piece of machinery.

In the line of motors, which cannot be classed as heat engines, we find the various makes of water motors. Progress with these has been rapid during the past few years, and the prospective user will find a number of designs from which to choose. In some localities, where comparatively high water pressures are maintained in the supply systems, water motors have come into extensive use to the exclusion of many small engines of other types. The entire absence of danger in their operation, ease of management, and general cleanliness have tended largely to make them popular.

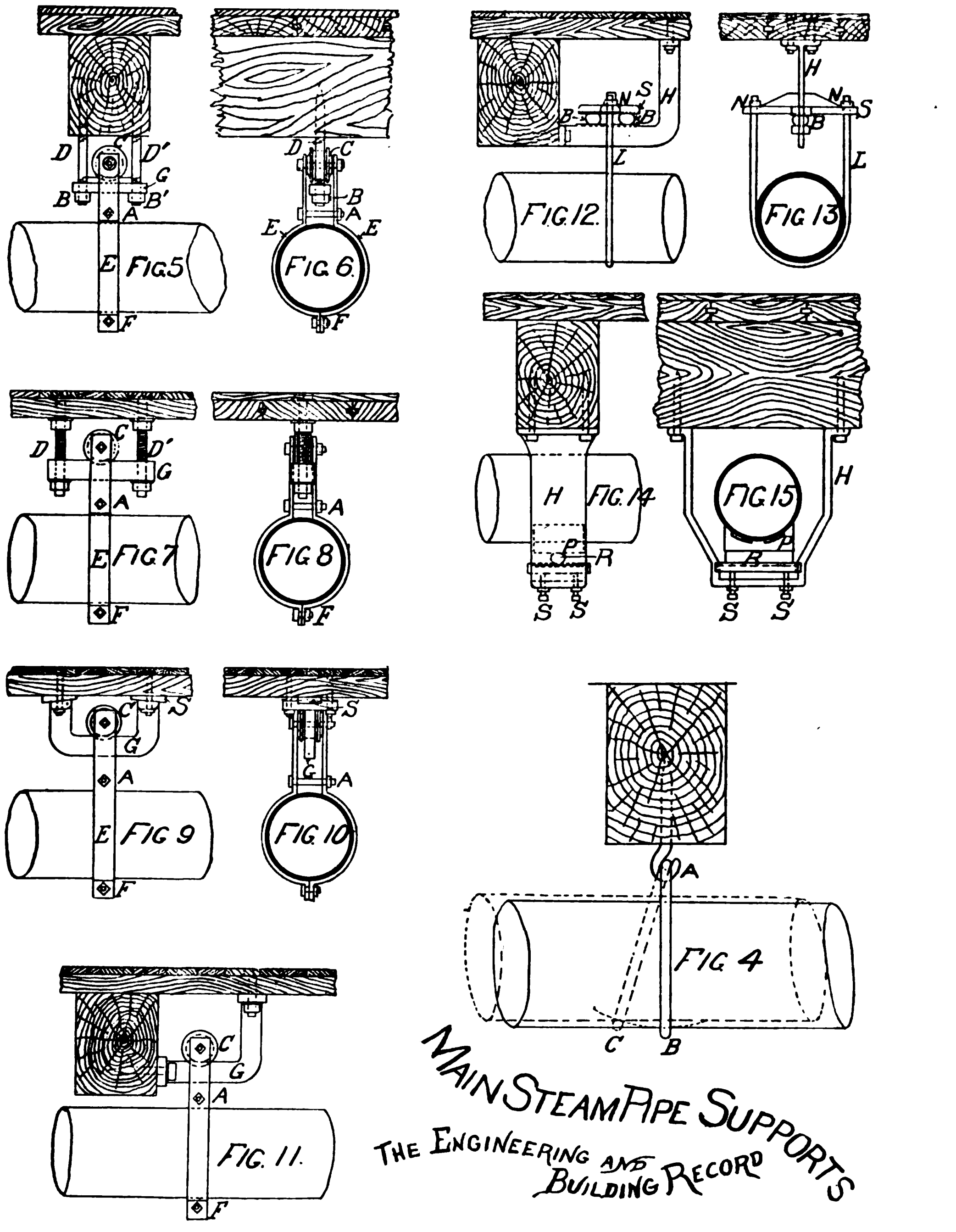
It is but proper that in this brief review we should direct attention also to several special forms of small steam engine and boiler outfits, which it has been endeavored to present in a shape likely to appeal to the unskilled user. The outfits are made principally in sizes of one and two horse-power. The boilers are heated by kerosene, and the working of both boilers and engines is entirely automatic and under perfect control. The oil fuel is used in the form of spray, produced by steam-jet atomizers, and the regulation of the fires, steam pressure and water level in the boiler is effected without any dependence being placed on a possible attendant. Danger from carelessness or ignorance is thus practically eliminated.

The latest arrival among small engines for household and other uses is the electric motor, and its special fitness for a wide range of application is at once apparent. The motor is well beyond the experimental stage, and is now put on the market by over a dozen firms in the United States. In capacity it is now made to range from small fractions of a horse-power up to relatively large sizes, so as to meet the requirements of the constantly increasing number of users. Some of the very small sizes, designed specially for such light work as running sewing machines, jewelers' and dentists' lathes and drills, etc., have been arranged to work with battery currents, and the outfits would seem to offer every possible convenience and to successfully meet every requirement for satisfactory work.

MAIN STEAM-PIPE SUPPORTS.

THE second of the series of articles on steam-pipes and their connections, published in the August number of *The Locomotive*, and already referred to in our last issue, is devoted to the support of main steam-pipes.

These are often hung up in a slipshod and inefficient manner, no proper allowance being made for the movement of the pipe by expansion. As a consequence, joints are strained and become leaky, flanges are broken off, and in many instances the hangers are pulled out and the whole line, or a portion of it tumbles down bodily. The usual support for steam-pipes is shown in Fig. 4. It consists simply of a ring or loop, which is slipped over the end of the pipe and supported by a gimlet pointed hook which is screwed into a beam above and admits of no adjustment. If the pipe is of any considerable length, the ring, when steam is turned on, assumes the position shown by the dotted lines in the cut.



MAIN STEAM PIPE SUPPORTS

THE ENGINEERING AND BUILDING RECORD

The pipe is raised, severe strains are thrown on the joints, and, unless a section is left uncovered where the hanger comes, the covering is badly torn. Few realize the severity of the strain set up in a long line of large pipe by using a hanger of this kind. In many cases the ring will be found lifted clear out of its supporting hook. Of course it is evident that when this is the case those hangers which do remain in place have to carry a greatly increased load, so that unless they are of excessive strength they are apt to give way. When one breaks the shock throws a severe strain on the next one, and if that gives out the whole line of pipe is pretty sure to come down.

Pipe of any considerable size should always be supported by some sort of hanger that will admit of a parallel motion when the pipe expands. Figure 5 is a side view and Fig. 6 an end view of one of the cheapest and best forms of hanger where the motion of the pipe is not very great. Two clips are made of 3x½ inch flat iron bent around to fit the pipe, so that when the nuts on the bolts at A and F are screwed up the pipe is tightly gripped. The upper ends of the clips are not brought together, but are left a few inches apart, and of sufficient length to allow the roll C to be placed between them as shown. The bolt passing through the clips and roll forms a bearing for the roll, which is grooved on its periphery, and runs on the bar G, which in turn is supported by the lag bolts screwed into the beam, as shown. The pipe may be raised or lowered by simply turning the nuts on the bolts, and may be set at any desired height.

Figures 7 and 8 show a hanger exactly similar in principle to the one just described, but available in a case where it would be necessary to carry a pipe as close as possible to the timbers. In this case the weight of pipe would be carried by the floor planks instead of the beams. With mill floors as constructed at the present time this would form a good support, especially if it were placed close beside a beam. Two bolts are let through the floor, the heads being flush with its upper surface so as to offer no obstruction. The bolts should be a "driving fit" through the planking, and have their threads cut of such a length that a nut and washer may be screwed up to the under side of the plank. The pipe is suspended from these bolts by means of bar, roll, and clips exactly as in Figs. 5 and 6, and the same facility of adjustment in a vertical direction is obtained as in that design.

Figures 9 and 10 show another form of hanger, in which the vertical adjustment is obtained by "shimming" with the wedges shown at S S, the remaining part of the design being similar to those already described. The objection to this form is that the vibration and shrinkage of the floor is apt to loosen the wedges so that frequent adjustment becomes necessary. This form might be used in some places with satisfaction, but we should not recommend it in preference to the ones described above.

Figure 11 shows another kind, in which no provision is made for adjustment vertically. When a line of pipe is run close to a wall so that there is no chance for the timbers or floor to settle appreciably, and so throw the pipe out of line, this form will answer every purpose if carefully put up in the first place.

Figures 12 and 13 show a different form of clip from those previously described. This is simply a bar of round iron bent around to fit the pipe and with threads cut on the ends. The ends of this clip pass through holes in the plate S, and are provided with nuts which enable one to make adjustment in a vertical direction. The plate S rests on two cast-iron balls B B, which roll with scarcely any friction as the pipe expands.

Figures 14 and 15 show a hanger made on a different principle, and which does not interfere with the pipe covering. A cast-iron saddle P, carries the pipe and rests on a cylindrical roller R, which gives the required freedom of motion endwise to allow for expansion. The friction in this construction is also very slight. The plate on which the roller R rests is supported by four set screws S S S S, by means of which the vertical adjustment is obtained, and the whole is supported by the casting H, which is securely bolted to the beam overhead.

CAREFUL ROAD MAKING.

THE Thomaston, Me., *Herald*, of recent date, says: "It is nothing unusual for a man to pay his tax by work on the roads, but the way Mr. Edwin McIntyre of Warren works out his tax is a little out of the common course. Mr. McIntyre goes over the piece of road he cares for at regular intervals and picks up every rock. He collects them in a wheelbarrow, takes them home, pulverizes them on a stone anvil and dumps them back into the road again. This practice he has kept up for 13 years. During that time he has ground and put into the road 15 cords of rocks. Mr. McIntyre not only measures them, but the last two years he has counted them. He found by actual count that in 1889 he used in this way just 67,604 cobblestones. It is needless to remark that this is one of the best pieces of road in the town."

Notes and Queries

on Domestic Engineering.

Communications relating to the practical details of plumbing, heating, lighting and ventilation will be welcomed in this column. The writer's true name and address must always be given, but an assumed name may be used for publication if preferred.

STAYING A TANK.

"J. W. C.," London, England, writes: "An interesting case, showing the results of water pressure on the sides of a cistern, has recently come under notice. The cistern was of the shape shown in the annexed sketch, and about 10 feet square and 8 feet deep. Being fixed in a turret, the base of which the cistern filled, it was necessary to cut out a corner 2'6"x2'6", for access to the cistern from the bottom. The cistern was made out of $\frac{3}{16}$-inch wrought-iron plate, riveted to angle irons. There were several ¾-inch stay rods *across* the cistern to keep the sides from bulging outwards. The whole was galvanized. On filling the cistern with water the angle iron at X cracked, and the cistern became slightly distorted. There is little doubt that if stay rods had been fixed, to tie the angles A and B, this would not have occurred. But rods across this part would have been an obstruction across the access to cistern. I should like to know what you consider the best way of staying a cistern or tank of this kind, the size of rods, and where they should be placed?"

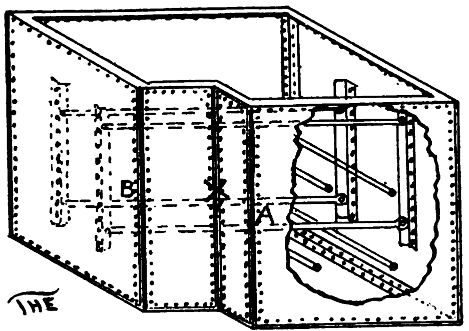


FIG 1.

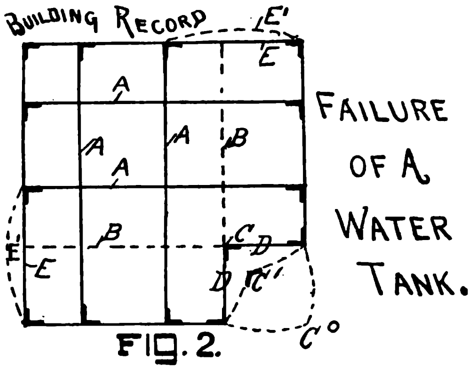


FIG. 2.

[From the above letter and sketch it appears that the cistern was stayed by two sets of rods, about in the position A A, etc., shown in Fig. 2. These were probably sufficient for the shorter two of the main walls, but left long unsupported lengths of wall at E and E, and weak places at D D, where the failure occurred. The water pressure would tend to bulge out walls E E to E' E', and cause the walls D D to move out till their intersection C reached C°. Of course they could not reach this extreme position without entirely destroying the angle X, Fig. 1, and they probably assumed a position like C'. An additional set of rods, B B, would have prevented any displacement of C and prevented distortion of D D and bulging of E E. One-half-inch rods would be ample to resist the strains.]

FIRE EXTINGUISHERS.

REFERRING to fire extinguishers, *Uhland's Wochenschrift* says that the theory of all such preparations is to cut off any burning object from the surrounding atmosphere. It is immaterial whether this be accomplished by a liquid or a solid substance. Water is the simplest and most natural one. Its efficiency as a fire extinguisher may, however, be increased by an addition of pulverized, common alum in sufficient quantity to obtain a saturated solution. On evaporating, this solution will leave on the material over which it was thrown a thin coating having a high resisting power to heat. Potash and common salt are not recommended, as the salts will volatilize and afterwards precipitate themselves in various parts of a room or building and tend to produce dampness, owing to their affinity for moisture.

ANNUAL REPORTS.

REPORT OF THE TRUSTEES OF THE SANITARY IMPROVEMENT BONDS OF THE CITY OF JACKSONVILLE, FLA., TO THE CITY COUNCIL. July 1, 1889, to July 1, 1890. With Report of Superintendent and Tables Annexed.

The report shows a small advance in the receipt of water rates over those of the preceding year. This, it is thought, would have been considerably increased, had provision been made for a stand-pipe which has been urgently recommended for several years. As it is, some large elevators had to be shut off, and the applications of several others had to be declined because this necessary supplement to the safety of the pumping machinery had not been supplied. R. N. Ellis, water-works superintendent, in his report, again urges the erection of a stand-pipe. There are now in use a little over nine miles of mains, and about two and a-half miles of temporary mains that should be replaced with cast-iron pipe of proper diameter. Three hundred and ninety-one water meters are in use. E. J. Howard, engineer at the works, reviews the present condition of, and the work performed during the year ended June 30, 1890, by the pumping plant. An appendix gives detailed tables of receipts and expenditures for the year.

THIRD ANNUAL REPORT OF THE CITY SURVEYOR AND SUPERVISOR OF STREETS AND HIGHWAYS, CAMDEN, N. J.; for the year ending March 1, 1890.

This is the third annual report, and is accompanied by tables showing the amount of work done and its cost, a list of all paved streets in the city, location of sewers, size, material, etc. There are in all seven of these tables. Table I. shows the streets paved, number of yards of paving done, number of feet of curb, gutter, etc., laid, number of yards of repairing, with cost of each, as laid during the year. Table II. shows the summary of the different kinds of paving done during the year, with the cost of each. Table III. shows the total number of yards of the different kinds of paving laid in the various wards to date, with the price per yard, year in which the work was done, and name of contractor. Table IV. shows the general summary of all paving now laid in the city, including the paving laid by private contract.

The total number of square yards of paving done during the year was 27,257 square yards, or equal to a street 25 feet between curbs of $1\frac{85}{100}$ miles in length, at an average cost of $1.58 per square yard, the total length of streets equal in width to 25 feet between curbs being $34\frac{44}{100}$ miles.

Table V., which gives location, size and cost of each sewer built during the past year. Table VI. shows the summary of sewer work during the past year, with total cost. Table VII. shows a complete list of all sewers laid in the city to date, together with the location, size, number of manholes, inlets, cost of each, when and by whom built.

There has been constructed during the year 5.527 feet, or $1\frac{4}{100}$ miles of sewers, at an average cost of $1.79 per foot, making the total length of sewers laid to date in the city 32 and $43\frac{1}{100}$ miles.

The department for several years past awarded contracts for repairs of sewer breaks, which proved unsatisfactory, owing to the unworkmanlike manner in which it was done, and the delay in doing it. For the past year it has had a corps of men especially for this purpose, this corps not only mending the breaks, but setting inlets and making connections to the sewers, and ready, at a moment's notice, to go to work either day or night. L. E. Farnham is the City Surveyor, and John Blowe, the Supervisor of Streets and Highways.

TRADE PUBLICATIONS.

STEAM AND HOT-WATER HEATING.

THE Western Engine Company, of Painted Post, N. Y., has sent out a new catalogue, devoted more particularly to steam and hot-water heating and to the Bronson water-tube boiler made by them. The boiler is described and illustrated in detail, and tables of dimensions and prices are given.

A COPY of the prospectus of the Young Men's Institute of the Young Men's Christian Association, of New York, has just been received. In the outline of the educational advantages which it affords attention is, among other things, directed to the classes of mechanical and free-hand drawing, carriage building and steam engineering.

SEATTLE and Tacoma, 42 miles apart, are to be connected by an electric railroad. This will probably be the longest electric road in existence.

Novelties.

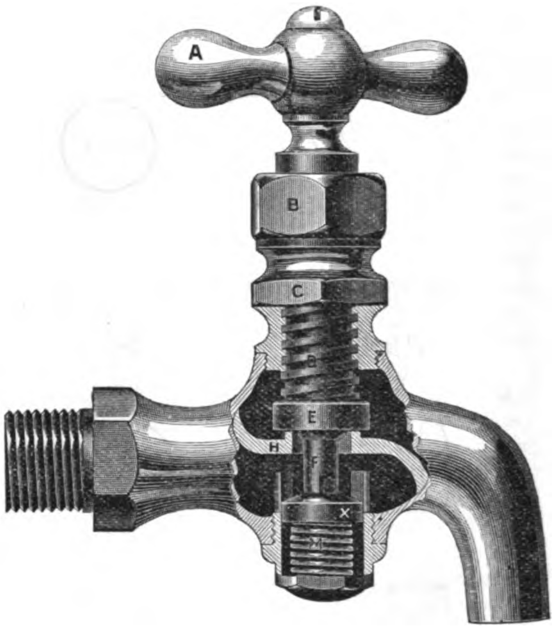
Devices are described under this head purely and strictly as news; because believed to be new and calculated to interest readers.

In no case is pay accepted, directly or indirectly, for publishing a novelty notice.

As the subjects are selected for their supposed novelty and interest merely, it will, of course, be understood that the selection does not imply indorsement.

THE "AUTOMATIC" COMPRESSION FAUCET.

THE H. A. Williams Manufacturing Company, 22 Milk Street, Boston, Mass., has just brought out the automatic shut-off faucet shown in the annexed cut. The latter represents the faucet closed to the passage of water, the valve E being seated on H. As the handle A is turned to open the faucet the valve E rises from its seat, as does also the auxiliary or shut-off valve X; one revolution of the handle A opens the faucet to its fullest extent and in this position the valve X is said to be just far enough away from the lower face of H to allow a free waterway through the faucet. If now a wrench is applied to the nut C the valve E rises still further, and the valve X, being actuated by the water pressure and the spring M, also rises until it meets the lower face of H and thus shuts off the water. This occurs before the nut C has been entirely removed, thus avoiding all splatter of the water; the washer may then be removed by unscrewing the tit F.



An additional advantage claimed for the faucet lies in the fact that when the valve E is wide open, its upper face makes a water-tight joint on the lower face of the nut C, and thus prevents any water getting up around the stem. The faucet should be opened wide before the nut C is removed.

ALLOYS FOR ELECTRIC FUSES.

THE following proportions for fusible alloys may be of interest to those who have occasion to make or use fuses in electric wire systems. They were given in a recent issue of *The Electric World*, and have been used in actual practice. The range of melting point is so great that almost any desired current can be probably taken care of without the use of too small a wire.

Lead.	Tin.	Bismuth.	Melting points, in degrees. Centigrade.
1	1	4	93 8
5	3	8	94 4
2	3	5	94.4
1	4	5	118.8
1	4	1	125
1	1	1	241.1
1	2	1	167 7
1	3	1	167.7
1	3	1	200

THE Mayor of the city of New York has been requested to appoint a citizen's committee to consider the plan of improving the westerly river side. One feature of the plan is to build a sea wall, or bulkhead, from Seventy-second to Ninety-eighth Street. The land under water is to be reclaimed, and for the entire length an avenue for general purposes is to be built.

THE MAINTENANCE AND OPERATION OF WATER-WORKS BY PRIVATE COMPANIES.

(Continued from page 212.)

7. INVOICE BOOK. 360 pages (4 quires). Horizontal ruling 3 to the inch. Record No. 930.

This is "journal ruled," with one extra vertical ruling following the date column for number of the voucher due to its place in Invoice Book, which should pertain to the bill in its entries in cash book.

There should be an index in which all bills should be alphabetically entered by seller's name, and referred to by "No. of voucher," instead of page.

The "pay roll" should be made out in bill form, as also a weekly summary of petty cash items, not loading up either Cash or Invoice Book with sums too small for bills. A "petty cash" book should be used, in which should be entered every individual item, and the account to which chargeable, and on Invoice Book simply enter the weekly aggregate of amount chargeable to each account.

All bills should be footed, and this footing should be entered in the last set of columns.

All bills, whenever approved for payment, should be copied on the Invoice Book, so that that book will show a full account of all expenditures incurred.

In case of transfers of charges from one account to another, they should be made through the Journal.

8. CASH BOOK. 360 pages (4 quires). Horizontal ruling 3 to the inch. Record No. 931.

Charge all sums received, noting account to be credited.

Credit all sums paid out, on vouchers only, noting account to be charged, and entering number of voucher opposite each item into which each bill may be divided.

On the last day of each month the receipts and disbursements on account of each ledger account for the previous month should be separately posted on the ledger cash, and on the opposite side of each of such ledger accounts.

9. JOURNAL. 270 pages (3 quires). Horizontal ruling 3 to the inch. Record No. 932.

To be used as a journal, for all cross entries, transfers, etc.

On the first day of each month, ledger accounts 6 to 17 inclusive should be journalized from footings of "Accounts Receivable Book," and properly posted to Ledger. Other accounts, cross entries, transfers, etc., should be journalized and posted to Journal whenever necessary.

10. LEDGER. 360 pages (4 quires). Horizontal ruling 4 to the inch. Record No. 933.

Contains no individual accounts except treasurer.

The ledger accounts to be kept are as follows:

No. of Acct.	Name of Acct.	No. of Acct.	Name of Acct.
1	Capital Stock.	26	Conduits, Force or Gravity Mains.
2	Bonds.		
3	Bills Payable.	27	Distribution.
4	Cash.	28	Buildings.
5	Treasurer.	29	Foundations.
6	Public Hydrant Rental Accounts Receivable.	30	Water-wheels.
		31	Boilers.
7	Private Hydrant Rental Accounts Receivable.	32	Pumps, either Steam or Power.
8	Water Accounts Receivable.	33	Fuel.
9	Meter Rents Accounts Receivable.	34	Oil and Waste.
		35	Lighting.
10	Services and Repairs Accounts Receivable and Payable.	36	Stand-pipe.
		37	Distributing Reservoir.
		38	Meters.
11	Miscellaneous Accounts Receivable.	39	Salaries.
		40	Legal Expenses.
12	Public Hydrant Rental.	41	Superintendent.
13	Private Hydrant Rental.	42	Engineering.
14	Water Rates.	43	Engine and Firemen.
15	Meter Rents.	44	Office Expense.
16	Services and Repairs.	45	Livery.
17	Miscellaneous Accounts.	46	Interest.
18	Bills Receivable.	47	Discount and Commission.
19	Organization.	48	Taxes.
20	Construction.	49	Insurance.
21	Real Estate.	50	General Expense.
22	Water Supply.	51	Dividends.
23	Improvement of Water.	52	Profit and Loss.
24	Storage.	53	Balance.
25	Water Power.		

1. *Capital Stock.*—Credit this account, and charge "cash" with the par value of all stock issued. Credit proper account, and charge "discount and commission" with all discounts on capital stock, or commission and expenses paid for the sale of the same.

2. *Bonds.*—Credit this account with the face value of all bonds, and charge the account for which the bonds were issued, whether "cash," "bills payable," "construction," or other accounts. Amount received for accrued interest will appear in interest account.

Credit proper account, and charge "discount and commission" with all discounts on bonds or commissions and expenses paid for the sale of the same.

3. *Bills Payable.*—Credit this account, and charge "cash" with all sums received from notes of the company.

Credit the full face of the note. When the note is paid, charge this account and credit "cash." If the notes read "with interest," then charge "interest," and credit "cash" with the amount of the interest, when the same is paid.

4. *Cash.*—Charge this account with all sums received. At the same time credit the account which may have furnished the funds.

Credit "cash," and charge proper account with all sums paid. If any bills are paid by treasurer, he must notify the principal office of number of voucher, amount, and date of payment, so that the treasurer may be credited and "cash" charged with the same, and "cash" credited and the proper account charged.

5. *Treasurer.*—Credit treasurer, and charge "cash" with all sums received from him. Sums received from the sale of material will not enter into the treasurer's account, unless the moneys are actually paid over to him.

6. *Public Hydrant Rental Accounts Receivable.*—Credit this account, and charge "public hydrant rental" with gross amount of all bills made out for public hydrants.

If any rebates are made before the bills are paid, charge this account, and credit "public hydrant rental." If rebates are made after the bills are paid, and the rebate is a cash transaction, credit "cash" and charge "public hydrant rental accounts receivable," take a receipt for the money paid, enter it in the invoice book, treating it as any other bill paid.

If errors are made in the amount of these bills, correct them by journalizing and posting as cross entries between this account and "public hydrant rental."

7. *Private Hydrant Rental Accounts Receivable.*—Credit this account, and charge "private hydrant rental" with gross amount of all bills made out for private fire protection.

Treat rebates, errors, etc., the same as detailed in account No. 6.

8. *Water Accounts Receivable.*—Credit this account, and charge "water rates" with the gross amount of all bills for "water rates," both "fixture" and "meter rates."

Treat rebates, errors, etc., the same as detailed in account No. 6.

9. *Meter Rents Accounts Receivable.*—Credit this account, and charge "meter rents" with the gross amount of all bills for "meter rents." This does not include anything charged for the sale of meters, or for setting or repairing meters, all of which go to other accounts.

Treat rebates, errors, etc., the same as detailed in account No. 6.

In closing this account at the end of the year, close it into "meters," and close that into "balance."

10. *Services and Repairs Accounts Receivable and Payable.*—Credit this account, and charge "services and repairs" with the gross amount of all bills for tapping the mains, furnishing and putting in service pipes, fittings, sidewalk stops, plumbing, etc., and the maintenance and repair of the same.

Credit "cash," and charge this account with all sums paid for labor, material, or expense in connection with the above.

Treat rebates, errors, etc., the same as detailed in account No. 6.

11. *Miscellaneous Accounts Receivable.*—Credit this account, and charge "miscellaneous accounts" with the gross amount of all bills made out for any purpose not already specified.

In case the bill is for the sale of material or the performance of labor belonging to any itemized department, then the account of that department should be credited instead of this account, but "miscellaneous accounts" should be charged with the amount.

Treat rebates, errors, etc., the same as detailed in account No. 6.

(TO BE CONTINUED.)

ARCHITECTURAL COMPETITIONS.

SAGINAW, MICH.—City Hall.—Plans are wanted until October 20, for the construction of a city hall building at this place. Estimated cost, $110,000. For circular of instructions, address John C. Matthews, City Clerk, as above.

WATER.

For Additional Water Items see Proposal Columns.

BLAINE, WASH.—It is estimated the system of water-works projected for this place will cost about $170,000.

MONETT, MO.—The sum of $14,400 has been voted by the people of this place for the purpose of establishing a system of water-works. Address the Town Clerk, for details.

LOUISVILLE, KY.—The Domestic Water-Works Company of this city wants machinery for its plant, including pumps, pipes, tanks, etc.

STEELTON, PA.—Estimates made put the cost of water-works for this place at $100,000. It is probable that operations will soon commence.

PULLMAN, WASH.—It is proposed to expend the sum of $8,000 on a water-works system for this place.

ST. LOUIS, MO.—Proposals for constructing the basins for the new water-works at this place will soon be advertised for, estimated to cost about $700,000. Bids for pumps amounting to $300,000 will also be wanted.

RITZVILLE, WASH.—Water-works for this place are now about a certainty.

HEBRON, NEB.—The water-works question at this place still remains undecided.

LEWISTON, IDAHO.—The capital stock of the Lewiston Water and Light Company has been increased to $100,000. Construction work will be proceeded with next spring.

CRESTON, IA.—It is estimated that the projected system of water-works for this city will cost the sum of $30,000.

SHEFFIELD, ALA.—Messrs. Johnson & Flood, hydraulic engineers, have been engaged by the City Council of this place to make the preliminary surveys for a system of water-works to be established at this place.

MONMOUTH, ILL.—Bonds in the sum of $15,000, at 5 per cent. are to be issued at this place for the purpose of establishing the projected system of water-works.

HUNTINGTON, L. I.—It is probable that the projected water-works system for this place will soon be established. For particulars address Joseph Irwin, as above.

YORK, NEB.—Reports say that the York Water-Works System has been sold to T A Post, of St. Louis, Mo., who obtained a judgment for $921.50 on interest for coupons. The sale was made on execution.

BROOKLYN, N. Y.—The scarcity of water in the 17th Ward, Greenpoint, will soon be relieved, for City Works Commissioner Adams September 15 awarded a contract for building a new water main to Harris & Maguire, at $12,000.

NEWARK, N. J.—The New York *Times*, of September 15, prints the following: "It is reported in Newark that the East Jersey Water Company has purchased a large tract of land from John Krean, of Elizabeth, in Upper Longwood Valley, near the sources of the Rockaway River. It is believed by those best informed on the question, that the East Jersey Water Company is making arrangements for using the Rockaway River as a source of water supply for some other city than Newark."

TALLADEGA, ALA.—The Talladega Gas Light and Water Company is about to increase its capital stock for the purpose of making improvements.

ROME, GA.—The East Rome Water-Works Company has, it is stated, received a contract to supply the city with water.

DARLINGTON, S. C.—The Darlington Water-Works Company has decided to establish a plant here, to cost $20,000. C. S. McCullough can furnish particulars.

ROANOKE, VA.—The local water-works system is to be increased.

SORRENTO, ME.—Preparations are being made for establishing a system of water-works at this place.

Contracting News Department.

A WEEKLY RECORD

OF SPECIAL INTEREST TO CONTRACTORS, BUILDERS AND MANUFACTURERS OF ENGINEERING AND BUILDING SUPPLIES.

WATER.

(For additional Water Items, see preceding page.)

For works for which proposals are requested see also the "Proposal Columns,' pages i-ii-255.

Aurora, Neb.—City Clerk H. E. Metzger writes: "On August 26, we voted $7,000 more water bonds. The same will be used in purchasing another boiler, sinking the third well and extending the water mains."

Wenham, Mass.—Town Clerk Wellington Pool writes: "A petition is in circulation for the purpose of securing (in connection with other towns) an aqueduct supply of water for this town. The town to incur no liabilities—except for hydrants for use in extinguishing fires."

Madison, Ga.—City Clerk T. B. Baldwin writes: "The city of Madison some time ago advertised for bids for water-works, proposing to grant franchises, etc., to any company that would undertake to establish water-works. Since then we have done nothing towards the matter, as we did not receive any bids satisfactory to the city authorities."

Lebanon, Ill.—C. L. Robinson, City Clerk, writes: "We contemplate building water-works, the Holly system, but, as yet, no contracts are let. The committee is at work but has not reported any definite action to the Council; are now investigating in regard to obtaining water. As soon as that point is reached, the remainder will be consummated."

Santa Ana, Cal.—City Clerk Edward Tedford writes: "As soon as we sell the bonds we will be ready to accept bids for material and the work of putting in water-works."

Earlville, Ill.—Regarding the water-works project at this place City Clerk H. A. Chase writes: "Our council has had several meetings, to discuss the matter, and at their last meeting the matter was referred to the Committee on Fire and Water, with instructions to fully investigate different plans and prices and report to council for their action."

Lancaster, Pa.—Among the proposed improvements to the local water-works system at this place is a new 40,000,000 gallon reservoir, a new dam at Ranck's Mill, and pipe extensions. For particulars address Mayor Clerk, as above.

Mount Sterling, Ky.—The people of this place having voted to establish water-works it is probable that the construction of the plant will soon be commenced.

Eustis, Fla.—It is probable that important steps will soon be taken towards establishing the water-works system projected for this place.

Greenville, S. C.—The Paris Mountain Water Company has been incorporated for the purpose of establishing a system at this place. Address William S. Perot for particulars.

Chillicothe, O.—This city is taking preliminary steps towards establishing a water supply of its own, as the contract with the private company now holding the franchise is about to expire. Address C. A. Malone for particulars.

Atkinson, Neb.—The contract between the city of Atkinson and Meals & Godfrey for the placing of a water-works plant at this place was signed September 10, and work will proceed at once. The works are to be completed by January 1, 1891.

Morristown, Tenn.—Edward D. Bolton, of No. 44 Broadway, New York, has been engaged to make plans for a system of water-works here, and the construction will be commenced at once.

Burlington, Col.—Town Clerk J. W. Clement writes: "We as yet have taken no definite steps towards establishing a system of water-works at this place further than to appoint a committee to investigate the advisability of sinking an artesian well."

Lowell, Mass.—The Aldermen have passed the ordinance favoring a loan of $60,000 for purchasing a new engine at the pumping station. Mayor Palmer can furnish particulars.

Lynn, Mass.—The City Treasurer has been authorized to borrow $75,000 for the extension of the water-works plant.

Kalkaska, Mich.—A dispatch to the Grand Rapids *Democrat* explains the water-works situation at this place as follows: "A system of water-works is needed for fire protection and to furnish sufficient water in times of drought for lawns and gardens. The Village Council have had experts on the ground looking it over with a view to putting in water-works, but it is not yet settled whether water will be furnished us by a water company under contract, or whether the works when built will be operated by the village. It is proposed to put in a system of water mains, with hydrants and suitable pipes for supplying houses with water in all the principal streets of the village. The supply of water will be obtained from the Boardman River, which flows conveniently near, or from a large well with supply pipes, and will be pumped into and forced through these water mains and pipes by steam power. The estimated cost of this improvement is from $16,000 to $25,000. The people voted for it by a good majority, and as soon as our bonds can be floated, a contract will be made and work commenced on the job." This is confirmed in a letter from C. M. Phelps, City Clerk.

Quincy, Ill.—There is some talk of building a new water-works plant here. The Mayor can give information.

Madison, Fla.—J. Arthur Durst, of this place, writes: "The supply for the proposed water-works was decided to be most practical from subterranean sources, and the contract for the artesian well was awarded to me. The incidental difficulties of drilling in this region makes progress rather slow—the rock being hard. The distributing system will probably not be considered until the well is completed and tested for capacity and quality."

Arkadelphia, Ark.—Town Clerk T R Zimmerman writes: "The indications are that water-works, electric lighting and ice factory will be constructed at once. A committee of citizens will go to Camden in a few days to examine the works at that place. Communications in reference to water-works or electric light should be addressed to Geo. M Carder, Mayor; ice factory, address Citizens Bank."

Brooklyn, N. Y.—Specifications are being prepared by Chief Engineer Van Buren, of the City Works Department, for the construction of a water tower on Mount Prospect, at a cost of $65,000, and for laying a 48-inch water main from the Ridgewood reservoir with 36-inch and 30-inch branches, at a cost of $400,000.

Rutherford, N. J.—The Hackensack Water Company has made a proposition to the Borough Council to supply this place with water, the cost to be about $15 per hydrant. Councilmen Alyea and Warner were appointed a committee to select two citizens, and the committee of four to investigate the plan and report to the Council.

Pittsburg, Pa.—The agitation on the South Side for a better and more abundant supply of water for that section of the city has resulted, it is said, in the announcement that a Citizens' Water Company is to be organized for the purpose of supplying Knoxville, Allentown, Beltzhoover Borough and Mt. Oliver. It is also reported that the company has already secured permission from the township authorities to run an inlet pipe from the Monongahela River, above Beck's Run, up through the township to Southview Place, where the reservoir will be located. It is proposed to fix the capital stock at $200,000 at present. Ferdinand Berry, C. E. Succop, Henry Miller, and others, of this city, are mentioned in conection with the new project.

South Orange, N. J.—The following proposals for the construction of the water distribution system at this place were opened September 17, by C. Ph. Bassett, C. E., Engineer-in-Charge: Dowd & Rice, $4,740.50; Ludwig Batt, $5,698; W. F. Linman, $6,239; T. M. Lesher, $6,379.50; H. H. Holmes, $6,494; Small & Berry, $6,525. Thielman & Co., $7,199; George P. Olcott, $7,852.50; Donato Cuozzo, $9,159; Rooney & Bergin, $18,329.

Philadelphia, Pa.—Director Wagner appeared before the Council's Committee on Water September 16, and recommended the expenditure of $700,000 on improving the water-works system. On the directors' recommendation the amount was allowed, and the work will soon proceed.

New York City.—The Aqueduct Commissioners have awarded the contract for building the earth and masonry work of the auxiliary dam of Reservoir D, at Carmel, to M. S. Coleman, the lowest bidder, at $83,092.58.

Gainesville, Ga.—City Clerk E. P. Chambers writes: "We have let contracts as follows: Stand-pipe to Tippitt & Wood, Phillipsburg, N. J.; pump and boiler to Duane Pump Company, Holyoke, Mass., and pipe to South Pittsburg Pipe Works, South Pittsburg, Tenn. This completes the job except laying the pipe."

Algona, Iowa.—The following bids for the construction of a complete system of water-works were received by W. B. Quartor, City Clerk, September 1: Harrison & Hawley, St. Paul, Minn., $7,850; N. S. Wind and Engine Company, Batavia, Ill.; $9 990; Fairmont Turner, Nevada, Iowa, $9,000; Fairbanks, Morse & Co., St. Paul, $8,439. Contract awarded to Harrison & Hawley.

Oxford, N. C.—City Clerk F. B. Hays writes: "The water-works question has been much agitated in our town, and a few weeks ago our Board of Town Commissioners, in answer to a petition of citizens, called an election on the question of borrowing $50,000 to build water-works. The petition was withdrawn, however, and the election has not been held. The town now contemplates letting the franchise to a private corporation, but nothing definite is looked for for some time yet."

Hamilton, Mass.—Town Clerk Otis F. Brom writes: "I understand that some party has been in town to see if the town would grant the privilege of putting in water-works. The town has taken no action."

Jersey City, N. J.—The Board of Trade has adopted a resolution calling the attention of the city authorities to the present condition of the water supply, and demanding prompt action to secure a better and a cleaner service.

Blue Hill, Neb.—The following were the successful bidders for the construction of a system of water-works received by A. A. Richardson, Consulting Engineer, September 11: Porter Boiler Manufacturing Company, Chicago, stand-pipe, $4,600; John McCarthy, Wymore, Neb., base of stand-pipe, $1,000; South St. Louis Foundry and Pipe Company, pipe, $34.10; National Tube Works Company, Chicago, hydrants and valves, $711.

Winchester, Tenn.—City Clerk T. A. Embry writes: "Henry Jackson, of Nashville, is talking of putting in water-works at this place."

Hempstead, N. Y.—It is probable that improvements will soon be made in the local water-works system.

Water-Works.—See our Proposal Columns for information regarding water-works and water-works furnishings at the following places: Toledo, Iowa; Dallas, Tex.; Allegheny, Pa.; Atlanta, Ga.; Sutton, Neb.; Fulton, Ky.; Dallas City, Ore.; Ellsworth, Kan.; Austin, Tex.

SEWERAGE.

For Additional Sewerage Items see Proposal Columns

Oakland, Cal.—Numerous sewer extensions are to be made at this place.

White Plains, N. Y.—Edward D. Bolton, of No. 44 Broadway, New York, has been appointed chief engineer of the construction of sewers at this place. The work has been commenced and is progressing rapidly.

Orange, N. J.—A meeting of the Joint Committee of the Common Council and the Citizens' Committee on Sewerage was held last week, when the proposed improvement was discussed informally. It was decided to hold a public meeting in the Council Chamber at at early date, to which citizens and taxpayers are invited to be present.

Calais, Me.—Mayor C. W. McCullough writes: "We have employed W. E. McClintook, C. E., Court Street, Boston, to make survey and furnish with plans for complete sewerage of our city. We have not yet received plans, and it is getting so near close of season that probably not much will be done this year. We do not intend building our sewers by contract, and at once shall build part each year and under supervision of our Street Commissioner."

Jersey City, N. J.—It is said that all obstacles which have existed regarding the construction of a joint sewer between this city and West Hoboken have been removed and that the undertaking is about to be commenced. For particulars address Mayor Cleveland as above.

Tarrytown, N. Y.—Edward D. Bolton, of No. 44 Broadway, New York, has been put in charge of the construction of the sewerage system as chief engineer. The work is well under way and will soon be completed. Messrs. Van Vranken & Duell have the contract.

Mount Vernon, O.—Important improvements and extensions are to be made to the sewerage system at this place. Particulars can be had by addressing City Engineer Alexander Cassil, as above.

Dayton, O.—The plans for the sewerage of this city, now being prepared by Messrs. Cady Staley & Pierson, of Cleveland, with Rudolph Hering as consulting engineer, are nearly completed.

Roanoke, Va.—Rudolph Hering, of New York, has been retained to make a plan for the sewerage of this place. City Engineer Dunlap is now making surveys.

Somerville, N. J.—The following proposals for constructing approximately four miles of sewers, at this place, were opened September 8, by Carroll Ph. Bassett, of Newark, N. J.: W. F. Aid, Hoboken, N. J., $31,394; C. W. Hunt, New Rochelle, N. Y., $28,319.90; Geo. E. Clark, New York City, $25,174 60; P. H. Harrison, Newark, N. J., $17,576; James McGuire, Newark, N. J., $18,782.50; J. E. Hillpot, Philadelphia, Pa., $26,128.05; P. F. Hawman, Reading, Pa., $26,615.61; Pt. Rehill, Jersey City, N. J., $26,077.65; Small & Berry, New York City, $19,184.60; Richardson & Farrier, Somerville, N. J., $23,291.30; Charles H. Coleman, New York City, $20,720.33.

Marion, O.—John W. Hill, civil engineer, of Cincinnati, O., is in conference with the authorities of this place regarding a sewerage and drainage system.

Chicopee, Mass.—The Selectmen of this place have decided to advertise for proposals for constructing about 2,000 feet of 24-inch sewer.

Amsterdam, N. Y.—Considerable sewer work is to be done at this place. Address the Sewer Commissioners for particulars.

Sewers.—See our Proposal Columns for information regarding the construction of sewers at the following places: Albany, N.Y.; Iron Mountain, Mich.; Davenport, Iowa; Key West, Fla.

BRIDGES AND IRON STRUCTURES.

For Additional Bridge Items see Proposal Columns

Fulton, Ill.—The Lyons and Fulton Bridge Company has been incorporated here to construct a bridge across the Mississippi River between the two points. Capital stock, $50,000. Incorporators, A. M. Hansen, S. W. Gardiner and others.

Troy, Ala.—A bridge is to be erected over Little Patsaliga River at this place. Address for particulars, J. B. Ewing, as above.

Chireno, Tex.—Reports say that a bridge is to be erected over the Atoyoc River at this place.

Roanoke, Va.—A communication from the Roanoke Gas and Water Company states that the contract for two bridges for the said company, across the Roanoke River, has been awarded to the American Bridge and Iron Co., of this city.

OSWEGO, N. Y.—Press dispatches of September 13, state that 40 bridges have been washed away by the floods in the eastern part of Oswego County.

RICHMOND, VA.—An exchange says: "The contract has been awarded to the Edge Moor Bridge Works, of Delaware, for building an iron and steel highway viaduct, 1,200 feet long and 40 feet wide and 75 feet high, connecting the properties of the Highland Park and Northside Land Companies with this place. The contract price is $74,000."

CARROLLTON, KY.—It now seems probable that the projected bridge over the Kentucky River, at this place, will be built. If established it will be built jointly by the Louisville, Covington and Cincinnati, the Carrollton and Louisville, and the Westport, Carrollton and Covington roads.

OCEANIC, N. J.—The Oceanic Bridge difficulty has at last been settled and the Board of Freeholders will proceed with the building of the structure.

WINONA, MINN.—The bill to erect a wagon bridge at this place has passed the Senate and will now become a law.

ROCKWOOD, TENN.—Reports say that the East Tennessee, Virginia and Georgia, and the Chattanooga Land, Coal, Iron and Railway Company are about to construct a $300,000 bridge at this place.

INDIANAPOLIS, IND.—The numerous railroads running through this city have decided to construct a viaduct across their tracks at a cost of $250,000. The matter is to be submitted to the City Council at its next regular meeting.

WASHINGTON, D. C.—The following bridge bills have passed the Senate: Senate bill to authorize the construction of a bridge across the Ocanee River in Georgia; House bill to authorize the Chicago, Henderson, Bowling Green and Chattanooga Railroad Company to construct a bridge over Green and Barren Rivers in Kentucky (with amendment); Senate bill to authorize the construction of a bridge across the Kentucky River and its tributaries; House bill to amend the act of July 16, 1889, authorizing the construction of a bridge across the Red River of the north.

NEW GRETNA, N. J.—The following bids for the erection of an iron bridge over the Mullica River were received by Charles A. Mathis, Chairman Board of Chosen Freeholders, September 15: Dean & Westbrook, New York City, low truss hemlock stringers and plank, $29,950; high truss hemlock stringers and plank, $31,900; low truss steel stringers and yellow pine plank, $32,200; high truss steel stringers and yellow pine plank, $33,875. Berlin Bridge Co., East Berlin, Conn., low truss steel stringers and yellow pine plank, $34,900; Groton Bridge Co., Groton, N. Y., $34,950; Pennsylvania Bridge Co., Beaver Falls, Pa., $35,390; New Jersey Steel and Iron Works, Trenton, N. J., $35,600; Pittsburg Bridge Co., Pittsburg, Pa., $37,300; King Bridge Co., Cleveland, O., no bond; Canton Wrought Iron Bridge Co., Canton, O., no bond; Wallis Iron Works, Jersey City, N. J., no plan.

WESTPORT, N. J.—The Bergen County Board of Freeholders has appropriated $3,500 for an iron bridge 60 feet long and 20 feet wide on the line of the highway.

WASHINGTON, D. C.—The Senate has just passed a bill authorizing the construction of a bridge across the Mississippi at Winona, Minn.

BRIDGES.—See our Proposal Columns for information regarding bridge construction at the following places; Reading, Pa.; Middlesborough, Ky.; San Antonio, Tex.

NEW DEPOTS.

PATERSON, N. J.—A new depot is to be erected at this place by the New York, Susquehanna and Western Railroad Company. Numerous car shops will also be erected.

GAS AND ELECTRIC LIGHTING.

INDEPENDENCE, MO.—The authorities of this place are about to ask for proposals from contractors for the public lighting of this city.

BIRMINGHAM, ALA. — The Consolidated Electric Light Company has been incorporated at this place, with a capital of $500,000. The incorporators are J. F. B. Jackson, R. M. Hulford and others.

TITUSVILLE, FLA.—It is proposed to establish an electric light plant at this place at an estimated expenditure of $10,000.

HULL, MASS.— The Nantasket Electric Light and Power Company has been organized for the purpose of establishing a lighting plant. A franchise for this city has been granted. Address Elisha Thayer for particulars.

BELLEVUE, KY.—An electric lighting plant is proposed for this place.

FALL RIVER, MASS.—Surveys are being made by Gilbert Hodges, C. E., of Boston, for an electric belt line road for this place.

FALL RIVER, MASS.—The Border City Manufacturing Co., of this place, will increase its electric light plant by 1,000 lights.

NEWARK, N. J.—The local gas companies will lay about four miles of additional gas mains this fall.

SPARTANBURG, S. C.—The local electric lighting plant is to undergo extensive improvements.

LUDLOW, VT.—The people of this place want electric lights.

JOLIET, ILL.—Articles of incorporation were filed September 5, for the Economy Light and Power Company, a consolidation of the Thomson-Houston and the Westinghouse Companies. Secretary, Treasurer and Manger, L. E. Ingalls, of this place.

SEATTLE, WASH.—The Heims Electric Light Co., has been incorporated at this place, composed of members of the Pacific Electric Light and the Commercial Electric Light Companies, E. C. Hilbourne, C. P. Stone and others. The capital stock is $500,000. It is intended to double the present plant in a short time and operate 105 arc and 3,700 incandescent lights, and spend $100,000 in improvements. Both light and power will be furnished.

MARTIN'S FERRY, W. VA.—Improvements are to be made to the local electric light plant.

PALMYRA, PA.—This place is to have an electric light plant.

OSCODA, MICH.—It is probable that the projected electric lighting plant for this place will be established at once.

PETERBORO, CAN.—At a recent Town Council meeting, a resolution was introduced to raise $11,000 to purchase a site for the works of the Edison General Electric Company.

RICHMOND, VA.—A resolution has been adopted asking the Council of this city to appropriate the sum of $75,000 to build an electric light plant.

CHICAGO, ILL.—The Burt Electric Light, Fuel and Power Company has been incorporated here, with a capital stock of $5,000,000, for the manufacture of incandescent dynamos, motors, etc. Martin C. Burt, Allen S. Bennett and J. L. Bennett, incorporators.

BERLIN, WIS.—The sum of $12,000 is to be expended on establishing an electric lighting plant for this place.

ELECTRIC RAILWAYS.—New electric railways are to be constructed and improvements are to be made to those already established at the following places: Cairo, Ill.; Sioux City, Iowa; Savannah, Ga.; Bloomington, Ill.; Chattanooga, Tenn.; Lancaster, Pa.

STREET-WORK AND PAVING.

MARION, N. C.—Street improvements to cost $10,000 are to be made at this place.

JOHNSON CITY, TENN.—The sum of $50,000 is to be expended for improving the streets at this place.

ALBANY, N. Y.—At a meeting of the Board of Contract and Apportionment, held September 15, the following proposals for street paving and sewers were opened: For the pavement of Allen Street with Trinidad asphalt from Central Avenue to Western Avenue: Barber Asphalt Company, asphalt per square yard, $3.10; curb per lineal foot, 80c.; circular curb per foot, 85c.; repairing asphalt at intersections, $1.90; filling per cubic yard, 35c.; excavation per cubic yard, 35c.; 15-foot sidewalks per foot, $1.85. Trinidad Asphalt Company, first item, $3.23; second, 95c.; third, 95c.; fourth, $1; fifth, 39c.; sixth, 23c.; seventh, $1.90. Contract awarded to the Barber Company. Sewer in Hawk Street, from Myrtle Avenue to the Beaver Creek sewer: John Doyle, 18-inch pipe, stone, per foot, $1.75; 12-inch iron pipe, $4.50; 6-inch vitrified, 75c.; 18-inch "Ys," $5; manholes, $60 each; lampholes, $95 each. Contract awarded to John Doyle.

WILMINGTON, DEL.— Considerable street paving is to be done at this place. Address the City Engineer for particulars.

WASHINGTON, D. C.—Considerable paving is to be done in this city at an early date. Address E. H. Tucker, of the Street Committee, for particulars.

BIDS OPENED.

WAUSAU, WIS.—The contract to build a court house in this city has been let to John Miller, of Wausau, at $48,500. Six Milwaukee contractors bid for the job.

SHELBYVILLE, IND.—The County Commissioners of Shelby County have opened bids for an orphan asylum to be erected at this place. The bidders: Louis F. Burton, of Indianapolis, $11,941; J. L. Fatout, Indianapolis, $11,944; St. John & Co. Shelbyville, $11,990; Wingate & Co., Shelbyville, $15,700; Victor & Co., Shelbyville, $13,339. All the bids were rejected as being too high. The commissioners do not want to exceed an expenditure of $10,000 in the erection of the building, and new bids will be received on that basis.

GOVERNMENT WORK.

PHILADELPHIA, PA.—The following bids for dredging in Philadelphia Harbor, Pa., for removal of Smith's and Windmill islands, were received by C. W. Raymond, Major of Engineers, U. S. Army, September 16: American Dredging Co., Philadelphia, $207,500; Frank C. Somers, Camden, N. J., $264,000; Penn Dredging Co., Philadelphia, $185,000, Baltimore Dredging Co., Baltimore, Md., $307,500.

GALVESTON, TEX.—The following proposals for the plumbing, etc., for the United States Custom House at this place were opened September 17, by the Supervising Architect of the Treasury Department: Crook, Horner & Co., Baltimore, Md., $8,839.20; May & Wammwright, Galveston, Tex., $10,900; Benjamin Whitney, Chicago, Ill., $9,423; Montgomery & Patterson, New York, $13,637; J. F. Dalton, Chicago, $9,236.55; V. E. Appleby, Galveston, $8,725; John Worthington, Philadelphia, Pa., $10,874.

INDUSTRIAL.

MADISON, ME.—The contract for the erection of the new mill for the Manufacturing Investment Company, of New York, has been let to the Berlin Iron Bridge Company, of East Berlin, Conn., whose designs were accepted. The building is to be of iron, 62 feet wide, 220 feet long, 4 stories high; the machine shop 72 by 172 feet, and the washing room 174 by 182 feet.

NICETOWN, PA. -The Midvale Steel Company have made a contract with the Berlin Iron Bridge Company, of East Berlin, Conn., for the erection of their new casting shop, 182 by 185 feet, with wings of 50 feet each. The building will have several 50-ton traveling cranes.

BUFFALO, N. Y.—The contract for the buildings of the Lake Erie Engineering Company at this place has been let to the Berlin Iron Bridge Company, of East Berlin, Conn. The buildings are to be of iron, and were designed by F. Felkel, civil engineer and architect, of Cleveland, O. The machine shop will be 180x185 feet, and the foundry buildings 185x225 feet.

WANTED.

TOO LATE FOR CLASSIFICATION.

CIVIL ENGINEER, EXPERIENCED IN SURveying, railroad work, sewers, etc., desires a position. Topographical and mechanical draughting a specialty. Address "B," 208 E 118th Street, New York.

DRAUGHTSMAN, WITH FOUR YEARS' EXperience, desires a permanent position in architect's office, with chance of advancement. Address SQUARE, Box 37, this office.

A YOUNG MAN WOULD LIKR POSITION as rodman. Five years' experience. Locality no object Can level. Address JOHN T. HYLAND, Jr., 112 Broadway, Sing Sing, N. Y.

WANTED.—A PLUMBER TO WORK ON lead or iron pipe; also two good boiler makers. Address W. J. BARNSTEAD, 20 West Main Street, Galesburg, Ill.

PROPOSALS.

Continued from page ii.)

PIPE AND RESERVOIR, Dallas City, Ore.—Proposals are wanted until October 8, for furnishing a quantity of wrought-iron pipe, special castings, etc., and for construction of a 3,000,000 gallon reservoir. Address M. T. Nolan, Secretary of the Board of Water Commissioners, as above.

PROPOSALS.

Notice to Paving Contractors.

PROPOSALS FOR MACADAMIZING SEVeral streets will be received by the Village of MT. VERNON, N. Y., up to September 30. Plans and specifications can be seen at office of Commissioner of Public Works, Mt. Vernon, N. Y.

JARED SANDFORD,
17 Village President.

SEWERS, Albany, N. Y.—Proposals are wanted until September 27, for the construction of sewers and drains at Watervliet Arsenal. Address Lieut.-Col. F. H. Parker, U. S. A., as above.

LIGHTING, Keokuk, Iowa.—Proposals are wanted until September 25, for lighting the public streets, etc., of this city for a period of five years. Address Rollin Clark, Clerk of Council, as above.

SEWERS, Davenport, Iowa.—Proposals are wanted until September 30, for the construction of certain sewers. Address Joe L. Hebert, City Clerk, as above.

WATER-WORKS, Fulton, Ky. — Proposals are wanted until October 1, for the construction of a system of water-works for this place. Address George Cadogan Morgan, C. E., No. 15 Major Street, Chicago.

BRIDGE, Middlesbrough, Ky. — Proposals are wanted until October 1, for the construction of an iron bridge. Address D. N. Mason, as above.

FLAGGING, New York City. — Proposals are wanted until September 25, for flagging numerous streets. Address the Department of Public Works, as above.

WATER-WORKS AND ELECTRIC LIGHT, Canton, S. Dak.—Proposals are wanted, no date specified, for furnishing a water-works and electric light system for this place. Address J. M. Zeller, Mayor, as above.

STREET RAILROAD, Cincinnati, O.—Proposals are wanted until October 2, for the construction of street railroad route No. 22, this city. Address Edwin Henderson, City Clerk, as above.

WATER-WORKS, Sutton, Neb.—Bids will be opened October 1, for a water-works system, apply to A. A. Richards, Engineer, Lincoln, Neb.

SEWERS, Dayton, O.—Sealed proposals will be received at City Commissioner's office, for constructing about 12 miles of pipe and brick sewer, according to plans on file in said office.

HEATING AND VENTILATING, Quincy, Ill.—Proposals are wanted until October 4, for the heating and ventilation of the new city hall building at this place. Address Harvey Chatten, architect, as above.

SCHOOL, Canton, O.—Proposals are wanted until October 15, for the erection of a brick school building. Address L. W. Radel, Clerk of the Board of Education, as above.

WATER-WORKS, Ellsworth, Kan.—Proposals are wanted until October 10, for the construction of a system of water-works. Address Chairman Board of Trustees, G. A. R., as above.

Building Intelligence.

NEW YORK.

Washington st, n w cor Little West 12th st, br factory; cost, $35,000; lessee, C F Wing; a, J M Farnsworth.

29 Catherine st, br flat; cost, $18,000; o, W Remsen; a, F T Camp.

137 Perry st, br and s flat; cost, cost, $20,000; o, W Bischof, Jr; a, M V B Ferdon.

S s 36th st, 233-3 e 8th av, 2 s flats; cost, $20,000 each; o, Cornett & Zimmerman; a, G F Pelham.

330–32 W 51st st, 2 br and s flats; cost, $35,000 each; o, W H Ramsey; a, G F Pelham.

S s 142d st, bet Amsterdam av and Hamilton pl, br and s flat; cost, $40,000; o and b, Mary E Stevens; a, H Van Benschoten.

N s 9th st, 200 w 3d av, br flat; cost, $18,000; o, Hachemister & Weummer; a, F Weummer.

N s 131st st, 60 w 5th av, 2 br flats; cost, $16,000 all; o, H S Wright; a, Cleverdon & Putzel.

S s 146th st, 20 e Amsterdam av, br stable; cost, $18,000; o, J Donnellon; a, H Van-Benschoten.

N s 128th st, s s 129th st, 125 e Lenox av, 6 br flats; cost, $132,000 all; o, P Hogan; a, A Spence.

205–7 e 23d st, br store; cost, $50,000; o, Irish & Miller; a, Schneider & Herter.

8 Dey st, br office bldg; cost, $100,000; o, Western Union Telegraph Co; a, H J Hardenburgh.

S e cor Chrystie and Hester sts, br school; cost, $250,000; o, City of New York; a, G W Debevoise.

E s Bainbridge av, 125 w Manhattan av, 2 fr dwells; cost, $10,000 all; o, A B Marshall and M Montag; a, A B Marshall.

BUILDING INTELLIGENCE.

NEW YORK.—Continued.

168 Elm st, br store; cost, $20,000; o, J R Anderson; a, Thorne & Wilson.

S s 116th st, 128 w Manhattan av, 3 br flats; cost, $60,000 all; o and a, T P Dunne.

N s 133d st, 225 e 7th av, br flat; cost, $18,000; o, L G Lever; a, M S Ungrich.

S e cor Railroad av and 150th st, fr dwell; cost, $10,800; o, E Callahan; a, Pfeiffer.

ALTERATIONS—NEW YORK.

195 Broadway, br office bldg; cost, $200,000; o, Western Union Telegraph Co; a, H J Hardenburg.

S s 108th st, 328 w 9th av, br storage bldg; cost, $12,000; o, Barnheimer & Schneid; a, not given.

BROOKLYN.

191 Court st, br store and ten; cost, $13,000; o, Owen McGreevy; a, S Hazzard; m, P Carlin & Son; c, not selected.

S s Atlantic av, 80 e Fountain av, br pumping house, boiler house and coal shed; cost, abt $140,000; o, City of Brooklyn; a, Parfield Bros; b, E Freel.

E s Central av, 24 s Putnam av, 8 fr stores and dwells; cost, $3,500 each; o, Mr Purgulo; b, not selected.

Central av, s e cor Cornelia st, and Central av, n e cor Putnam av, 2 fr stores and dwells; cost, $4,000 each; o and b, as above.

N s Harman st, 150 w Central av, 6 fr (br filled) tens; cost, $28,000 all; o, John Hahn; a, A Berckmeier; m, Mr Koch; c, not selected.

S s Atlantic av, 25 e Pennsylvania av, 2 br dwells; cost, $18,000 all; o, F E Pitkin; a, C Infanger.

N e cor Madison st and Lewis av, br dwells; cost, $10,000; o, P H Godfrey; a, J D Dwyer.

N s Ellery st, 225 w Marcy av, br engine house; cost, $10,500; o, City of Brooklyn.

S s E Parkway, 633 w Utica av, br dwell; cost, $14,500; o, C Williams; a, C P H Gilbert.

E s Oxford st, 102 e Park av, 3 br dwells; cost, $27,000 all; o, E Vielmann; a, J W Baily.

N e cor Jefferson av and Broadway, 4 br dwells; cost, $40,000 all; o, C M Moller; a, F Holmberg.

N s 7th st, 160 w 4th av, 7 br dwells; cost, $28,000 all; o, C E Collins; a, J G Glover.

47 Siegel st, fr dwell; cost, $8,000; o, M Rich; a, E Dennis.

N s Stagg st, 118 w Rogers st, 6 fr dwells; cost, $25,000 all; o, J Schneider; a, Th Engelhardt.

The Commission having charge of the erection of the new Thirteenth Regiment armory has adopted Architect Daus' plans, with certain modifications. Work on the new building will be begun shortly.

ALTERATIONS—BROOKLYN.

Henry st, n w cor Amity st, br extensions, interior alterations; cost, $20,000; o, L I College Hospital; a, W B Tubby; b, J Thatcher and L W Seaman, Jr.

MISCELLANEOUS.

ADAIR, IA.—Adair County has decided to build a $25,000 court house.

AUSTIN, TEX.—West wing St Edward's College; cost, $20,000; o, Rev P J Hurth, President; a, N J Clayton, Galveston;b, not let yet.

BOSTON, MASS.—776–784 Washington st, br mercantile bldg; cost, $75,000; o, R Sherburne; b, Richardson & Young.

786–790 Washington st, br alteration; cost, $9,000; o and b, same as above.

Wrentham st, 3 fr dwells; cost, $12,000, o, a and b, J I Stewart.

Westminster st, br aparts; cost, $14,000; o and b, Ira Bradley; a, S S Woodcock.

219 Shawmut av, br alteration; cost, $7,000; o, George H Jacobs; a, S D Kelly; b, J Murphy.

Dromey av, 2 fr dwells; cost, $8,000; o, Cath Drummey; b, W W Dromey.

Humboldt av cor Howland st, fr dwell; cost, $7,800; o, Walter R Meins; a, E I Wilson; b, H C Allen.

Walter st cor Peters st, 2 fr dwells; cost, $7,000; o, a and b, H D Van Norden.

536 Beacon st, br dwell; cost, $30,000; o, G Z Silsbee; a, W T Peters; b, C H Dodge.

BUILDING INTELLIGENCE.

BRIDGEPORT, CONN. — McMahon & Wren, merchants, have accepted plans drawn by a local architect for a new hotel, to be erected on what is known as the Sterling homestead, to cost $150,000.

Elmwood av, fr dwell; cost, $7,500; o, Thomas Boudren; a, H A Lambert; c, James Burnes; m, Thomas Young.

CHICAGO, ILL.—Clark and Oakdale, theater, halls and stores; cost, $200,000; o, The Pythion Temple Co; a, J J Kouhn; b, C B Williams.

1906 Wellington, br dwell; cost, $15,000; o, C W Lasher; a, A M F Colton.

1723–29 York, br dwell; cost, $16,000; o, Louis Willie; a and b, J L Woollacott.

1115 N Clark, br dwell; cost, $8,000; o, Edw M Landis; a, H C Hansen; b, Siebold & Alke.

4352 State, br store and flats; cost, $10,000; o, Jos Schilling; a, J F & J P Doerr; b, W Reinert.

66th and Sherman, br dwell and flats; cost, $40,000; o, McConley & Swartman; a, J Eighlien; b, C A Leke.

45th, Court and State, br flats; cost, $14,000; o, Albert Vingens; a, Bargerbush & Koster; b, Wm Reinert.

43d and Carpenter, br warehouse; cost, $19,000; o, Armour & Co.

47th and Throop, barns; cost, $16,000; o, W E Perrin.

4509 Grand boul, br dwell; cost, $14,000; o, M C Schroneman; a, Flanders & Zimmerman; b, A D Elmers.

5417 Jefferson av, br dwell; cost, $8,000; o, J Abrams; a, M L Beers; b, O Hero.

5609 Indiana av, br flats; cost, $11,000; o, M P Commings.

789–91 Blue Island av, br store and flats; cost, $10,000; o, Herman Beifuss; a and b, C W Karbach.

850–56 W Polk, br flats; cost, $13,000; o, J R Madison; a, J N Tallon; b, F Townsend.

1245 Washington boul, br dwell; cost, $11,000; o, Adam Kolb; a, C L Stiles; b, J D Edwards.

369–71 S Lincoln, br flats; cost, $9,000; o, M L Prismann; a, E Rockwell; b, L Sommers.

201 W Erie, br store and flats; cost, $16,000; o, B Henderson; a, R A Denell; b, Jno Olson & Son.

495 Lincoln, br flats; cost, $8,000; o, W Buras; a, Anton Chevat; b, F Uekola.

888–90 W Adams, br dwell; cost, $15,000; o, Isaac Hoffert; a, Edbrooke & Burnham; b, Jno O'Connell.

3100–08 Groveland av, apartment bldg; cost, $250,000; o, Howard & Berwin; a, Jno Duncan; b, M J Benson.

165–67 Morgan and 282–90 Jackson, br store and flats; cost, $60,000; o, Howard & Berwin; a, D S Pentecost; b, Alex McKadway.

3648 Wentworth av, br store and flats; cost, $8,000; o, Peter H Kaup; a, J F & J P Doerr; b, Bock & Krause.

Dearborn and Erie, additional story; cost, $8,000; o, Geo F Harden; a, L G Hallberg; b, N Hoffman.

4730 Evans av, br dwell; cost, $10,000; o and b, Custard & Logan; a, E C Hentz.

4030 Lake av, br dwell; cost, $28,000; o, A Strickland; a, A Gronner; b, W H Cameron.

Greenwood av and 45th, br dwell; cost, $10,000; o, Frank Hecker; a, Robt Rae, Jr; b, B G Robinson.

170-72 Oakwood boul, br flats; cost, $16,000; o, Smith & Jones; a, Thomas & Rapp; b, M McMillan.

4737-39 Lake av, br dwell and barn; cost, $12,000; o, H C Fisher; b, Bernritter Mfg Co.

77-9 W Ohio, br store and flats; cost, $8,000; o, Dennis Mitchell; a, Wm Ohlbober; b, P Schroeder.

Paulina and Augusta, hop room; cost, $12,000; o, West Side Brewing Co; a, F Hansen.

North av and Rockwell, br store and flats; cost, $11,000; o, Edw Michlieu; b, Fred Hansen.

899-903 31st, br school; cost, $16,000; o, P L Brielmann; a, J F & J P Doerr; b, Gulrich Bros.

BUILDING INTELLIGENCE.

CHICAGO, ILL.—Throop and Madison, colliseum; cost, $20,000; o, C H Wyman; a, J M Haskins; b, McGraw & Muller.

538 Washington bd, br dwell; cost, $11,000; o, M M Clark; a, S M Roudolph; b, McGraw & Mullin.

412-14 27th, br flats; cost, $9,000; o, Wendel & Pebbles; a, E B Eigendroth; b, R H Morgan.

4516 Champlain av, br dwell; cost, $9,000; o, M E Smith; a, A A Smith.

118 Lake Shore Drive, br dwell; cost, $45,000; o, Mrs B Armour; a, Barling & Whitehouse; b, Barry & Rodatz.

306 Sheffield av, br flats; cost, $8,000; o, Henry Ruder; a, A Woerner; b, C J Westpool.

1202-06 Milwaukee av, br store and flats; cost, $16,000; o, Fred Housen; a, Hy Kley; b, Housen & Widkie.

1648 W 12th, br store and flats; cost, $10,000; o, W A Fox; a, Hetherington & Ward; b, Krieg & Son.

254 buildings costing less than $7,000 each.

CINCINNATI, O.—John G Morris is having the plans made for a wire foundry, to be 6 stories, br, and cost $50,000, to be built at Canal and Vine sts.

Coleraine av and C H & D R R, 3½-story br dwell and store; cost, $7,000; o, John Bruckman; a, Wm Shroeder.

Central av, near Baymiller st, 2-story br addition to tannery; cost, $5,000; o, Wm C Kennett.

3-story br addition to *Enquirer* Printing office; cost, $11,000; o, *Enquirer* Co; a, S Hannaford's Sons.

563 Race st, 4-story br store and flats; cost, $11,000; o, Phillip Klopp; a, G & A Brink.

8th and Harriet sts, br boiler and engine room; cost, $7,000; o, Blymer Ice Machine Co; a, Brice & McMiller.

3 6-story br bldgs for rectifying and distilling purposes; cost, $40,000; o, Rheinstrom Bros; a, A O Elzner.

McMichen and Ohio avs, Phillipus Evangelical Protestant Church; cost, $35,000; c, Wm Miller.

Harrison and Western avs, 3-story br iron and brass foundry; cost, $40,000; o, Joseph Joseph; a, S Hannaford's Sons.

COLUMBUS, O.—Broad st, br and st business block; cost, $10,000; o, Jas T Zollinger.

37 dwellings costing $68,100.

DECATUR, ILL—A vote will be taken here on the question of building a $100,000 court house.

DENVER, COL.—Gaylord, bet Colfax and 16th av, br dwell; cost, $7,500; o, Doone Chamberlin; a, Burhandt & Vaughn.

13th av, cor Elizabeth, br dwell; cost, $11,000; o and a, S Benson.

Larimer, cor 24th st, br store; cost, $11,000; o, A Miller; a, J J Huddart.

Curtis, bet 20th and 21st, br addn; cost, $12,654; o, City of Denver; a, Building Inspector.

Broadway, bet 2d and 3d avs, br double dwell; cost, $10,000; o, Mrs Wm Daily; a, Varian & Sterne.

DETROIT, MICH.—Grand River av, bet 4th and 5th sts, block 3 3-story br stores and flats; cost, $25,000; o, Robt Bell; a, Harry J Rill.

Cor Woodward av and Montcalm st, block 5-story br stores and flats; cost, $25,000; o, Jas Burtenshaw.

N w cor Larned and Shelby sts, 8-story br business block; cost, $50,000; o, *Evening News* Ass'n.

Willis av, bet Antoine and Hastings sts, 2-story br res; cost, $8,000; o, Stephen Baldwin.

Calhoun st, bet Beaubien and Antonio sts, br church (enlarged and remodeled); cost, $8,000; o, Ebenezer African M E Society; a, Harry J Rill.

N w cor Champlain st and Meldrum av, 3-story block of 3 br stores and flats; cost, $8,000; o, Jas E McDonald; a, G W Myers.

ELKHART, IND.—The Elkhart *Review* will erect a building specially designed for the printing business.

BUILDING INTELLIGENCE.

FITCHBURG, MASS.—Cor Middle and 2d sts, 2-story br parochial school; cost, $15,000; o, St Bernard parish; b, John H Kirby.

GALESBURG, ILL.—Wm Wolf, architect, has prepared plans for a $10,000 residence for Thos McKnight.

GRAND RAPIDS, MICH.—Cor Fountain and Barclay sts, br and s church; cost, $20,000; o, First Reformed Society; a, Rush & Son; b, Vanden Boogert Bros.

HOLYOKE, MASS.—Maple st, br addition to block of tens; o, Mrs. J E Cragin; a, G P B Alderman.

MEADVILLE, PA.—Plumb Alley, 50 feet south of Walnut st, chapel for the Episcopalian Church; cost, $8,000; o, Episcopalian Society, Rev Israel has charge; a and b, W E Morrison.

MILWAUKEE, WIS.—N e cor Biddle and Market sts; business block; cost, $25,000; o, W T Jacobi; a, C F Kinger; b, Hamboldt & Froemming.

Teutoma and Center sts, business block; cost, $8,5000; o, F Brembach; a, H P Schnetzky; b, Kern Bros.

NEW YORK CITY.—The Board of Estimate and Apportionmeot has approved the plans for the extension of the Metropolitan Museum of Art submitted by General Di Cesnola.

BASSAIC CITY, VA.—Store and warehouse; cost, $10,000; o, Crall & Brien; a, J C Smith, Harrisburg, Pa; b, contract not let yet.

PALESTINE, TEX.—R C Church; cost, $25,000; o, Rev C M Thion; a, N J Clayton & Co; b, not let yet.

PEORIA, ILL.—The Free Methodist denomination has decided to build a large church here. Plans have not yet been drawn.

PROVIDENCE, R. I.—Stewart st and Warner's lane, 4-story br bldg; cost, $20,000; o, American Electrical Works; b, J W Briggs.

Sprague st, 2-story br observatory; o, Mechanical Fabric Co; b, Freeborn Johnson.

Dartmouth av, 2 fr tens; o, Mary E Price; b, Richard Hayward.

Cooke and Angell sts, fr dwell; o, H M Bron estate; a, Goulot & Angell; b, Chas H Swan.

Benefit st, alteration in fr dwell; o, Jenkins estate; a, Stone, Carpenter & Willson.

Prospect and Watermane sts, br and stone gymnasium; o, Brown University; a, same as above.

Olneyville st, fr schoolhouse; o, St Teresa Church; a, same as above.

SIOUX CITY, IA.—Cor Pearl and 9th sts, 2 double dwells; cost, $7,500; o, J A Magoun; a, G G Baldwin; b, Weinees & Nelson.

Cor 11th and Jones sts, fr dwell; cost, $10,000; o, T Galbraith; a, E Loft; b, C K Poor.

Cor Jackson and 20th sts, fr dwell; cost, $11,000; o, L E Skinner; a, J P Martin; b, Payette & Corneau.

SALT LAKE CITY:—West Temple st, 6-story hotel build; cost, $750,000; o, Syndicate; a, Adler & Sullivan; b, Elias Morris and H Probst.

WHEELING, W. VA. — Lantern factory; cost, $15,000; o, Company; a, C Hamilton; b, not let.

Rectory bldg, cost, $12,000; o, Mathews Church; a, E Franzheim; b, not let.

WORCESTER, MASS.—Cor of Chatham and High sts, br and s bldg; cost, $60,000; o, Young Women's Christian Ass'n; a, S C Earle; b, not let.

BUILDINGS.—There is nothing over $7,000 in value to report at the following places: Geneva, N. Y., Youngstown, O.; Charleston, S. C.; Newark, O.; Poughkeepsie, N. Y.; Allentown, Pa.; Pine Bluff, Ark.; Binghamton, N. Y.; Detroit, Mich.; Topeka, Kan.; Montclair, N. J.; Pottstown, Pa.; Dennison, O.; Pottsville, Pa.; Wilkesbarre, Pa.; Allegheny, Pa.; Dayton, O.

THE ENGINEERING & BUILDING RECORD

AND

THE SANITARY ENGINEER.

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THE CHEAPEST FORM OF LIGHT.

IN the ordinary means of artificial lighting there is evolved a great amount of energy in the form of heat, which is not applied to any useful purpose, and which, therefore, is said to be wasted. In common candle, lamp, and gas flames this waste ordinarily exceeds 99 per cent. of the total energy developed, and although less in the electric light, it is still very much the larger part. The problem, from an economic point of view, is how to produce light with the least amount of heat.

In nature this seems to be effected in certain living organisms, such as the glow-worm or the fire-fly, the light of which is not accompanied by a sensible development of heat; but until recently the quantity and quality of the heat which accompanies such light had not been measured or demonstrated. This has now been done by Prof. S. P. Langley, the Secretary of the Smithsonian Institution in Washington, and the paper in which he describes the results obtained is a very interesting and suggestive one. The measurements of the heat evolved were made by means of the bolometer, an exceedingly sensitive instrument devised several years ago by Professor Langley for the purpose of measuring the heat radiated to us by the stars. To give an idea of the sensitiveness of this instrument, and of the exceedingly small amount of heat radiated with the light of a tropical fire-fly, it is stated that "if that rate of radiation from a lamp-black surface one square centimeter in area, which represents the amount of heat necessary to raise one kilogramme of water 1° Cent. in one minute, be taken as a unity—*i. e.*, one calorie, then the luminous radiation of the fire-fly's heat per square centimeter of exposed luminous surface is about 0.0004 calorie in ten seconds. Of course only a small portion of this heat could reach the bolometer, and that which did fall on it in ten seconds would have raised the temperature of an ordinary mercurial thermometer, having a bulb one centimeter in diameter, less than one four-hundred-thousandth part of 1° Cent."

Yet even this small amount of heat received on the instrument consisted of two different kinds which must be separated — namely, the ordinary animal heat and that specially connected with the luminosity. This separation was accomplished. The result was to show that the insect light was accompanied by approximately one four-hundredth part of the heat ordinarily associated with the radiation of ordinary illuminating flames, or in other words, that nature produces the light of the fire-fly with only about one four-hundredth part of the cost of the energy which is expended in a candle flame giving the same light. Professor Langley concludes that there is no reason why we may not hope to yet discover a method of obtaining an enormously greater result than we now do from our present ordinary means of producing light.

NEW YORK'S NEW PAVEMENTS.

THE repaving of one of New York's principal streets—Broadway—was commenced this week and will, it is thought, be completed from the Battery to Chambers Street by the early part of November. Previous to the laying of the new pavement whatever changes and repairs may be necessary in the various pipe systems under the street surface are supposed to be made, and the underground work for the Broadway cable road is to be put in such shape that there need not be any subsequent disturbance of the street. This, at least, seems to be the good resolution which is popularly supposed to have been made, and Public Works Commissioner Gilroy is credited with having expressed himself to the effect that after the new pavement is down he will turn a deaf ear to all applications for permits to tear it up again, no matter how specious the pretext.

Every one will acknowledge that this is just as it should be, but the New York citizen has learned by sad experience that all such assurances must be accepted with a goodly share of allowance for what are very conveniently termed "unforeseen contingencies." It would be a fair spectacle indeed to have at least one of New York's down-town thoroughfares in an undisturbed condition for a period measureable by weeks or months, and Commissioner Gilroy will, no doubt, receive praise without stint if he will be able to restrain, as he proposes, the earth-burrowing corporations and others who have made themselves so uncomfortably prominent in the past.

Now that the work of repaving is just beginning, the application of a little foresight cannot be too strongly commended, and with reasonable care, and firm action of the authorities, New York ought soon to have a Broadway pavement which would be in creditable condition even after a few years' use.

UNWORTHY ATTACKS ON CITY ENGINEERS.

CITY ENGINEER RUNDLETT, of St. Paul, Minn., has recently been the victim of charges, given publicity in a local paper, such as all engineers holding similar positions are from time to time liable to.

There has of late been considerable sewer building in St. Paul. The City Engineer's specifications, as it was necessary they should do, required hard burned brick, and brick that would stand a certain test. To meet the requirements of these specifications it was necessary that brick should be purchased from brick yards elsewhere than in St. Paul, whereupon a manufacturer, in an interview published in a local paper, accused the City Engineer of being responsible for the practical destruction of the local brick industry, and the fact that certain contractors are now working for the city who once held positions under the City Engineer is cited as a case where favoritism is likely to occur.

After giving publicity to these charges, which are about on a par with those constantly made by disappointed contractors and manufacturers of something that they fail to succeed in selling to a public officer, the journal publishing them allows the City Engineer to say that his duty was to build a good sewer, and to use the required materials necessary to do it without regard to the locality from which they came. Moreover, he plainly pointed out that the brick used by builders in the city also came from other localities, so that, even to the average reader, there would seem to be the amplest justification for his statement that the St. Paul bricks were too soft for the city's purposes.

It is a melancholy fact that an engineer striving to serve his community is at any time liable to have the columns of a local paper open for just such attacks on his character and reputation, and that too many people are only too quick to jump at the conclusion that he can have no motive in making a decision regarding the choice of materials other than a mercenary or a corrupt one.

CABLE *VS.* ELECTRIC TRACTION.

IN a pamphlet on "The Return of Power in Electric and Cable Traction," prepared some months ago by A. Bryson, Jr., of New York, cable and the more commonly known overhead electric traction systems for street car work are compared, with the view to establishing, as nearly as possible, their relative positions in point of cost and efficiency. The pamphlet has been specially commended to our attention because of the reference to electric storage battery systems for street car propulsion made in our issue of August 9, 1890, and the tabulated statement there published, giving the costs of electric, cable and horse traction, as calculated for the Fourth Avenue street car line at New York, on which the storage battery system has been used for some time. The figures published were presumably determined for a known set of conditions, but were not given as correct and final measures of the values of the different systems considered. As a matter of fact it was intimated that they might be found to differ from those subsequently found in actual every-day work.

General comparisons can in no case be expected to give definite values, and in Mr. Bryson's pamphlet, therefore, the data submitted can be accepted only as general indications of possible wastes in the two methods of power transmission which he compares. What he has to say, however, is not the less interesting. We extract the following from the pamphlet:

Beranger, an engineer in the employ of the German Government, has estimated the return of energy in different systems of transmission as follows:

Dist. in Feet.	By Electricity.	By Cable.
1,640	68 per cent.	93 per cent.
3,280	66 " "	90 " "
16,400	60 " "	60 " "

In street railway traffic the power is not all transmitted to a given point, as in the above table, but is distributed all along the line; hence the comparative economical distance for cable as given above will be very much exceeded when street railway service is to be provided for. And it must be remembered that transmission of power only is considered exclusive of the loss in converting the electrical into mechanical energy by the motor.

Mr. Deprez, although a most ardent advocate of the high-voltage system of transmission, has realized only about 33 per cent. of the original energy at a small distance.

The loss in the dynamo is the next to be considered, and the following extract from Mr. J. T. Sprague's work on electricity will serve:

"The efficiency of a dynamo machine is often reckoned from its capacity as a converter of mechanical energy into electrical; that is, by the formula $C^2 \times R$. But the electric energy expended within the machine is as much waste as the mechanical friction. The true efficiency is represented by the ratio of the energy in the external circuit to the mechanical energy expended in driving. . . . If we call the horse-power employed in driving 100, then we shall generally have about 10 to 13 per cent. absorbed in friction and local currents, which would reduce the efficiency of the particular Burgen,* as stated above, to 63 per cent., while the various tests made at public trials show that this true efficiency, as developed in different machines, actually ranges down to 30 per cent. only. The efficiency is greatest in large machines and when the machine is used under the conditions for which it was designed."

Next as to the efficiency of motors. High velocity of rotation is a prime condition of efficiency, and to that end the moving parts should be as light as possible. Therefore, when running at their proper full speed they are doing their best and most economical work; but when starting, or running slowly as is so often the case when passing along crowded city streets, the conditions are most unfavorable and the expense increased.

Professors Ayrton and Perry (England) give the efficiency of various motors with which they experimented as follows:

Motor.	Weight in lbs.	Resistance.	Current.	Revs. per min.	H. P.	Efficiency.
Griscom	2.5	1.1	3.9	513	.00225	.0542
Gramme Armature, Sieman Field	30.8	.973	5.4	932	.0275	.296
Ayrton & Perry	37	.2	25.9	1,880	.215	.383
De Meritens	72	.850	10.6	660	.154	51
Siemens	519	. . . .	......	900	4.90	.746

---

* This is the machine which he previously experimented with and gives diagrams and calculations for, and which indicated a useful work of 73.5 per cent.

These figures do not relate to the cost of putting the energy into the motors. And yet some electricians claim 90 per cent. efficiency for their motors, while others, more modest, state 80 to be the figure. However, we will accept these figures and see what the result is, starting with the engine cylinders and ending at the gearing side of the motor. The friction loss of the engine we will assume to be 10 per cent., the horse-power in the cylinders as one. Then there will be delivered to the dynamo 90 per cent. For the dynamo we will allow 80 per cent., and it will then deliver to the conductor 80 per cent. of 90 per cent. — 72 per cent. Counting loss in transmission as only 25 per cent., which, as has been previously shown, is much less than disinterested experimenters place it, we shall have delivered to the motor 72 — 25 — 54 per cent.; and allowing 80 per cent. again for the motor, the resulting net return, to apply to driving the gearing on the car, will be 54 × .80 — 43.2 per cent of the original power in the engine cylinders. This will diminish as the work to be done increases and the motor approaches its maximum capacity, as for instance on grades, and it is exceedingly doubtful if any such returns have been practically realized.

The cost of power stations will be about the same for cable as for electricity; leaving the interest on street construction and price of fuel to determine the result, due consideration being given to dangers, possibility of breakdowns, grades, and climatic effects.

The cost of an electric street construction increases with the business for which it is proportioned, due to the varying size and weight of conductors, etc.; whereas the cable is the same whether light or heavy traffic is contemplated, varying only with the character of the street through which it passes.

The storage battery is not considered at all in this, though a correspondent, in a letter accompanying the pamphlet, takes exception to the figures published in our issue of August 9, pointing out that nobody knows what the depreciation and repairs in the storage battery system amount to; that no storage system has ever yet given better returns than direct transmission; that the cost of the special features of the storage battery car would, at a low estimate, be $24 40, as compared with $300 for the cost of equipping a cable car with grips and other fixtures; and that, as the sizes of the horse, electric and cable cars are not the same, the costs of the cars do not admit of reasonable comparison. As regards the last, it may be well to state that the storage battery cars on the Fourth Avenue line differ but little in size, if at all, from the ordinary horse-car used on that line, and that a large number of cable cars in some places, Philadelphia, for example, are of ordinary horse car proportions. From all this, therefore, there would seem to have been available a very good basis for reasonable comparison. However, it is not at all necessary for us to enter into these details. The point to which we wished to give prominence was that, taken altogether, the storage battery system for street car work could, as apparently shown by experience at New York, be operated safely, successfully, and profitably. That much being established, there was little else to say as to which of the several systems claiming public approval for city street service was most commendable. There could be but one choice.

THE A. L. HOLLEY MEMORIAL.

THE Committee of Arrangements connected with the erection of the memorial bust of Alexander L. Holley, in Washington Square, New York, are making elaborate arrangements for the unveiling ceremonies, which are to take place on October 4. The various societies interested in the affair will assemble at Chickering Hall at 2 P. M., when James E. Dredge, of London, editor of *Engineering*, will deliver an address. The American Institute of Mining Engineers and the American Society of Mechanical Engineers, the principal societies promoting the memorial, are to take part in the exercises, with their guests, the British Iron and Steel Institute, and the Verein Deutscher Eisenhuettenleute, of Germany.

After the exercises at the hall the procession will be formed and will march to Washington Square, where the statue will be presented by James C. Bayles to President Gallup, who will accept it on the part of the Park Department.

THE Expert Committee on the Brooklyn Bridge terminal facilities, composed of Samuel Spencer, President; Charles H. Buckholz, secretary, and Prof. George W. Plympton, have held preliminary meetings and organized. The plans submitted have been informally examined, and no others will be received, the date for their reception having expired on September 20. If any of those who have submitted plans desire to explain them, public hearings will be afforded. A report will be made at the November meeting of the trustees.

NOTES.

TORONTO, CAN., is reported to be suffering from a general breakdown of its water-works system.

THE officers and directors of the National Association of Builders met at the rooms of the Building Trades' Club, 20 East Twenty-first Street, New York, on the 22d inst., to make arrangements for the fifth annual convention of the organization, which will be held at New York on the second Tuesday in February.

CHIEF ENGINEER FTELEY of the new Aqueduct Commission, New York, has resolved to turn the water off from the big tunnel once more on October 1, so that a proper inspection may be made of the repairs on section 9, and if satisfactory, a consequent removal of the repair platform will be made. A leak has been discovered at shaft 24, but it is evidently of such modest dimensions that it can be fixed and the aqueduct placed in running order by October 15. There are now over 33 feet of water in the Central Park reservoirs, and water at the rate of 600,000,000 gallons daily is flowing to waste at the Croton dam.

AN English correspondent writes to the effect that electric lighting has just been adopted in a little village in the neighborhood of Nimes, which possesses only 465 inhabitants. Motive power is afforded by a water-fall. The dynamo is capable of a total supply of 1,600 candle power. The streets are lighted by 25 lamps of 16 candle power each.

AFTER hearing an argument on the subject by Erastus Wiman, the House Committee on Commerce, according to a Washington despatch, this week, ordered a favorable report to be made on Representative Covert's bill to authorize the construction of a tunnel under the waters of the bay of New York, between Middletown and New Utrecht, by the New Jersey and Staten Island Junction Railroad Company. The railroad tracks through the tunnel are to be open to all railroad companies desiring to use them, for a reasonable compensation.

OBITUARY.

ROBERT DUNBAR died in Buffalo on the 17th inst., aged 77 years. He was proprietor of the Eagle Iron Works, and was the father of the present system of grain elevators. His invention and improvement in elevators are known all over the world. He built most of those in Buffalo, also designing elevators at Liverpool and Hull, England, and Odessa, Russia, besides New York and other points in this country and Canada.

ARTHUR J. STACE, Professor of Civil Engineering at Notre Dame University, Indiana, died September 25. Professor Stace was born in Sussex, England, in 1838. He had been connected with the University of Notre Dame since 1860, and was one of the Commissioners to the Paris Exposition of 1889.

THE funeral of James Gallatin took place on the 19th inst. at his summer home in East Hampton, L. I., where he died suddenly of heart disease last week.

PERSONAL.

WILLIAM B. BURSON was recently appointed City Engineer of Streator, Ill.

M. R. SHERRED, civil engineer, of Troy, N. Y., has been appointed Assistant City Engineer of Peoria, Ill.

WILLIAM P. ROUNDS was recently appointed City Engineer and Superintendent of the Water-Works of La Salle, Ill., and Oliver Smith, formerly of Flint, Mich., one of his assistants.

MR. E. SHERMAN GOULD, leaves New York to-day, for Havana, Cuba, with a force of American workmen, to complete the Vento Water-Works, for the contractors, Messrs. Runkle, Smith & Co., 15 Wall Street.

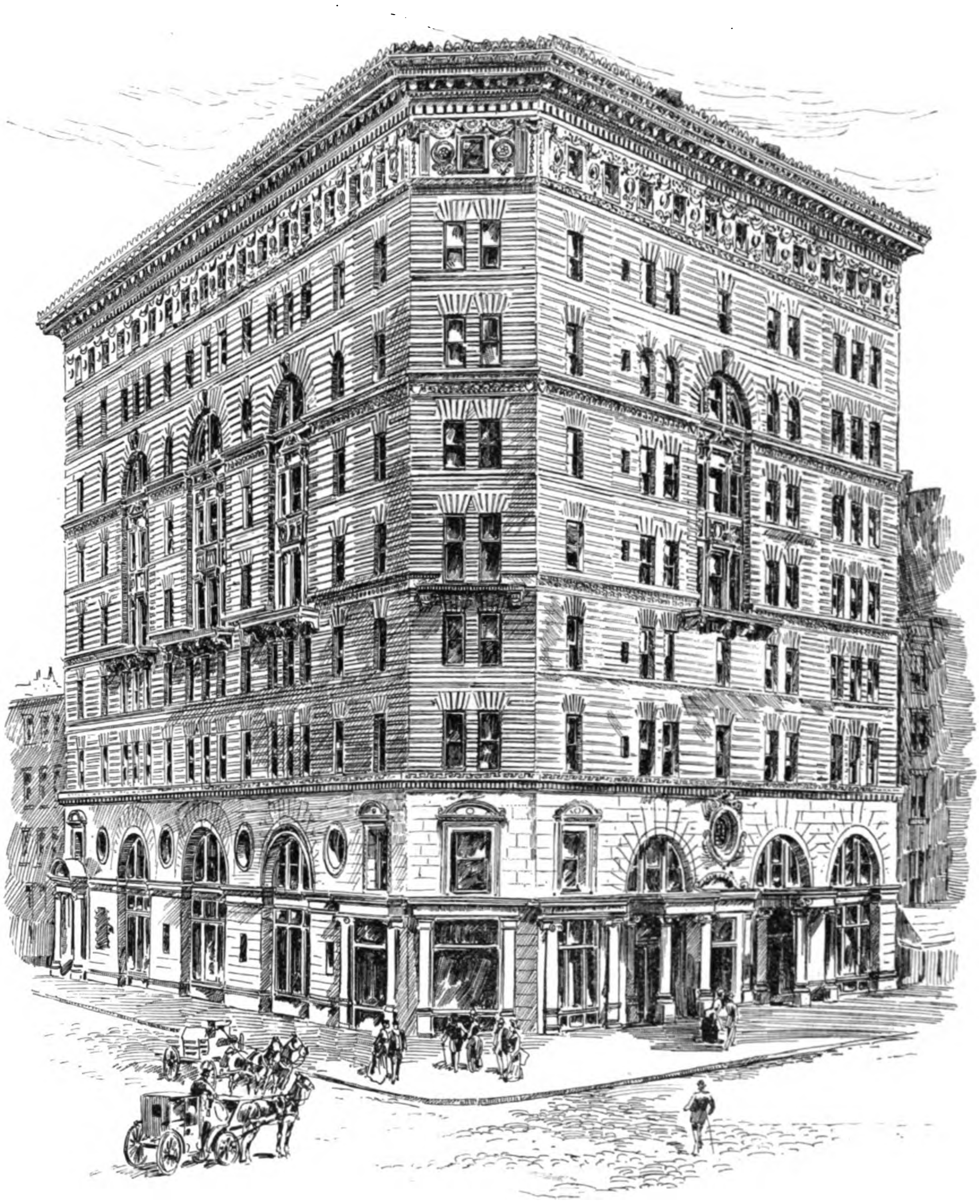
ANGELO MYERS sent his resignation as a trustee of the Brooklyn Bridge, New York, to the Mayor's office on the 20th inst. Mr. Myers is a brother of Comptroller Myers, and it is said that he finds the duties of bridge trustee decidedly irksome. One cause assigned for Mr. Myer's resignation is that he is not in accord with the majority of the trustees as to the management of the bridge.

OUR ARCHITECTURAL ILLUSTRATIONS.

HOTEL IMPERIAL, NEW YORK.

MCKIM, MEAD & WHITE, ARCHITECTS, NEW YORK.

CANDELABRA AND FIRE-DOG FROM THE SOUTH KENSINGTON, MUSEUM, LONDON, ENGLAND.



THE ENGINEERING AND BUILDING RECORD ILLUSTRATED SERIES.

HOTEL IMPERIAL, THIRTY-SECOND STREET AND BROADWAY, NEW YORK.

McKIM, MEAD & WHITE, ARCHITECTS, NEW YORK.

NEW YORK, VOLUME XXII.

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MEETINGS OF ENGINEERING SOCIETIES.

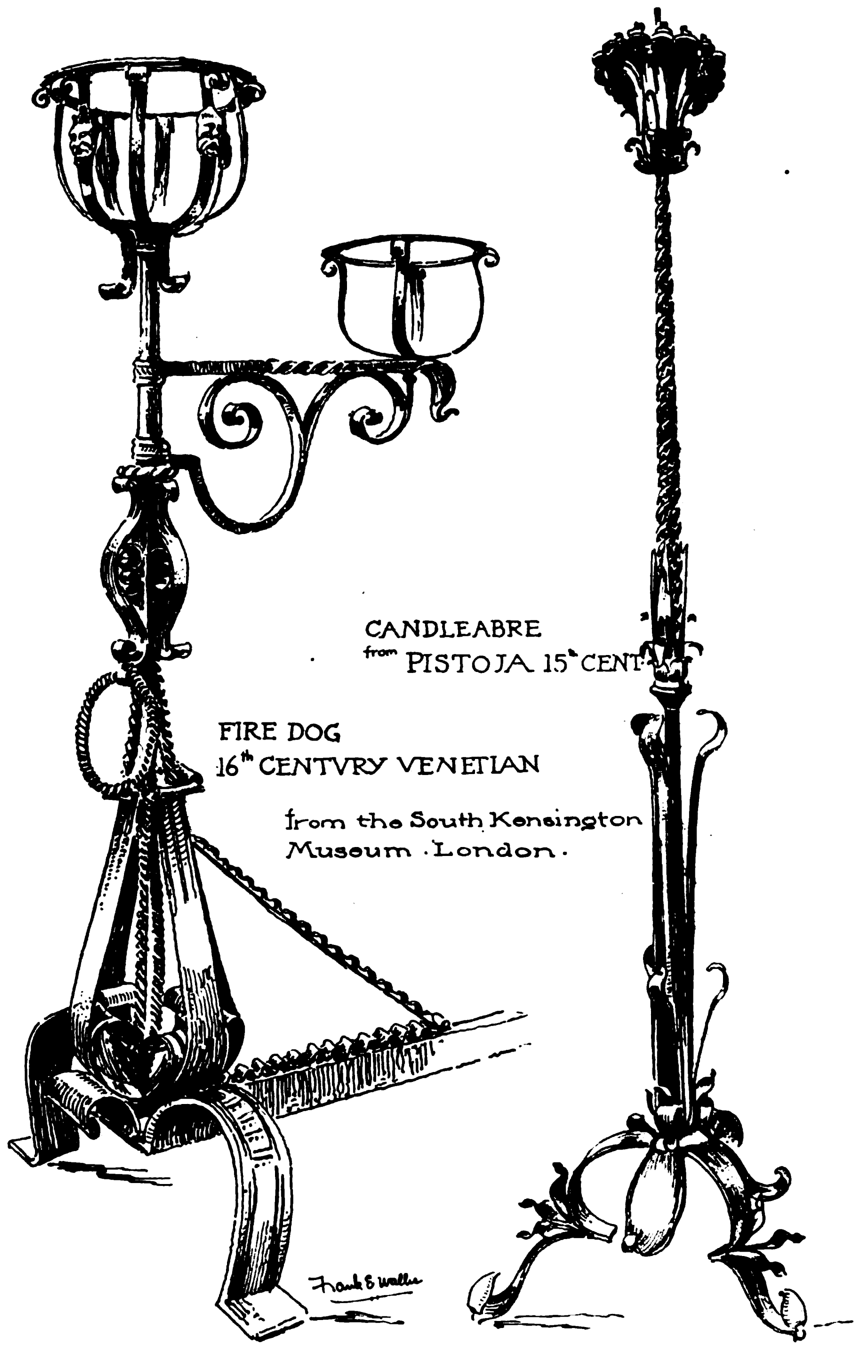
THE fifty-seventh meeting of the AMERICAN INSTITUTE OF MINING ENGINEERS will begin in New York City on Monday, September 29, 1890, at 2 P. M. All sessions will be held in Chickering Hall, 130 Fifth Avenue.

The AMERICAN SOCIETY OF CIVIL ENGINEERS holds its regular meetings on the first and third Wednesday in each month, at the House of the Society, 127 East Twenty-third Street, New York.

The BOSTON SOCIETY OF CIVIL ENGINEERS holds its regular meetings at the American House, Boston, at 7.30 P. M., on the third Wednesday in each month.

The WESTERN SOCIETY OF ENGINEERS holds its regular meetings at its hall, No. 67 Washington Street, Chicago, at 7.30 P. M., on the first Wednesday in each month.

The ENGINEERS' CLUB OF ST. LOUIS holds regular meetings in the club's room, Laclede Building, corner Fourth and Olive Streets, St. Louis, on the first and third Wednesdays in each month.



CANDELABRA AND FIRE-DOG FROM THE SOUTH KENSINGTON MUSEUM, LONDON.

The ENGINEERS' CLUB OF PHILADELPHIA holds regular meetings at the House of the Club, 1122 Girard Street, Philadelphia.

The ENGINEERS' SOCIETY OF WESTERN PENNSYLVANIA holds regular meetings on the third Tuesday in each month, at 7.30 P. M., at its rooms in the Penn Building, Pittsburg, Pa.

The ENGINEERS' CLUB OF CINCINNATI holds its regular meetings at 8 P. M. on the third Thursday of each month at the Club rooms, No. 24 West Fourth Street, Cincinnati.

The CIVIL ENGINEERS' CLUB OF CLEVELAND holds regular meetings on the second Tuesday of each month, at 8 P. M., in the Case Library Building, Cleveland. Semi-monthly meetings are held on the fourth Tuesday of the month.

The ENGINEERS' CLUB OF KANSAS CITY meets in Room 200, Baird Building, Kansas City, Mo., on the second Monday in each month.

The ENGINEERING ASSOCIATION OF THE SOUTHWEST holds regular meetings on the second Thursday evening of each month at 8 o'clock, at the Association headquarters, Nos. 63 and 64 Baxter Court, Nashville, Tenn.

The CIVIL ENGINEERS' SOCIETY OF ST. PAUL meets at St. Paul, Minn., on the first Monday in each month.

The MONTANA SOCIETY OF CIVIL ENGINEERS meets at Helena, Mont., at 7.30 P. M., on the third Saturday in each month.

The CIVIL ENGINEERS' ASSOCIATION OF KANSAS holds regular meetings on the first Wednesday in each month at Wichita, Kan.

The NEW ENGLAND WATER WORKS ASSOCIATION holds quarterly meetings in Boston at Young's Hotel.

The convention of the American Institute of Architects will be held in Washington, D. C., beginning on October 22, and continuing until the business has been completed. Papers on art, construction and kindred topics are solicited from the members. The titles of such papers should be forwarded to the committee of Arrangements by October 8, so they can be arranged for in the Order of Proceedings

THE NICARAGUA CANAL.

Telegraphic despatches received from San Juan del Norte (Greytown) announce the arrival there of the towing steamer "G. W. Jones" with the powerful steam dredge "Jules Dingler," which is one of the three largest dredges used on the Panama Canal, and has a record of excavating 237,000 cubic meters per month. The steamer also brought a large cargo of tools, machinery and supplies, which, with the dredge, is the first delivery on account of the important purchase made by the Nicaragua Canal Construction Company of the Slavin dredging plant. A large number of lighters and other property of great value are on their way from Colon, and the steamer "River Mersey" left that port yesterday with another of the large dredges, the "City of Paris," in tow, and another cargo of tools, machinery and supplies.

Satisfactory progress in railroad construction and other engineering work is also reported. The Medical Officer reports an excellent condition of health and entire freedom from epidemic and febrile diseases.

SKY SIGNS IN ENGLAND.

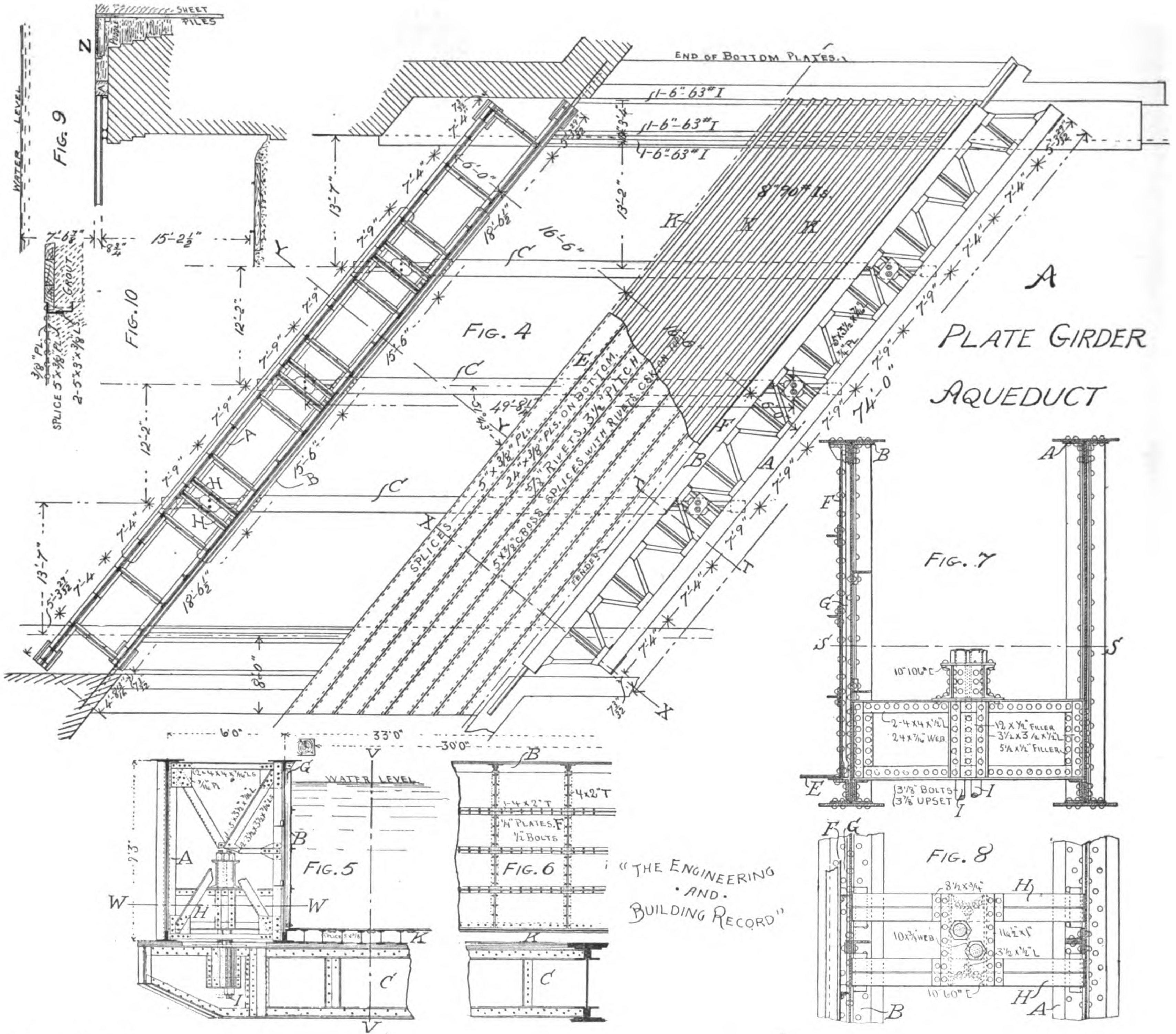
A LONDON correspondent writes that the question of sky signs is creating a great deal of discussion on the part of the public. The objections are so loud that a firm of provision merchants, Messrs. Hudson, who have recently erected a handsome building on Ludgate Hill, surmounting it by one of these sky signs at a cost of some £200, yielding to the pressure of public opinion, as enunciated in *The Times*, are taking down their sign after it has only been erected some fortnight to three weeks. The objection in the present instance arises from the fact that the sign is forced upon the vision of any individual standing at the foot of Fleet Street or Ludgate Hill who is looking up towards St. Paul's Cathedral. These signs, which are of patent construction, consist of a series of horizontal and perpendicular tubing of light construction properly stayed to the roof of the house. This frame work carries on the under side of its top cross member the series of large letters advertising the firm and its business. It is proposed to bring the matter under the notice of Parliament, with a view to obtaining legislation restricting the use of these large signs. The objectors take the ground that the height of buildings is restricted by legislation, and that legislation is called for and justifiable, inasmuch as the public has a right to uninterrupted study of the firmament.

A PLATE GIRDER AQUEDUCT.

The aqueduct illustrated herewith was built by the Pennsylvania Railroad Company to replace an old structure carrying the Delaware and Raritan Canal over two of its tracks at Trenton, N. J. In the new structure the length was increased to permit the laying of four tracks.

The original tunnel Fig. 1, was rather small for a train and engine. It was also a low spot in the grade and could not be properly drained. This tunnel was remodeled in 1876, when the arches were torn down to a point some 6 or 7 feet below the crown and the pier and abutments dressed off to give a width of 12 feet for each track, and a roof of beams and plate iron was substituted for the arches, Fig. 2.

In the two first structures the canal held its full width of 80 feet at water level, and the embankments were carried across the tracks, supported by the stone arches in the first case, and by the iron beams in the second.



To build the third and fourth tracks at this point, it became necessary either to make two more openings like those already described or to make a radical change of plan and dispense entirely with the intermediate piers. It was decided to adopt the latter course, and the present aqueduct, Fig. 3, is the result. The work was closely limited at almost all points, so that the solution of the problem was a little troublesome, but the aqueduct has been in service several months and is giving entire satisfaction. The leakage is very slight, the iron work being almost perfectly tight. There are two or three damp places on the masonry, but not enough water comes through to give any trouble.

The work of tearing out the old aqueduct was begun during the second week of December, 1889, and the new aqueduct was opened for traffic March 28, 1890. In this time the old abutments, containing over 3,000 cubic yards of masonry, were torn down, the excavation for the new abutments made, and about 2,500 cubic yards of new masonry built and the iron work put in place and riveted up. In addition to this a large amount of filling and puddling, etc., had to be done for the canal before the water could be turned into the level.

Figure 4 is a general plan of the aqueduct, the left side of it being shown in section at W W, Fig. 5, and a portion of the floor plates E being removed on the right side to show the floor joist, K K, etc.

Figure 5 is a vertical section of Y Y, Fig. 4.

Figure 6 is a section and elevation at V V, Fig. 5.

Figure 7 is an enlarged section and elevation at T T, Fig. 4.

Figure 8 is a horizontal section and plan at S S, Fig. 7.

Figure 9 is a section through the abutment and shows the connection between the aqueduct and the earth banks of the canal.

A, Fig. 9, is a brick wall, and Fig. 10 is an enlarged view of the detail at Z, Fig. 9.

Figure 11 is an outside elevation of the girder B.

Figure 12 is an elevation of the girder A.

Figure 13 shows a partial plan and elevation of floor beam C.

Figures 14 and 15 are sections at R R and Q Q, respectively, Fig. 13. The inside girders B B have lining plates F, Figs. 7 and 8, between which and their webs is a space G, filled with asphalt. The bottom plates E, and side plates F, are also thoroughly coated with asphalt on their wetted sides. The floor beams C C, etc., are suspended at each end by the hangers I I from the girders H H, etc., that distribute the load equally between the main girders A and B.

The total weight of iron in the aqueduct is 434,000 pounds. The four main girders weigh 153,000 pounds, and the cross girders weigh 25,200 pounds each.

The iron work was designed by William A. Pratt, Assistant Engineer Pennsylvania Railroad Company, and built by Cofrode and Saylor at their Pottstown shops.

The Pike's Peak rack railroad will probably be completed to the summit late this autumn.

FERROID, A NEW ARTIFICIAL STONE.

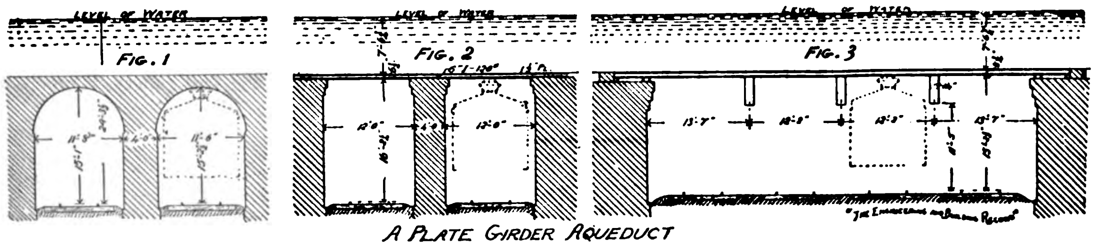
Ferroid, a new artificial stone, is made the subject of an interesting paper read a short time ago before the Civil Engineers' Club of Cleveland, by Herman Poole, and reprinted in the *Journal* of the Association of Engineering Societies.

Ferroid, as its name suggests, is like iron—in color, expansion and many other properties, and contains proportions of that metal varying from 25 to 33 per cent. It is a compound, partly chemical and partly mechanical, of the elements iron, sulphur and silicon, with more or less foreign matters; and from the union of these elements a material is obtained having some properties of each of its constituents, besides others possessed by neither.

It is mainly a super-saturated solution of iron in the sulphur, with the silica acting as a binder and hardener,

UTILIZING THE WATER POWER OF THE RHONE.

Colonel Turrettini, who has for many years been in the service of the municipality of Geneva, after having directed the works of the St. Gotthard Tunnel, has published a very interesting account of what has been done under his superintendence for the purpose of utilizing the waters of the Rhône, as they flow out of the Lake of Geneva, for motive power. According to the London *Times*, he begins by pointing out that it was not until 1708 that Geneva, which in the Roman period had an aqueduct that brought down water from the Savoy Mountains, was provided with a hydraulic motor for pumping up the water from the Rhone. A fresh machine was provided about half a century ago, while in 1880, these two being found insufficient, a steam pumping engine was found necessary. Preliminary investigations had already been made with the view of utilising the waters of the Rhône for motive power, and a company was formed for the purpose, but it was thought best that the work should be undertaken by the municipality itself, and in the autumn of 1882 the grand council granted it a concession. But before utilising the motive power of the Rhône it was necessary to regulate the level of the lake, and the authorities of Geneva determined to take this opportunity of settling a long-standing dispute as to the level of their lake. In the summer the waters rise high enough to incommode very much the occupiers of land upon the shore of the canton of Vaud, and the inhabitants of that canton have for more than a century asserted that the people of Geneva prevent the water of the lake running freely off because they obstruct the Rhône, while the argument of Geneva has been that the people of Vaud have only their own encroachments on the lake to thank for any damage they may have sustained. But, after a lengthy negotiation, the governing bodies of the two cantons came to an understanding, the cost of the works necessary to remedy the state of things complained of being put at about $460,000, a third of which was assumed by the Confederation, while the rest was paid by the cantons concerned. The works now completed have had the effect of regulating the depth of the lake and minimising the possibility of its overflowing its bank. The city of Geneva holds, therefore, the key of the lake, and the agreement come to between the cantons has already borne such good fruit that the Vaudais have not since had any reason to complain.



A PLATE GIRDER AQUEDUCT

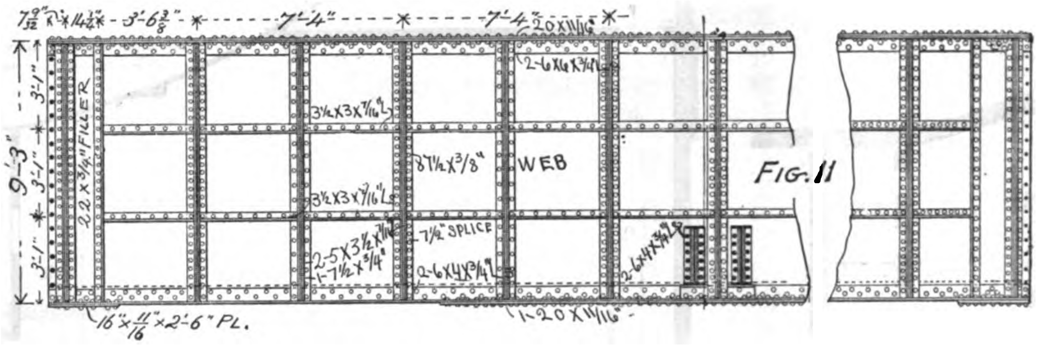


FIG. 11

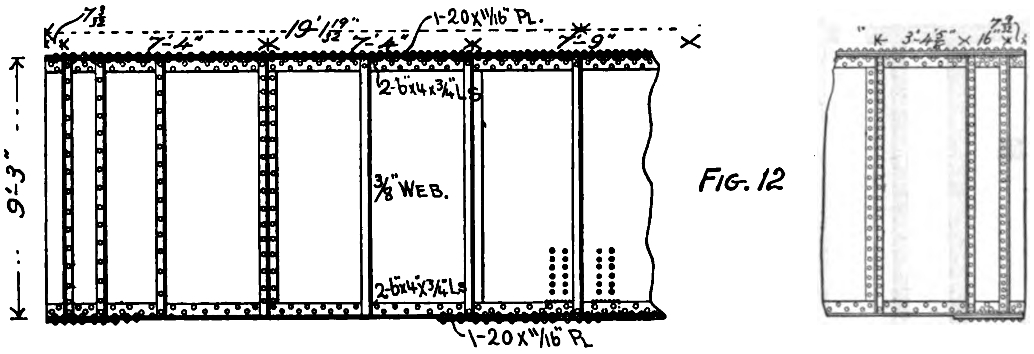


FIG. 12

A PLATE GIRDER AQUEDUCT

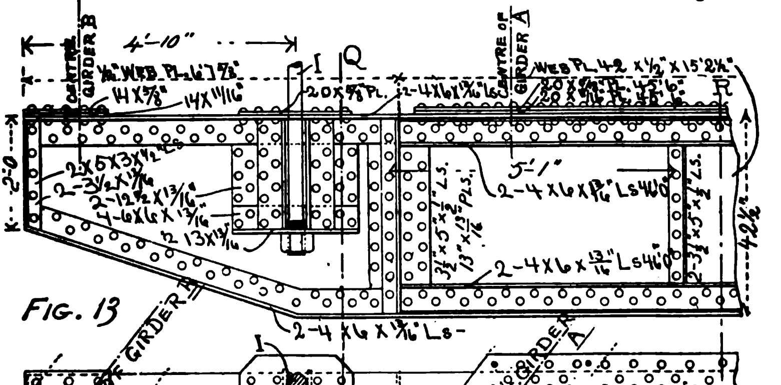


FIG. 13

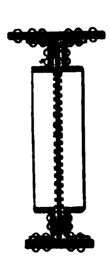


FIG. 14

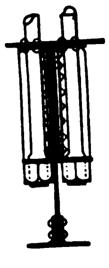


FIG. 15

"The Engineering and Building Record"

It was not until September, 1883, that Colonel Turrettini laid his plans for the works to be executed in the Rhône itself before the municipality. The Rhône, as it passes through Geneva, is divided into two by an island covered with buildings, and Colonel Turrettini proposed that the right arm of the river should be reserved for running off the water, while the left arm, transformed into an industrial canal, was to conduct the water into a building to be constructed in the bed of the river, and in which would be placed, as they were required, twenty turbines with 4,400 net horse-power. The whole of this work is now done, except that only half the turbines are in use. The method of distributing the motive power gave rise to a good deal of discussion, but as Geneva does not possess any large manufactories, for which transmission by cable is suitable, the system of transmission by water under pressure was adopted, and the municipality decided to make two canalizations, one with low and the other with high pressure, the latter with an ascending force of 460 feet. The execution of the work was confided to a contractor, who agreed, in the event of the cost being below his estimate, to divide the profit with the municipality, while if the estimate was exceeded he was to lose his time, the municipality only defraying the actual expense incurred for labor, etc. The result was a saving of between $75,000 and $80,000. The enterprise was a very considerable one, for it was necessary to completely empty the two channels of the Rhône in succession. This was done in order to deepen the bed of the river, and give it a gentle slope from the mouth of the lake to the turbines. Opportunity was taken to construct upon the banks of the stream large sewers which run along the two banks of the lake and of the Rhône for a distance of more than three miles. These sewers, which cost about $480,000, empty into the Rhône some distance below the town, and thus prevent the water which is used by the inhabitants from being contaminated.

Several other works were also undertaken at the same time, including the dredging of the port, the reconstructing of a bridge over the Rhône, and the formation of a weir in the right channel of the river; while, in order to regulate the high pressure, it was necessary to form upon a hill about 2½ miles from the town a reservoir capable of holding 2,000,000 gallons of water. The practical result of the works has gone far beyond what the promoters anticipated, for at the end of last year there were 216 industrial motors, rated at 1,565 horse-power. All kinds of trade and industry make use of the water-power. The demands for power vary considerably, the minimum being a third of a horse-power, and the maximum up to the present 625 horse-power for an electric light company. The total cost of the work has been about $1,420,000, of which about $1,000,000 has been for the account of the municipality, while the gross return upon the sale of water in 1887 reached $115,000, or 150 per cent. more than it was nine years before. After deducting all the cost of maintenance, staff, interest, and paying off the capital invested, this leaves a clear profit of $27,500. The demands for more motive power are steadily increasing, and it is anticipated that in a few years' time all the turbines will be in use and that the municipality will have to fall back upon the reserves, which consist of an island some way down the Rhône, where a fresh motive force of 7,000 horse-power could easily be obtained and be transmitted to Geneva by electricity, the loss by waste en route being calculated at about 2,000 horse-power. But this would leave a margin of 5,000 for actual use, so that there is no fear of the supply running short, while the return upon the capital invested makes the enterprise a very profitable one for the municipality.

SEWER SPECIFICATIONS.

From the recent specifications of the city of Oakland Cal., for contracts to build about 3,600 feet of 2½ to 4 foot brick and concrete sewer, and about 4,300 feet of salt glazed vitrified pipe sewers and conduits, we make the subjoined extracts. For a copy of the specifications we are indebted to City Engineer T. W. Morgan.

All lumber that may be used in securing a foundation shall be black heart redwood.

Where the ground at bottom of sewer is firm and solid, clay, gravel, or hard pan, it will suffice to build the sewer upon. Where the ground is soft and yielding, or is of marsh mud, the soft material must be excavated to hard bottom and the cavity filled up to bottom of sewer with concrete, one part best Portland cement, three parts sand, six parts clean, hard, broken rock. In case this soft material is over 10 feet deep, then the sewer shall rest upon a pile and lumber foundation, piles not less than 10 inches in diameter at butt inside of the bark.

All excavation to be made in open trenches, batter not to exceed one-half inch to the foot.

All brick to be hard, well burned, well shaped, clear and ringing. Brick to be sprinkled, laid in cement mortar composed of one part fresh Portland cement, thoroughly *mixed dry* with two parts of clean, sharp sand before adding water. No mortar mixed over one hour to be used. Inside and outside of brickwork to be plastered with one to one cement mortar, inside smooth finished.

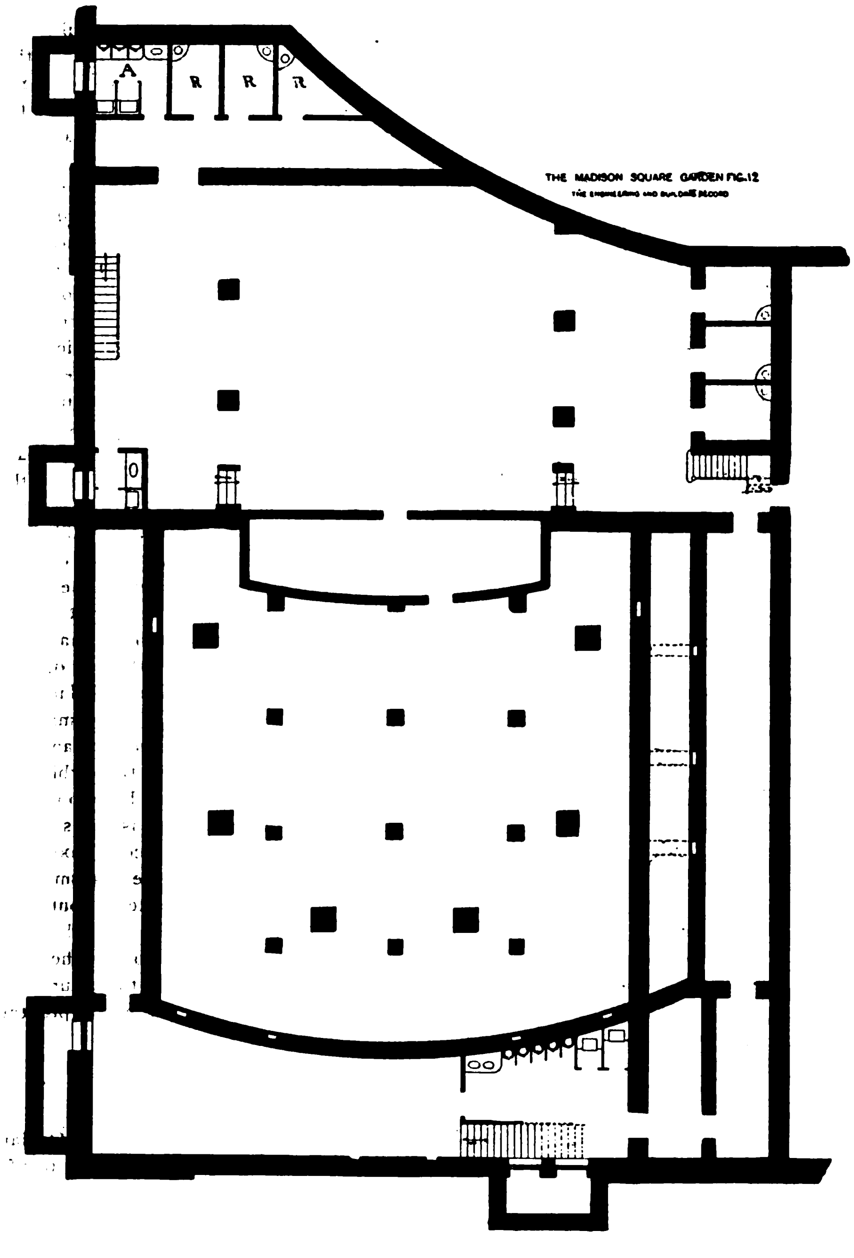
The concrete portions of sewer to be composed as follows: 1 part best fresh Portland cement, 2 parts clean, sharp sand, 4½ parts hard, clean, sharp, crushed rock. Sand and cement mixed dry three times turned, rock sprinkled as mixed, or the concrete may be mixed by latest improved concrete mixers. Concrete placed in layers of 6 inches, and well tamped.

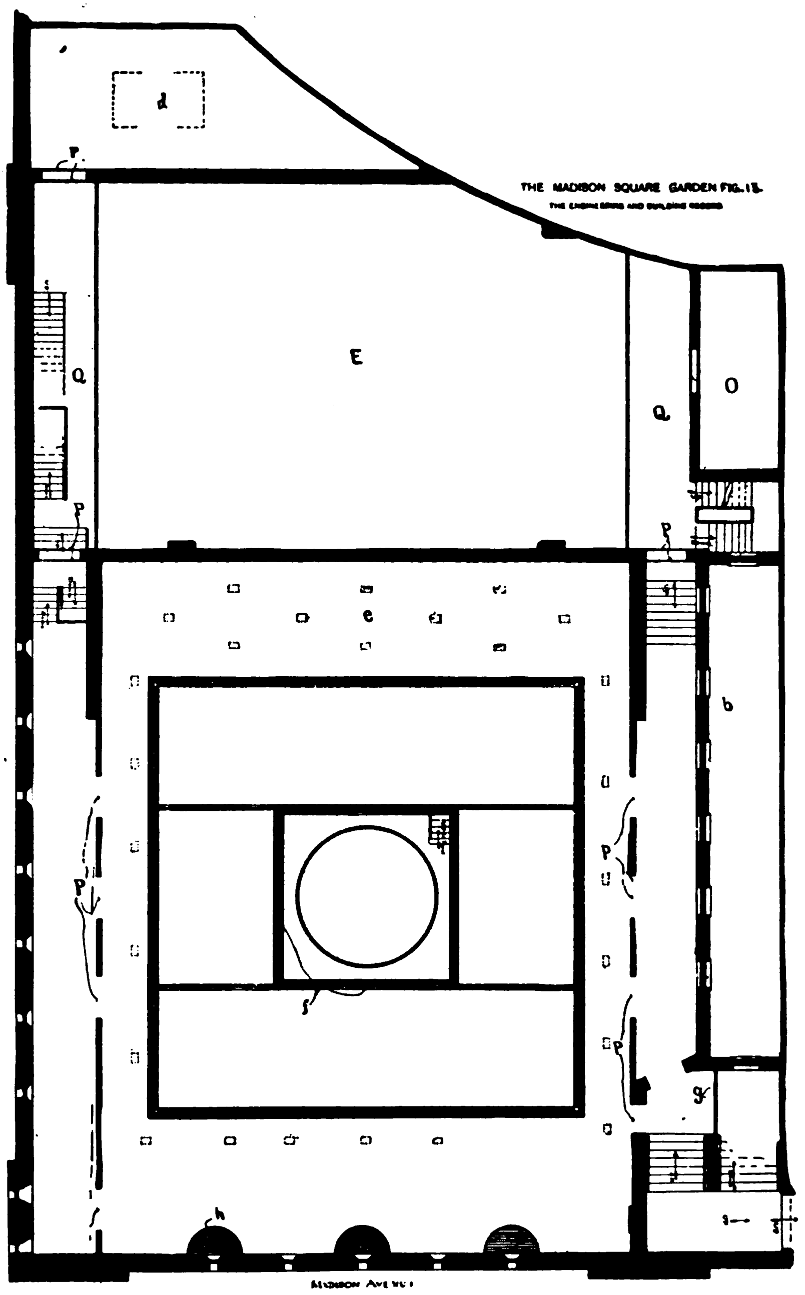
In laying have bottom of pipe with full bearing on grade of ditch, bottom of ditch being cut out for each flange. Cement mortar placed in collar to bed spigot end for lower quarter of pipe, so that the bottom inside of pipe is flush, the joint around collar to be thoroughly filled with cement mortar, joint at end of collar covered at least one inch with mortar.

After a pipe is cemented it must have fine dirt filled and tamped thoroughly to half-way up the pipe before the next joint is put in.

All pipe sewer and conduits to have inside of joints cleared of projecting cement and rubbish by dragging along by a rope through the pipes, as they are laid, a sack stuffed with straw, fitting the pipe.

In filling trenches over sewer the earth is to be tamped in layers of six inches from the middle of the pipe to one foot above the pipe. The balance of trench may be filled in layers of one foot each to be well tamped, or by settling with water; provided, however, that the cement has had 24 hours to set before any settling is done by water.


THE MADISON SQUARE GARDEN FIG.12
THE ENGINEERING AND BUILDING RECORD
A
R
R
R
O


THE MADISON SQUARE GARDEN FIG.13
THE ENGINEERING AND BUILDING RECORD
d
P
E
Q
Q
O
P
P
e
b
P
P
f
g
h
MADISON AVENUE

THE ERYGMATOSCOPE.

THE Paris *Genie Civil* describes an instrument called the erygmatoscope, designed by M. G. Trouvé, for the examination of geological strata pierced by deep boring. The apparatus consists simply of a powerful electric incandescent lamp, inclosed in a cylindrical case, one of whose curved sides serves as a reflector, and the other, made of thick glass, permits the illumination of the bore hole. An elliptical mirror, set at an inclination of 45 degrees in the bottom of the case throws its images vertically upwards through the open top of the case to the observer who examines them with a powerful telescope. It is said that the apparatus works satisfactorily to a depth of 1,000 feet, and that the Portuguese Government has supplied it to its expedition that is exploring the shores of Mozambique.

A CONCRETE BRIDGE.

AT the freight station of Matzleinsdorf the Vienna Bureau of Works for Southern Austria has built an arch bridge of concrete to test the suitability of the Monier system (*i. e.*, the use of supplementary iron lattice bars) for the reconstruction of its numerous viaducts.

The arch rests on piers, is 32.8 feet span, 3.28 feet rise, 6 inches thick at the springing line and 8 inches at the key. The concrete, of Portland cement and Danube sand, 1 to 3, was rammed in layers, each 1½ inches thick.

The lattice work was buried in the concrete, and consisted of round bars ¼-inch and $\frac{11}{16}$-inch in diameter, laid 21½ inches apart, respectively, parallel and transverse to the axis of the arch, the latter extending in one length from abutment to abutment.

Fourteen days after the arch was finished the centering was removed. It was ballasted and a track of 31½-inch gauge was laid on it. Forty days later, after the temperature had fallen to eight degrees, the bridge was tested by groups of laborers and loaded cars, which carried 6,600 and 13,200 pounds on their two axles. A tender with three axles, each loaded with 20,300 pounds, and another with three axles loaded with 28,700 and 22,700 pounds, was also placed on the bridge, and the records made. Observations were made at nine points, three on each of three lines through the soffit parallel to the axis, one at the key and one half-way to the abutment each side. The maximum deflection was $\frac{1}{32}$-inch.

The *Revue Universelle des Mines et de la Metallurgie*, from which the above is taken, considers the results to justify the use of this construction.

THE Paris *Semaine des Constructeurs* announces the offer of three prizes of 15,000, 7,000 and 3,000 francs for the best designs of a palace for the Roumanian "chamber of deputies." The competition is open to the architects of all nations who should send their designs before November 15, 1890, to the Roumanian Legation at Bucharest.

THE MADISON SQUARE GARDEN.

PART III.—FOUNDATION PLAN AND FIRST FLOOR, AND FIRST AND SECOND GALLERIES OF THE THEATER AND THE ROOF OVER THE THEATER.*

FIGURE 12 is a plan of the foundation walls under the theater, and shows basement rooms intended for heating apparatus, machinery, storage, etc. A is an actor's toilet-room, and R R R are dressing-rooms

Figure 14 shows a general plan of the theater, O is a property-room; Y, the green-room; E, the stage; *a*, the orchestra; Z Z, ticket-offices; T T, etc., boxes; B, ladies' toilet-room; K K, lobbies; *b*, open court; W, lobby; *c*, manager's office.

Figure 15 is the second gallery of the theater; O is the property-room; P P, etc., are iron doors; Q Q are the fly galleries; R R are dressing-rooms; T T, boxes; S is the stair well; B is a ladies' toilet-room; V, loggia; U, fire-escape.

Figure 16 is a plan of the first gallery, E representing the stage; R R, dressing rooms; W W are staircases and gallery; T T, boxes; U U, fire-escapes; and X, smoking-room. Figure 13 is a plan of the roof over the theater. In this *d* is the carpenter's shop; P P, etc., are iron doors; Q Q, fly galleries; O, property-room; *f*, ventilation openings; *g*, rail; *h h*, etc., iron gratings; K K, etc., copper frames.

(TO BE CONTINUED.)

PROF. SYLVANUS THOMPSON claims that William Sturgeon was the inventor of the electro-magnet. He was born at Whittington, in Lancanshire, England, in 1783.

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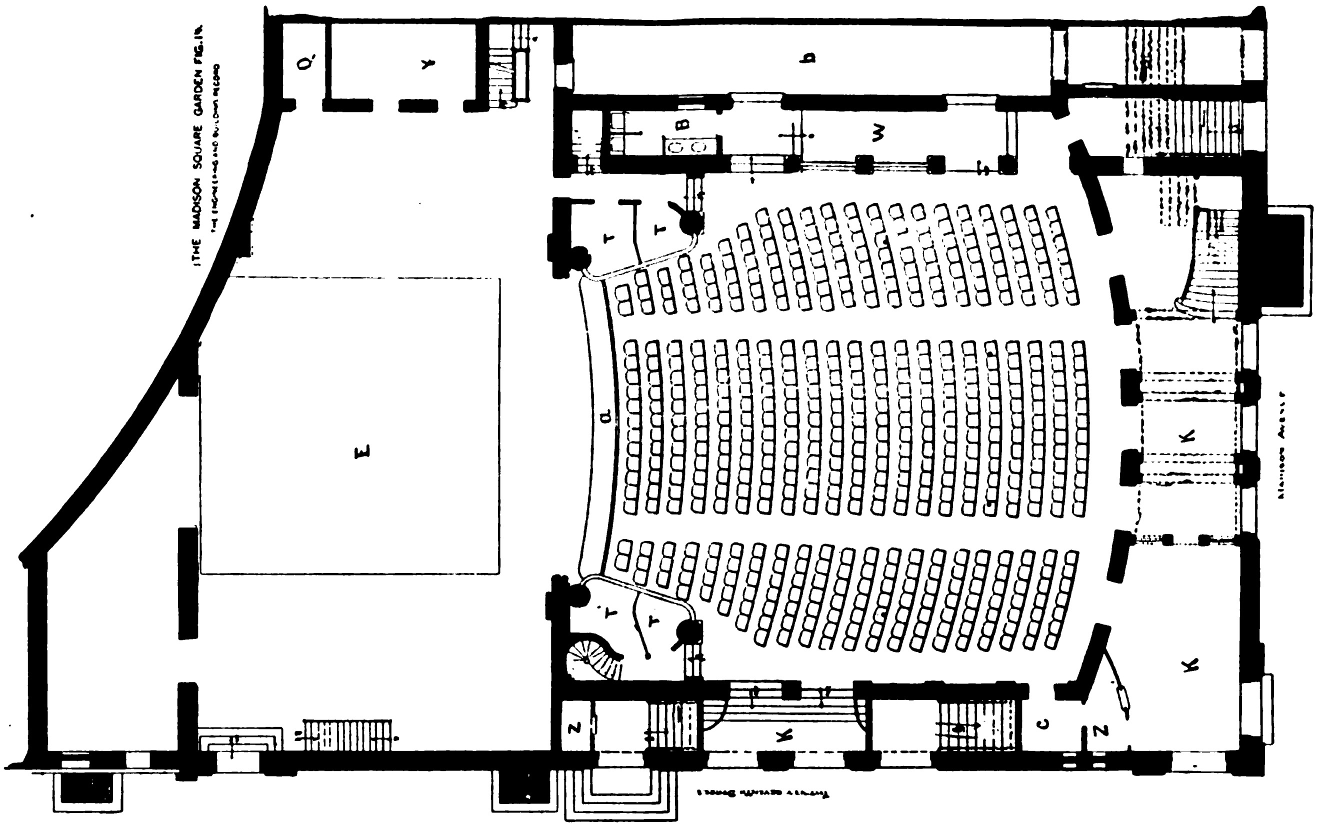
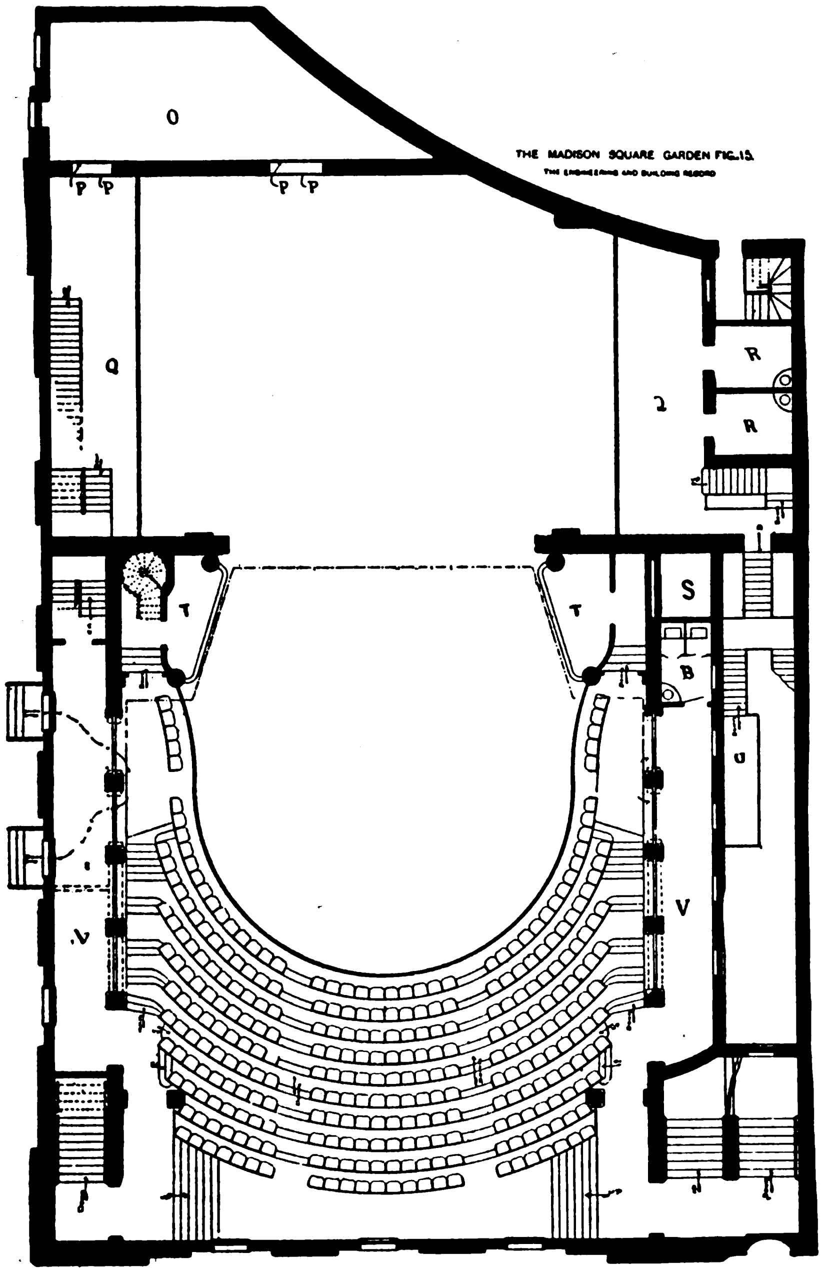
* Part I.—General Description and Perspective, Front and Side Elevations, Longitudinal and Transverse General Sections, General Plan and Plan of Roof Garden was published August 30.

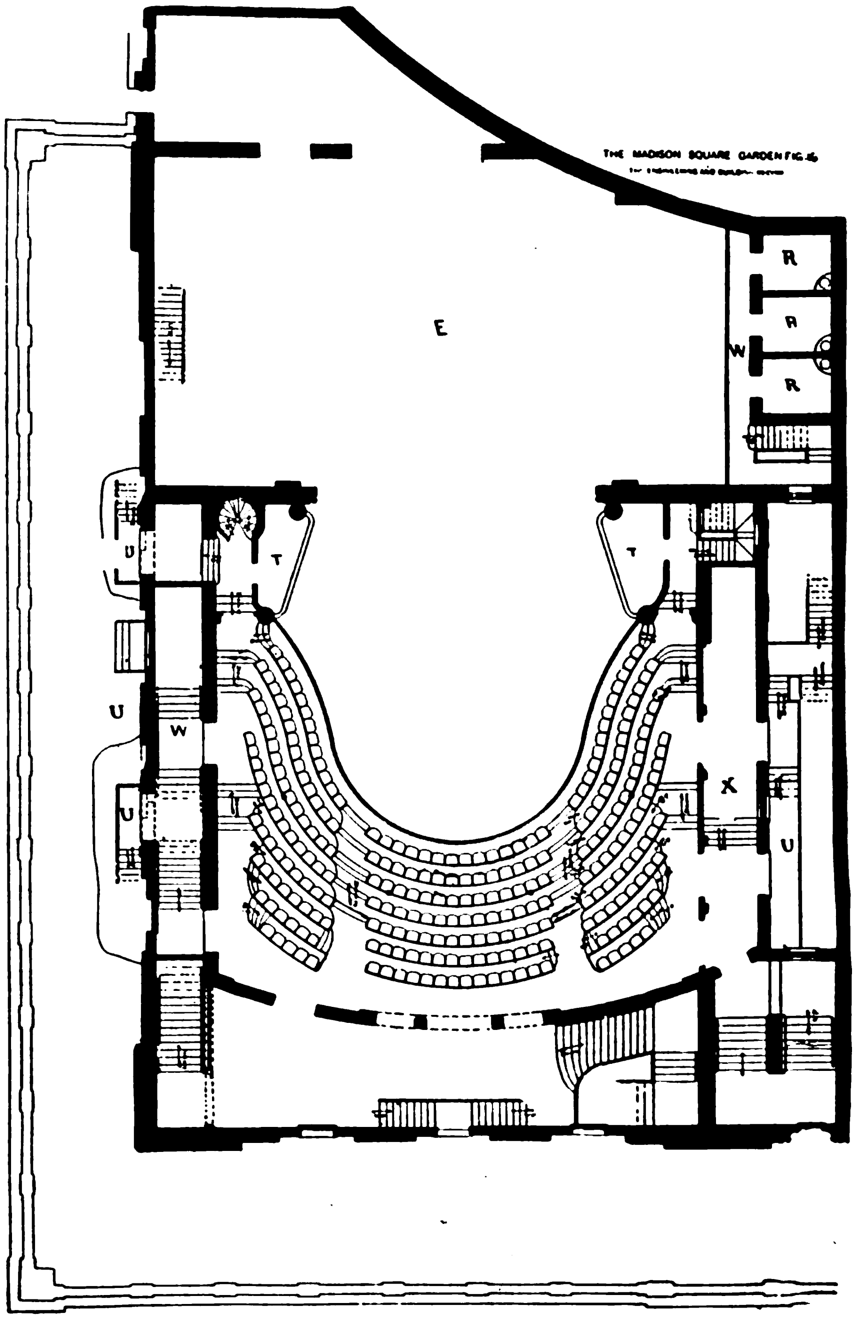
Part II.—Basement Horse Stalls, Arena and Auditorium of Amphitheater, Restaurant, Ball-room, and Concert Hall, Gallery and Foyer was published September 20.



THE MADISON SQUARE GARDEN FIG. 14
THE ENGINEERING AND BUILDING RECORD



THE MADISON SQUARE GARDEN FIG. 15
THE ENGINEERING AND BUILDING RECORD



THE MADISON SQUARE GARDEN FIG. 16
THE ENGINEERING AND BUILDING RECORD

PRESERVATION OF TIMBER.

AN interesting summary of recorded facts on timber preservation has been given by H. W. Reed, roadmaster of the Savannah, Florida and Western Railroad, as a report of the Roadmaster's Committee on the subject.

Mr. Reed states that there are four situations which require different properties in the preservatives used. These situations are:

1. Submersion in water, and subject in sea water to attack of the teredo navalis and other sea worms.
2. Exposure to alternate moisture and dryness.
3. Exposure to the atmosphere only.
4. Situated so as to be exposed to transverse strains.

Of the many preservative agents employed those of value may be resolved into several classes, viz.:

1. Those derived from the distillation at high temperature of vegetable tars, albuminous and oily substances.
2. Those having a mineral acid as a base.
3. Any modification or combination of the two foregoing classes.

Under the first head we have creosote, as the only known preservative capable of resisting for an indefinite time the attacks of the teredo and destruction of atmospheric germs and of leaving the structure of the timber in its normal condition and strength. Thus creosoting is the only process known that successfully meets *all* the requirements of a wood preservative, only one element, the expense, militating against it.

There is some question relative to the comparative value of coal tar creosote. The committee have been unable to learn of any experiments with it of sufficient duration to demonstrate its comparative value. But they are of the opinion that by observing the same rules in the use of the products obtained by distillation at high temperature we will arrive at about the same results as in the use of dead oil. If such proves to be the case we can expect to purchase creosote oil at much less that the present rate of one cent per pound.

Under the second head are the processes of: Kyanizing, treatment with corrosive sublimate; Burnettizing, the use of the chloride of zinc; Boucherie, the use of sulphate of copper.

The patents on these materials as applied to preserving timber have long since expired, thus we are at liberty to use any of them without royalty, provided we do not infringe upon various patented methods of their application.

With the salt at 50 cents per pound, the cost of Kyanizing is estimated at from 25 cents to 32 cents per tie. This process has been recommended for timber entirely protected from moisture (other than atmospheric moisture), but owing to the fact that corrosive sublimate is partially volatile at ordinary temperatures, is readily liquefied and is a deadly poison, invariably injuring the workmen engaged in preparing it, and that it is said to render the timber brittle, it is generally considered objectionable as a preservative for ordinary use.

Next in point of age is Burnettizing. Chloride of zinc, when used in large quantities as a solution, over three per cent. strong injures the elasticity and strength of wood seriously. The usual strength is 1.91 to 2 per cent. Another objection is that chloride of zinc is easily soluble in water, and therefore it is manifestly unfit for bridge timber; applied to cross-ties it serves a better purpose, as in that situation it has no transverse strain to resist, and is not readily washed out, but an objection occurs even here, as the ties are liable to crack and split under the rays of the sun.

The cost of this system is from 15 to 25 cents per tie. A report of a committee to the American Society of Civil Engineers, June, 1885, recommends Burnettizing as the best method for preserving cross-ties.

The Boucherie process, with sulphate of copper, has been tried extensively both in this country and in Europe. This process is a failure as against the teredo or other sea worms, and renders the wood very brittle, but as a protection to timber exposed to the atmosphere it seems to have been successful in a few cases and a particular failure in others.

Under the third heading is mentioned a modification of the Burnettizing process, which was patented by Mr. Wellhouse, and has since been extensively employed at several places, notably on the A. T. & S. F. R. R. This process consists, first, of an application of chloride of zinc with a little glue added, followed by a solution of tannin, "which it is claimed forms upon coming in contact with the glue small pellicles or films of insoluble artificial leather, which plug up the mouths of the sap ducts so as to prevent the zinc from washing out." This process has been employed only since 1879, and its merits are yet to be demonstrated.

While the committee find that creosoting is the most perfect, it is at the same time the most expensive method of timber preservation, and consequently it becomes desirable to form such a combination as will cheapen the process without decreasing the efficiency. This, it is believed, may be done for cross-ties by employing chloride of zinc (Burnettizing), which readily seeks the center or heart of timber, and does not readily return to the surface again, as the first material to be injected, and next to inject creosote as an outer covering or protection. By this means we obtain a valuable result at minimum cost. The creosote will overcome the tendency of the sulphate of zinc to wash out or volatilize, and will also neutralize the tendency of the timber to surface crack, as when the zinc alone is used, while the zinc will thoroughly protect the interior of the timber. Just how much the cost of creosoting can be reduced by this process only actual experiment can determine. It has been shown that Burnettized timber rots first on the outside, and creosote timber begins to decay on the inside. Thus the combination should be more perfect than either one alone.

Another process known as "Vulcanizing" has been recently introduced, and large claims are made for it.

In all works on the subject it is insisted that open grained or sappy, or thoroughly seasoned timber alone should be used, for the reason that such timber absorbs the preservative solution after the sap is partially removed by seasoning.

Many processes of applying preservative agents have been resorted to, from the ordinary paint brush through the various stages of steeping, vital suction and application by hydraulic pressure, to the more perfect means of exhaust and pressure within a closed iron cylinder. This latter method excludes sulphate of copper and corrosive sublimate, which have a deleterious effect on iron. Thus Kyanizing has to be carried on by the steeping process, the timber being placed in vats or tanks, thus rendering this process very tedious. Chloride of zinc and creosote may be applied in a closed cylinder successfully.

Another method of treating timber is by charring it within closed iron cylinders; this process is patented, and is yet on trial. It seems to possess merits of coagulating the albumen rapidly and of placing another exterior barrier against destructive action, as it is well known that charring the outside of timber without the aid of other treatment will materially increase its life. This method, however, is not recommended, as the steaming process seems to possess all the merits of simplicity and efficiency.

THE EFFECT OF FREEZING UPON IMPURITIES CONTAINED IN WATER.

REGARDING the effect of freezing upon impurities in water the Massachusetts Board of Health has published experiments, as stated by *Public Health*, with 76 samples of water and 336 samples of ice from 58 localities In ice from polluted sources compared with water from the same, the experiments showed: (1) That in the ice the color and salt had been removed. (2) That all but 13 per cent. of the other impurities of the water, as shown by chemical analysis, had been removed. (3) The number of bacteria in the cubic centimeter were: For snow (one sample), 1,246; for clear ice (part of the same cake as above), 6; for clear ice from an unpolluted source, 0. (4) The average of 12 samples from the most polluted sources, 138. The number of bacteria varied much in different parts of the same cake.

From the examinations which have been made, it appears probable that when ice first forms in the surface of a pond or river, a considerable part of the impurity in the water near the surface is entangled in the first inch or less in depth, and that the ice which forms below this first inch contains but a very small percentage of the impurities of the water. If snow falls upon the thin ice, causing it to sink, so that the water from below saturates the snow, it will freeze without purification; or if rain falls upon the snow and freezes, the ice thus formed contains the impurities of the snow and of the rain water, and of whatever else may have settled out of the air. The method often pursued, of flooding the ice of a pond or river by cutting holes through it, gives a layer of ice as impure as the water of which it is formed.

The purifying effect of freezing is greater upon substances in solution than upon those in suspension. This is confirmed by the fact that a large part of the organic matter, one-half or three-quarters, and sometimes more than is found in good ice, is of particles in suspension, and is readily removed by filter paper.

From the average of all the water and ice used for ice supplies, which they have examined, they find: The organic impurities of snow ice (the sum of the ammonias) = 69 per cent. of the impurities of the water. The organic impurities of all the ice (except snow ice) = 12 per cent. of the impurities of the water. The organic impurities of clear ice = 6 per cent. of the impurities of the water. The color of waters was removed by freezing. The salt of the waters was nearly removed by freezing.

Of bacteria there were 81 per cent. as many in snow ice as in the waters, 10 per cent. as many in all other ice as in the waters, 2 per cent. as many in clear ice as in the waters.

The results obtained lead to the conclusions: That while clear ice from polluted sources may contain so small a percentage of the impurities of the source that it may not be regarded as injurious to the health, the snow ice, or any other, however clear, which may have been obtained by flooding, is likely to contain so large a percentage of the impurities of the source, and with these impurities some of the disease germs which may be in the source, that the board feels bound to warn the public against using ice for domestic purposes that is obtained from a source polluted by sewage beyond that which would be allowable in a drinking water, stream or pond, and that in general it is much safer to use for drinking water, and for placing in contact with food that portion of the ice that is clear.

RIVER SLUICES.

AT the recent meeting of the British Association for the Advancement of Science, F. G. M. Stoney read a paper on "The Construction of Sluices for Rivers." This paper possesses special interest from the fact that Mr. Stoney's sluices are playing an important part in the design of the Manchester Ship Canal.

Mr. Stoney pointed out that in Indian irrigation many attempts have been made to work, or render more workable, sluices for the supply of water to canals, and while some experimenters confined their attention to finding means of overcoming great resistance with greater power, others have more properly sought to devise means for eliminating resistance to motion in sluices, rather than overcoming that resistance. This latter he held is the true direction to work in, and has eventually conduced to the best results. Several forms of the throttle valve have been tried on irrigation sluices, and have not succeeded. The principle is not very suitable for solid bodies like water, because what may be nicely balanced in static pressure may not be at all balanced when eddies and reflex forces are generated under high velocities. Such sluices have also failed mechanically, because of the too great concentration of load on pivots; moreover these pivots may be subject to the action of rust and grit. The ordinary sliding doors are subject to an amount of friction which precludes their useful application to such large openings as are now generally required. Equilibrium sluices have been made by arranging two outlets directly opposite each other, and the two doors closing the outlets so constructed as to form one plug (as it were) filling the space. The water pressure on one door being equal and opposite to that on the other door, the pair were in equilibrium. Here again was a very promising scheme, but the heavy bodies of water directly impinging would quite prevent this appliance being used in great sizes.

Another form of equilibrium sluice, specially designed for canal locks, was made by stopping a horizontal circular orifice by a cylinder. This cylinder had neither top nor bottom. Its lower edge, neatly faced in the lathe, rested on a suitably prepared face round the valve seat, and the top of the cylinder stood above water level. In this way the column of water was completely removed from above the sluice orifice, and the surrounding water simply tended to compress the cylinder, but not to prevent its vertical motion. The weight of the cylinder was balanced, and lifting it one-fourth of its diameter gave the full area of the sluice-way. Many of these sluices were made, and proved very useful. They were abandoned by Mr. Stoney chiefly for two faults: they pumped large quantities of air into the culverts, and they could not be applied to direct openings for scouring purposes. The most successful sluice for almost any situation is the sluice on free rollers. In this case there is not any sliding friction. The sluice door carried its load of water pressure on free rollers, the motion being similar to that of the drawbridges on free rollers, and to that of observatory cupolas mounted in a like manner. There is, however, one marked difference as to the planes of motion. The ordinary application of free rollers was on horizontal planes; in the sluices it is on vertical planes, which was one of the primary difficulties in the way. But no doubt the bare idea of introducing free rollers between the sluice door and the sluice frame, apparently precluding the possibility of a water-tight joint, was the real stumbling block to be got over. Sluices on free rollers are now constructed to any required size, and to be easily workable under great pressure, by one man, without hydraulic power. They have proved very reliable during years of test, and the wear and tear is hardly noticeable, chiefly because of the absence of resistance.

These sluices are made to suit single, double, or alternate pressures and they are made water-tight in various ways, according to the degree required, from absolutely tight to sluices purposely not made tight. These sluices can be usefully applied to the purposes of increasing water power without increased risk of flooding the country; on the contrary, they have proved most successful in preventing floods. They can also be applied to the main stream of navigable rivers, as in the plan now sanctioned by Parliament for Richmond, England, in which three sluice gates, each 70 feet clear span, are used to hold up water to half-tide, and at that period or level of water the gates are quickly raised some 23 feet above Trinity high-water mark, to allow of barges and steamers sailing under. A new element has been introduced into these sluices, by which during the upper part of the lifting process the gates automatically turn over on their flats and disappear in the overhead bridges.

ENGINEER COOLEY AND THE CHICAGO DRAINAGE BOARD.

It is gratifying to see such sensible comments as appear in the Chicago *Herald* in its reference to the recent conduct of certain members of the Drainage Board and their treatment of their chief engineer. The *Herald* says:

> "Probably one of the most absurd demonstrations of egotism that this community has been favored with recently is that of which the Drainage Board is guilty in its treatment of Chief Engineer Cooley. Not one of the commissioners is a scientific man. Not one of them knows anything about the engineering problems involved in the work about to be undertaken. Yet nearly all of them have assumed an attitude toward the chief engineer that is offensive, dictatorial and impertinent
>
> "It is morally certain that if Chicago is to be drained these commissioners will be compelled to depend upon the advice of some such man as Mr. Cooley. They may imagine that they know all about it and they may be disposed to go off recklessly on guesses and theories of their own, but the people who must foot the bills would prefer to be guided by an expert who knows his business.
>
> "The commissioners should do everything in their power to assist the engineer in his preliminary surveys and in his estimates. He should not be handicapped or bullyragged in any manner. If politics has crept into the board, let the man responsible for its introduction be rebuked. If conceit has taken possession of any member, let him be admonished. If there is a disposition to snarl and to carp, let it be discouraged.
>
> "These commissioners have an important duty, but they are not expected to work miracles. It is known that not one of them is an expert. It is known that they are all dependent upon others for scientific knowledge as to the problem in hand. They will, therefore, stand much better in this community if they will sensibly and modestly defer to the man whom they and the people must look to for facts and figures."

Such advice is too often needed by commissioners in other places.

ANCIENT MORTAR.

A sample of mortar, says *Industries*, taken from a building in the neighborhood of Ober-Florstadt, erected towards the close of the third century, had the following composition: Silica, 78.39; alumina, 7.35; carbonate of lime, 8.41; sulphate of lime, 0.32; other lime salts, 0.97; carbonate of magnesia, 0.42; combined water, 2.76; moisture, 1.32. Only traces of alkalies and chlorine were present. The sample is chiefly remarkable for the considerable quantity of alumina it contains.

LIME *VS.* CEMENT MORTAR.

Prof. Ira O. Baker contributed to the last volume of Transactions of the Illinois Society of Engineers and Surveyors some notes on the use of cement mortar, from which we take the following:

Common lime is made by heating nearly pure carbonate of lime—limestone or marble—sufficiently to drive off the carbonic acid. Common lime mortar hardens by absorbing from the atmosphere the carbonic acid which was driven off in making the lime. It will never harden under water, or when excluded from the air.

Hydraulic lime is made by exposing limestone containing from 10 to 20 per cent. of clay to a comparatively long-continued and high heat, which drives off the carbonic acid, and causes a chemical combination to take place between the remaining elements. The common lime in the compound causes the whole mass to slake when exposed to water or moist air, while the compounds of clay with the lime prevent its slaking freely and cause it to set, to a moderate extent, under water.

Hydraulic cement is made by submitting a limestone containing about 20 per cent. of clay to a long-continued and very high heat, which drives off the carbonic, and causes all, or nearly all, of the clay to unite chemically with the lime. As there is little or no free lime in the residue, it will not slake on the addition of water, and hence must be reduced to powder by grinding between ordinary millstones.

There are two classes of hydraulic cement—Portland and Rosendale. The latter is frequently called "natural," "American," "domestic," and "Roman"—all of which are misappropriate. Portland cement is heavy, slow-setting, and has great ultimate strength. Rosendale is less heavy, sets more quickly, and has less ultimate strength than Portland. Roughly speaking, Rosendale weighs about two-thirds as much as Portland, sets in one-tenth of the time, and attains to about half the ultimate strength. There is a great variety of brands of each class, which differ from each other in minor particulars.

Nearly all masonry is laid in lime mortar, in which case the mortar is the weakest link, both in strength and in durability. This is particularly true of buildings. When a brick building burns, it is noticed that the masonry tumbles down as rapidly as the wood burns up. If well built with good mortar the walls would stand intact even though the interior and roof did burn. Again, nearly all brick buildings, after having stood ten or fifteen years, require a considerable amount of pointing up, particularly in damp places and against chimneys. The strength and durability of the masonry could be greatly increased by replacing even part of the lime with cement. The mortar for the "ordinary brick-work" of the United States public buildings is composed of "one-fourth cement, one-half sand, and one-fourth lime." Many private builders reinforce lime mortar by the addition of hydraulic cement, and many railroads employ cement mortar in all masonry structures, and cement mortar is generally used for sewers, arches, and important masonry constructions; but it is neverthelesss true that altogether too much lime mortar is used. Under most favorable circumstances as to exposure to the atmosphere, lime mortar will attain a maximum strength of about 50 pounds per square inch, as compared with a possible 300 for Rosendale and 500 for Portland.

The addition of cement to lime mortar adds to its strength—the strength of the resulting mortar being intermediate to the strength of the two separately. However, it is not certain that it is true economy to mix lime and cement. As far as strength is concerned, the lime, under favorable circumstances, is but little better than an equal volume of sand, and, under water, in damp places, or in thick walls, it is not as good. Lime mortar taken from the walls of ancient buildings has been found to be only 50 to 60 per cent. saturated with carbonic acid after nearly 2,000 years of exposure. Lime mortar 2,000 years old has been found in subterranean vaults in exactly the condition, except for a thin crust on top, of freshly-mixed mortar.

The strength and durability are unquestionably mainly dependent upon the mortar, and it is highly illogical to insist upon a high quality of stone or brick, or of stone instead of brick, and then use common lime mortar. Experiments show that an increase of 50 per cent. in the strength of the brick shows no appreciable effect on the strength of the masonry, and that the substitution of a Portland mortar for a lime mortar adds 70 per cent. to the strength of the masonry; and also that the substitution of a Rosendale mortar for one of lime adds 50 to 60 per cent. Probably the difference in durability between cement motar and lime mortar is considerably greater than their difference in strength.

If cement is to be used, it then becomes a question whether Portland or Rosendale should be preferred. If great ultimate strength is required, then Portland cement must be employed; but if a quick-setting mortar is desired, then Rosendale cement must be employed. Unless a quick-setting mortar is required there is a decided advantage in using Portland, for, as it hardens more slowly, it is not so liable to set before reaching its place in the wall. This is an important item, since with a quick-setting cement any slight delay might necessitate the throwing away of a box of mortar, or the removal of a stone to scrape out the partially set mortar.

It is sometimes very desirable to have a cement which will set more quickly than Portland, and finally attain a greater strength than Rosendale. Under such circumstances a mixture of Portland and Rosendale can be used. Such mortar sets about as quickly as if made with Rosendale cement only, and acquires great subsequent strength, due to the Portland cement contained in it. The strength of the mixed mortar is almost exactly a mean between that of the two mortars separately.

If the choice of the cement is not determined by any of the preceding conditions, the question then becomes one of relative strengths and relative prices. For example, an examination of a table of the strength of cement mortars will show that at the end of a month the strength of a neat Rosendale mortar is equal to that of a 1 to 1½ Portland mortar, a 1 to 1 Rosendale is equal to 1 to 3 Portland, and a 1 to 2 Rosendale is equal to a 1 to 5 Portland. The cost per cubic yard of the last two mortars will be about as follows:

Rosendale 1 to 2.		Portland 1 to 5.	
Cement (720 lbs.), 2.40 bbls. at $1	$2.40	Cement (425 lbs.), 1 14 bbls. at $3	$3.42
Sand, 0.84 cu. yd. at $0.40	.33	Sand, 0.99 cu. yd. at $0.40	.40
Labor	.50	Labor	.50
Total cost of cu. yd.	$3.23	Total cost of cu. yd.	$4 32

This shows, that, under these conditions, the Rosendale, strength for strength, is the more economical.

In conclusion, Professor Baker gave the following fact, by means of which a mortar may be made impervious to water. Mortar may be made practically non-absorbent by the addition of alum and potash soap. One per cent., by weight, of powdered alum, is added to the dry cement and sand, and thoroughly mixed, and about one per cent. of any potash soap (ordinary soft soap made from wood ashes is very good) is dissolved in the water used to mix the mortar. The alum and soap combine and form compounds of alumina and the fatty acids, which are insoluble in water. These compounds are not acted upon by the carbonic acid of the air, and add considerably to the early strength of the mortar, and somewhat to its ultimate strength. With lime mortar the alum and soap has a slight disadvantage, in that the compounds which render the mortar impervious to water also prevent the air from coming in contact with the lime, and consequently prevent the setting of the mortar. On the other hand, the alum and soap compounds add considerably to both the early and ultimate strength of the mortar. This mixture could be advantageously used in the mortar of outside walls, for masonry in wet places, for pointing mortar, for the plastering of cellar and basement walls, for lining cisterns, etc. The efficiency of the alum and soap compounds is shown by the fact that the walls of the Croton reservoir, in Central Park, New York City, were rendered impervious by simply washing them four times alternately with the alum and the soap solutions. Before being coated the walls allowed the water to pass freely. Four coatings—two pairs—made a common brick absolutely impervious under a 40-foot head of water.

The use of the alum and soap as above would in all cases greatly diminish, and in most cases entirely prevent, efflorescence or "whitewash," which so frequently disfigures brick walls.

The London *Engineer* says, that according to a report from Dacca, the great iron bridge at Tongi, India, which cost the late Rajah Kali Narayan Rai Bahadur an immense sum, has been clean washed away by a flood.

EARLY HISTORY OF NEW YORK'S WATER SUPPLIES.

IN connection with the completion of the New Croton Aqueduct, conveying water to the city of New York, it is of interest to recall some of the early facts relating to the city's water supplies, as given in one of the daily newspapers.

It was not long after the early settlement of New York that the want of a sufficient water supply was felt. Wells were at first the only source of supply. Up to 1658 there were no public wells, the inhabitants supplying themselves from private wells on their own premises. In 1658 a public well was sunk in front of the old fort. Nineteen years later six additional wells were ordered, the inhabitants of the streets where they were made defraying the expense. This order went out in the following shape:

One well opposite Roelof Jansen's, the butcher; one in Broadway, opposite Van Dyck's; one in the street, opposite Derick Smith's; one in the street, opposite John Cavalier's; one in the yard of the City Hall; one in the street, opposite Cornelius Von Boroum's.

Seven more public wells were ordered in 1687, and the city government undertook to pay one-half the expense. No person could use a well until he had contributed toward the cost of it.

It was a great event in 1750 when pumps came into use. Afterward a general act was passed to enable the city to raise a tax for the construction and repairing of the public wells and pumps.

Some of the wealthier inhabitants at this time preferred to send to the suburbs for their water supply. The water in the wells was not good. They sent out to the Fresh-Water Spring, known at that time and long afterward as the "Tea-Water Spring." Just before the Revolution the vicinity of the spring, now the junction of Park Row and Roosevelt Street, became a popular and fashionable resort, where various beverages, mixed with pure spring water, could be obtained.

A pump was put up over the spring and a sort of park was laid out around it. The people called this resort "The Tea-Water Pump Garden." Water was bartered for like any other commodity. Venders sold it by contract, or at a cent or a cent and a-half a pail. Knapp's tea water, which was drawn from a spring near the old White Fork, at Tenth Avenue, near Fourteenth Street, gave a good living to a great many men. Mr. Sweeny, the founder of Sweeny's Hotel, is said to have obtained his start in life as a vender of water.

A company, styled the "New York Manhattan Water-Works," was incorporated in 1799 for the purpose of supplying the city with pure and wholesome water. This was the year after the yellow fever had ravaged through the city. But the Manhattan Company seemed more interested in banking money than in furnishing pure water. The company's works consisted of a well in Cross Street, two steam engines, a reservoir on Chambers Street, and a couple of small wooden reservoirs.

Another of these old wells—the one in lower Wall Street—inspired Samuel Woodworth to write his famous poem, "The Old Oaken Bucket."

To Christopher Colles, however, is given the credit of having suggested, in 1774 the scheme afterward adopted by the Manhattan Company, that of digging large wells and pumping water from them into reservoirs. Colles even looked so far ahead as to see the advantages of communication uniting the great lakes and the Atlantic Ocean. In pursuance of Colles' plan a spacious reservoir was built on Broadway, between Pearl and White Streets. But these reservoirs and wells did not succeed in giving New York a sufficient water supply. In 1819 Robert Macomb asked permission to furnish the city with water. No positive action was taken, however, until 1829, when it was resolved by the Board of Aldermen to establish a well and reservoir in Fourteenth Street. There were at the time 40 public cisterns in the city.

Half a dozen companies were incorporated in succession, having the view of furnishing pure water to the city, but they met with no success. In 1830, an iron tank 43 feet in diameter, 20 feet high and containing 305,422 gallons of water was completed at Thirteenth Street and Fourth Avenue.

Francis B. Phelp's memorial of May 17, 1830, was the first definite proposal for the introduction of Croton water into the city. The same year it became necessary to build 16 more cisterns. Colonel De Witt Clinton favored the Croton project, and in 1834 the Common Council obtained from the Legislature a law authorizing a loan of $2,500,000 to create a stock called the "Water Stock of the City of New York." Under Chief Engineer D. B. Douglas and four district engineers the work on the Croton Aqueduct was begun in the spring of 1837. In 1839, the Legislature authorized the erection of High Bridge, on which to convey the Croton over the Harlem River. The total cost of the aqueduct was $11,452,619.61.

Extensive preparations to celebrate the completion of the aqueduct were begun by the Fire Department, and the city appropriated $2,000 for the expense.

At sunrise on the day of the celebration 100 guns were fired and all the church and public bells were rung At 9 A. M., in front of the City Hall, Mayor Morris presented a banner to the Fire Department. In the procession there were ten divisions, and over two hours were taken in passing a given point.

High Bridge was finished in 1848, and ten years later the large reservoir in Central Park was begun. It was completed in 1862. The two 36-inch pipes crossing High Bridge were replaced in 1861 by a large 7½-foot iron pipe, equal to the full capacity of the aqueduct. The high-pressure works at High Bridge were made available in 1870. The storage at Boyd's Corner was completed in 1873. The Carmel Reservoir became available in 1878. Up to 1879 the total expense for everything connected with the water supply had been $35,820,081.46.

Correspondence.

Communications giving information or opinions on matters of general interest to the engineer, the architect, the contractor, or the municipal officer, will be welcomed in this column. Fairness will suggest that when communications are sent simultaneously to this and other journals we should be informed of it at the time. Anonymous letters will not be noticed.

THE USE OF CLAY IN MACADAM ROADS.

NEW YORK, September 20, 1890.

To the Editor of THE ENGINEERING AND BUILDING RECORD:

SIR: A controversy is going on in Union County, New Jersey, about the wisdom of permitting the use of 2 inches of clay over the Telford foundation, "for the purpose of forming a bond or cushion for the first overlying course of macadam." In a published communication defending this practice, one of the Commissioners says:

"Clay, as used in the Union County roads, is something over and above anything and everything called for in the original contracts of last year, and does not in any way or to any degree lessen or modify the quantity, quality or number of courses of stone or binding of screenings and stone dust used in the construction of the roads. Nor is the contractor allowed anything in measurement for the 2 inches or clay. He is required to furnish so many inches of stone, in such and such courses without regard to the clay, and entirely independent of it. It is simply an additional requirement made of the contractor without additional cost to the county. Such use of clay prevails and has prevailed for the past 15 or 20 years in England and Scotland, the home of Macadam and Telford roads, to the entire satisfaction and comfort of the public, and without detriment to the roads. It has the sanction of such eminent road builders as D. C. Proudfoot and David Stratton, road surveyors, etc., for the city and county of Edinburgh. The clay thus used forms a cushion or bed, and instead of filling up and destroying the drainage, as claimed by some, actually prevents this very thing occurring by arresting and holding the stone dust and screenings, which, from experience, we know will sift through the larger courses and interfere, more or less, according to the quantity used, with the proper drainage of the road. Furthermore, it gives a Telford road the elasticity so justly claimed for the macadam, and adds to its comfort and life."

Is it a fact that the practice of the best road builders abroad has so far departed from what has been for years the recognized standard? C. E.

[The contractor can well afford to add clay to a macadam road without extra charge, as its presence greatly reduces the cost of rolling. We would, however, be pleased to hear from any of our readers on the subject.]

LARGE SIZE VITRIFIED PIPE FOR SEWERS.

SPRINGFIELD, ILL., September 15, 1890.

To the Editor of THE ENGINEERING AND BUILDING RECORD:

SIR: I was interested in reading the letter of Col. George E Waring in your issue of September 13, under the head of "Vitrified Pipe for Sewers." I can hardly agree with him in the assertion that the material is not a safe one to use in a larger diameter than 15 inches, and would not hesitate to adopt a diameter of 20, or even 22, inches, if good sound vitrified pipe is used, especially if laid in a clay subsoil and care is taken in laying the pipe on a solid bed. I think the failure in the large pipe is due to insufficient excavation under the sockets.

I fully agree with him that in providing specifications for sewers 3 feet in diameter, two rows of brick is a waste of material, and would not only construct sewers of 3 feet caliber with a single row, but would not hesitate to construct them up to a diameter of 4, or even 5 feet, if good material is used. In this city, up to 1887, sewers of 3 feet and over were constructed with two rows of brick, and from 5 to 7 courses in the invert, laid dry. I succeeded in securing the adoption of a single ring with the invert laid in cement mortar, saving at least 40 per cent. in the cost, and securing a far better job than when constructed with a double ring. It is of vital importance in sewer construction that the very best material should be used, and thorough construction secured. With these there is not the least danger in construction up to a diameter of 5 feet, and in deep excavation and clay, or hardpan subsoil, a very much larger diameter might with perfect safety be constructed with a single ring. W. D. CLARK.

Questions and Answers.

All questions relating to building construction, paving, sewerage, water supply, or kindred subjects, will be welcomed in this column provided they relate to matters of general interest and are not such as should properly be referred to a consulting engineer. Answers will be carefully prepared and a proof of both question and answer mailed to the inquirer as early as proper consideration will permit. They will be published for the benefit of other readers as soon as convenient. The full name and address should be given, not necessarily for publication, but as a guarantee of good faith, and to facilitate further correspondence in case the question is not sufficiently explicit.

Inquiries of the Editor, in order to secure prompt attention, should *not be written on the same piece of paper as a communication* to the *Publishing Department.* Letters renewing subscriptions are sent to a clerk in the publishing office, and matter for the Editor, if in the same enclosure, is likely to be overlooked unless it is on a separate piece of paper, so that it may be promptly sent to the Editor.

HOW TO KILL GRASS AND WEEDS IN GUTTERS AND SIDEWALKS.

D. F. SNOW, New York, writes: "In answer to John W. Howard's inquiry in the current number of THE ENGINEERING AND BUILDING RECORD as to 'the best and most appropriate method for killing grass and weeds that grow up in our gutters and sidewalks,' I would say that I had no difficulty in keeping the grass and weeds out of the graveled paths and roadways of a country place, owned and occupied by myself, by the simple application of salt (chloride of sodium) in its dry state. I should say that a strong brine made of the same material and applied by a sprinkler would be just as effectual."

ADDRESS OF BUILDING MOVER.

H. E. SMITH, of York, Pa., writes: "Will you please give me the address of a firm, or firms, who make a specialty of raising brick buildings from their foundations?"

[We would refer our correspondent to the following: Sam. E. Goodwin, 517 East Seventeenth Street, and T. B. Brown, 365 South Street, New York City.

Isaac Blair & Co., 444 Harrison Avenue; J. Cavanagh & Son, 473 Dorchester Avenue; and John Soley, 35 Hawley Street, Boston, Mass.

W. R. & G. R. Cavanagh, 207 E Street, South Boston, Mass. A. M. Richards, 39 Lexington Avenue, Charleston, Mass.]

BOOKS ON BREWERY DESIGN AND CONSTRUCTION.

"J. A. F.," Boston, Mass., writes: "Can you give me the titles and publishers of any reliable American or foreign works on the planning and construction of modern breweries (especially those for brewing lager beer), and the arrangement of their fixtures and machinery?"

[After extended inquiry it would seem that the literature of the subject referred to by our correspondent is rather scant. Messrs. E & F. N. Spon, of New York, are the publishers of a book entitled "Breweries and Maltings: Their Arrangement, Construction, Machinery and Plant," by George Scammell. Second edition, revised and enlarged and partly rewritten by F. Colyer; 178 pages, with 20 plates; London, 1880. Price, $6. This might meet J. A. F.'s requirements.]

BOOK NOTICES.

PURVES' TABLES OF BOILER PRESSURES. John Brown & Co., Ltd; Sheffield, England.

These tables, which are issued in neat and convenient form, give Lloyd's working pressures for steel boilers, and of furnaces under Board of Trade and Lloyd's rules. The pressures given are for flat plates with different methods of staying and various pitches of stays, for boilers with cylindrical shells, and for circular and patent ribbed furnaces. Various rules are also given for determining the safe working pressures. The value and convenience of the tables are at once apparent, and they will commend themselves favorably to engineers.

ACCORDING to our Italian contemporary, *Progresso*, articles of iron can be protected against rust by sinking them near the negative pole of an electric bath composed of 10 liters of water, 50 grammes of chloride of manganese, and 200 grammes of nitrate of ammonia. Under the influence of the current the bath deposits on the articles a film of metallic manganese which prevents them from rusting.

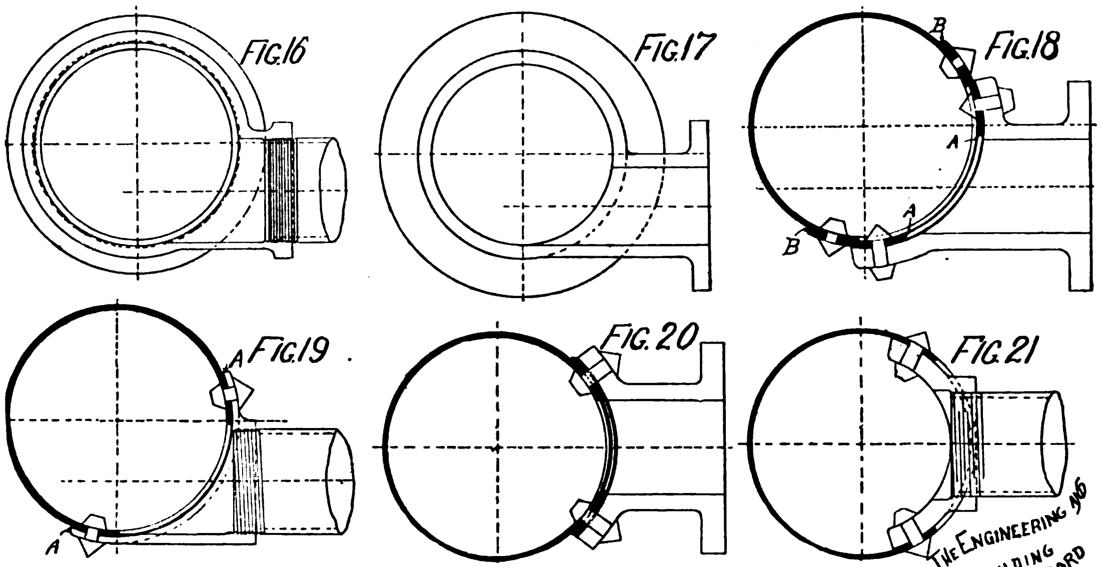
DOMESTIC ENGINEERING
PLUMBING HEATING LIGHTING & VENTILATION

ATTACHMENT OF NOZZLES TO STEAM DRUMS.

THE attachment of nozzles to steam drums is the subject of the third of the series of articles in the August number of *The Locomotive*, alluded to in previous issues. We quote as follows:

"To the best of our knowledge we have never seen the nozzles of a large steam drum, that is, those forming the connection between the boilers and drum, put on as they should be. This seems to be rather a sweeping statement, and may seem to reflect upon the abilities of our leading boilers makers, steam engineers, pipers, and others who have had more or less to do with the designing of such work, but it is nevertheless true.

"For drums up to 10 inches in diameter, made usually of ordinary steam pipe, the connections from the boilers are generally by means of the ordinary screwed tee. We will suppose, for instance, that four 60-inch boilers are set in a battery. Then the drum would be of 10-inch pipe, the steam pipe from each boiler, 5 inch, and they would connect with the drum with a 10'x10'x5' tee with inlet, outlet, and branch all threaded, and the whole screwed together.



ATTACHMENT OF NOZZLES TO STEAM DRUMS

"So far this is all right. But the pipes leading from the drum to the engine and other parts of the establishment are not usually the full size of the drum. They will oftener be found not over 6 inches in diameter, and are taken out by means of the usual forms of fittings. These pipes being led horizontally from the drum, with all centers at the same height, leaves a chance for water to collect in the lower part of the drum. This is apt to cause trouble unless the drum is dripped. This drip must be connected to all the boilers, and be furnished with valves so that the water may always be returned when but one boiler is running, and that one, any boiler of the battery.

"This arrangement works all right, but it is of the nature of a makeshift, and the work should be done in such a manner that it is not necessary.

"The connections to the boilers should be made by means of eccentric fittings. Figures 16, 17, 18, and 19, show in section, fittings adopted to this purpose, which would cost no more than those of the ordinary pattern, and the expense of the drip connection would be saved.

"Figure 16 shows an ordinary screwed tee, with the exception that the branch which receives the steam pipe from the boiler is dropped, so that the bottoms of the pipes forming the drum and that leading from the boiler are at the same level. Then when connection is made with any boiler in the battery, the drum always has a chance to drip freely back into the boiler. Under no circumstances can water collect in the drum, and no extra piping is required.

"Figure 17 shows a section through the branch of a cast-iron flanged tee, such as would be used in making the connection with a pipe larger than 10 inches in diameter. The same remarks apply as in the case of Fig. 16

"Figure 18 is a section through a nozzle such as would be put on a large drum, either of lap-welded pipe or a riveted-up drum. It should be put on eccentrically when connections to the boilers are made. For pipes leading out of the drum this is not essential, and the connection had better be made as shown in Fig. 21 further on.

"A word here about putting nozzles of this kind on to drums. A common way of doing it is shown in Fig. 20. A 'shim' or calking piece of wrought iron is put between the pipe and the base of the nozzle, and the rivets extend through pipe, shim, and flange of nozzle, and are driven from the outside. The joint is then made tight by calking the edge of the shim. As the rivets are driven from the outside against the rigid cast-iron flange, it is impossible to bring the flange and pipe into close contact, and very hard calking is resorted to. Even this generally fails to make a permanently good job, leakage is apt to set in soon, and is difficult to stop. Figure 18 shows a much better way to do this job. A patch is first riveted to the nozzles and calked at 'A.' This is then riveted to the pipe and calked at 'B.' By this means a permanently tight piece of work is secured.

"But a better way still to do this work would be to use a mild cast-steel nozzle, as shown in Fig. 19. The rivets can then be driven from the outside, the edge of the flange brought down closely to the pipe, and calked at 'A' in the usual manner. This form of nozzle would leave nothing to be desired. We believe that steel castings can easily be obtained at the present time possessing the requisite qualities for a nozzle of this kind.

"Figure 21 shows the best method of making the nozzle attachment to drums of large size, either riveted up or made of welded pipe, when the branch pipe is taken out on the center, although for some reason or other it is seldom used. The cast-iron screwed nozzle is simply riveted to the inside, which allows the rivets to be driven from the outside, the iron of the drum is brought closely down to the flange of the nozzle, and the calking edge is outside, in short, a *good job* is *easily* made, whereas, if the nozzle is put on the outside of the drum a *botch job* is made at much *greater cost*. Of course, if the drum is large enough to admit men inside to drive rivets, and do efficient calking, as good a job can be made in one case as in the other, but such large drums cannot be advised. They are useless and expensive appendages."

Notes and Queries

on Domestic Engineering.

Communications relating to the practical details of plumbing, heating, lighting and ventilation will be welcomed in this column. The writer's true name and address must always be given, but an assumed name may be used for publication if preferred.

DISPOSAL OF HOUSE WASTE IN TIGHT CLAY SOIL.

"E. W. L.," Troy, N. Y., writes: "Please refer me to articles in THE ENGINEERING AND BUILDING RECORD, which I have from the beginning of its publication, covering the subject of sewage disposal like the instance I have in hand.

"The lot is 300 feet front by about 800 feet deep, and the greater part inclines upward from the front about one foot in ten, and at the ridge the house stands. There is no creek nor any sewer to which house drains can possibly be connected, the location being quite outside of the village limits. The soil is 8 feet and 4 feet deep on the rock, and is all very compact clay. In half a dozen places I caused test holes to be dug, and all filled with water in 24 hours, which later somewhat decreased in depth; but they always contain more or less water.

"It is desired to put in complete bath-room accommodations and water supply to the house. I think the only course is to build tight cesspools. But I prefer to ascertain if similar difficulties have received consideration in your paper."

[From the facts given it would seem that tight cesspools will have to be relied on and the expense of pumping them out incurred, though the depth of the lot, 800 feet, will probably allow for good sized ones, or several. The water may also be utilized, in some degree, in the garden. If first expense be no important consideration, a sufficient amount of clay might be removed, specially prepared soil substituted, and the subsurface irrigation system adopted. This, with suitable soil, is the best thing to do. It is described fully in "The Disposal of Sewage in Suburban Residences," by E. S. Philbrick, reprinted from this journal, and in William Paul Gerhard's little book (Van Nostrand's Science Series) on "The Disposal of Household Wastes."]

LIGHTING AND VENTILATING A SCHOOL BUILDING.

P. K. PATTISON, Superintendent of Public Schools, Colorado Springs, Col., writes:

"The Board of Directors of this city contemplate erecting a High School building, as per inclosed circular. We are much pleased with one plan, but would like expert testimony relating to the lighting, heating and ventilating of the building. Will you please answer the following questions?

"1. Do you think it best to light class-rooms 33x27 feet on one side *only*, or, on one side *mainly*, and have some additional light at the rear?

"2. Do you think a study-room, 65x45 feet, can be properly lighted by admitting light on the 65 foot side only, the room being on the north side of the building?

"3. Does the fact that direct sunlight never enters this room make it less healthful, or is this point of little importance in a school-room?

"4. Do you think this building will be best heated by the gravity system, or by the fan system?

"5. Is it right in principle to allow the gas and other products of combustion to enter from the furnace into the ventilating shaft and mingle with the foul air which is brought to its base from the entire building?

"Perhaps it is best for me to explain this last question more fully, and in so doing I will give you *data* for answering the fourth also.

"The system of ventilation seems very good, the opening for the admission of heated air into each room for 50 pupils being nearly four square feet. All the heated air is taken into the room at or near the top, and the foul air is taken out at or near the bottom. This foul air is conducted by large flues to the basement, and taken in a large duct beneath the floor of the basement to the bottom of the ventilating shaft, and is admitted thereto. This ventilating shaft is 6x8 feet. The smoke-pipe from the furnace enters this flue in the basement, and makes an upward turn, and is then cut off.

"There is some fear on the part of the Board that high winds, by adverse draughts, may carry the gases of combustion *downward* to the base of the shaft, and thence throughout the building. Do you think that there is any danger of such a result? When there is no fire in the furnace, a draught is to be created by a small stove in the base of the shaft.

"Is it right in principle to change the size of the smoke-pipe, say from a 20-inch pipe to a space 6x8? Is such an arrangement likely to give a good draught?

"In giving an opinion on the subject of lighting, you should keep in mind that the air here is very clear. An immediate reply will be of great service."

[It is not necessary for us to reprint the circular which accompanies this letter. The questions are answered in the order in which they are put.

1. It is best to light class-rooms on one side mainly so that the principal light shall come from the left of the pupils, and to have additional light at the rear.

2. A study room, 65x45 feet, and not more than 15 feet high, cannot be properly lighted for school purposes by windows in the long side only. The ratio of window to floor space, even in Colorado, should not be less than 18 per cent.

3. The fact that direct sunlight never enters a school room does make it less healthful. It is not important that the sunlight should always, or even usually, enter the room while it is occupied by the children, but the room should be exposed to the direct rays of the sun for at least two or three hours every day.

4. The meaning of this question is not quite clear, but it probably refers to ventilation rather than to heating. Presuming this to be the case the answer is that the most complete control and satisfactory working of the ventilation can be secured by the fan system, but that this requires more knowledge and attention on the part of the janitor than do aspirating shafts, that it is more likely to get out of order, and will cost somewhat more to run.

5. It is not right to turn the gaseous products of combustion into the main foul air shaft. The smoke pipe from the furnace should be continued up through the whole length of the ventilating shaft, and perforate its cap or cowl, having a separate cowl of its own.

The arrangement by which a 20-inch smoke pipe is discharged into a flue having 48 square feet of area will depend too much on the temperature and moisture of the external air and on the direction and force of the wind to give reliable and satisfactory results.]

MEMPHIS ORDINANCE REGARDING WATER-CLOSET ROOMS.

Latting & Bailey, of Memphis, Tenn., write: "We inclose herewith a copy of an amendment to our health ordinance, and would thank you to read same carefully and give us a free expression of your opinion of it. We ask this of you at the request of the most of our plumbers here as well as others, and a reply through the columns of your paper will be appreciated by us all."

[The ordinance in question reads as follows:

Be it enacted by the Legislative Council of the Taxing District of Shelby County, Tenn., that section 207 of the health ordinances be amended by adding thereto the following, as sub-section 207 a:

That all water-closets, privies and urinals hereafter constructed in any building used as a residence, within the Taxing District, shall be placed in a room not less than 5 feet in diameter, and said room shall have at least one window 2½x6 feet, with upper and lower movable glass sash hung on weights. There shall also be placed in the ceiling of said room a ventilator, at least 18 inches in diameter, connected with a pipe not less than 6 inches in diameter, leading through the roof of the house wherein said closet or urinal is placed. Said room shall not communicate directly by means of any door or opening whatever with any sleeping room, sitting room or apartment which is occupied by any human being during as many as two out of any 24 consecutive hours, nor shall any door, window or other opening of said room, be made within 3 feet of any apartment occupied by any human being during two out of 24 consecutive hours.

Any architect who prepares any plan of a house in violation of the above, shall be guilty of a misdemeanor, and subject to a fine of not less than $5 nor more than $50.

Any contractor or carpenter, constructing a closet in violation of the above, shall be guilty of a misdemeanor, and punishable by a fine of not less than $5, nor more than $50.

Any plumber putting in a privy, or urinal in violation of the above, or any owner or agent paying for same, or authorizing the construction of a closet or urinal in violation of the above, shall be guilty of a misdemeanor, and punishable by a fine of not less than $5 nor more than $50 for each offense.

Passed September 4, 1890.

W. D. Bethell, President.

Attest—Henry J. Lynn, Secretary.

This ordinance would seem to be too absolute and restrictive in its terms, since no possible exceptions are allowed even if approved by the sanitary officials. If the space is to be ventilated we know of no reason why an area of 4 feet square for a single water-closet or urinal is more dangerous to health than an area of 5 feet square, and we do not understand why a ventilator 18 inches in diameter is required for a 6-inch flue. Not having a copy of the health ordinances of the district before us we do not know how minute are the directions as to the kind of water-closets to be used, as to cisterns for flushing, traps, bath-tub connections, safe wastes, etc., all of which are more important from a sanitary point of view than anything specified in this ordinance. Undoubtedly a water-closet room should be ventilated, but to effect this air must be brought into the room as well as taken out of it. Probably the person who framed this ordinance intended that the window should be the fresh-air inlet, but to carry out the principle of detailed requirement it should have been specified that the window is to be so made that it cannot be kept shut. We do not know just what a Memphis privy may be, but if it resembles a New England or a New York privy it should not be allowed in a dwelling house at all. The motives for the framing and the passage of this ordinance are no doubt highly commendable, but we doubt the wisdom of such sweeping and non elastic legislation.]

THE METROPOLITAN MUSEUM ART SCHOOLS AT NEW YORK.

The prospectus for 1890–91 of the art schools of the Metropolitan Museum of Art, New York, has just been issued.

These art schools have been established by the trustees of the Metropolitan Museum of Art, in order to furnish superior opportunities for thorough instruction in design, drawing and painting, architecture and sculpture; especially to those who desire to acquire an artistic education applicable to industrial and commercial uses. Large, well ventilated rooms have been provided in the Museum, with superior art material and furniture. In order to offer all genuine students every facility in their work, a series of lectures are given, the privilege of visiting the Museum free of expense, prizes and certificates, so that all may measure their progress by the degree of their industry and application.

"Penny-in-the-slot" machines have been applied to the sale of gas for dwellings in England. According to the Bolton *Journal* the system has been introduced into that town, and while there are not many machines at present in operation there is thought to be no reason why the number should not increase. The system is supposed to appeal directly to consumers of limited means.

Novelties.

Devices are described under this head purely and strictly as news; because believed to be new and calculated to interest readers.

In no case is pay accepted, directly or indirectly, for publishing a novelty notice.

As the subjects are selected for their supposed novelty and interest merely, it will, of course, be understood that the selection does not imply indorsement.

SOME RECENT PLUMBING PATENTS.

The annexed illustrations of some plumbing devices, recently patented, are of interest:

Figure 1 is a urinal, whose flushing syphon K is operated by valve L, attached to float A by the bent lever C, pivoted at B. When the chain E is pulled it opens valve L and produces syphonage; when the chain is released the float A closes valve L. It also closes when the tank is filling before the water reaches the level of the valve seat. Peter White, St. Louis, Mo., is the patentee.

Figure 3 shows sections of a "retarding device for water-closet valves." C is the tank-valve chain, attached to a handle rod D, which works through a spherical shell E, containing an elastic hollow ball or diaphragm, F. This is attached to the rod and to the shell by collars G and H. The inside of the diaphragm is in constant communication with the external air through passage K. When the valve is operated, the diaphragm is forced into the position shown in B, and resists the movement of the handle L and chain C to a degree, adjustable by setting the valve screws at I and H. These control the air passages to the diaphragm. Timothy McHugh, Wakefield, Mass., is the patentee.

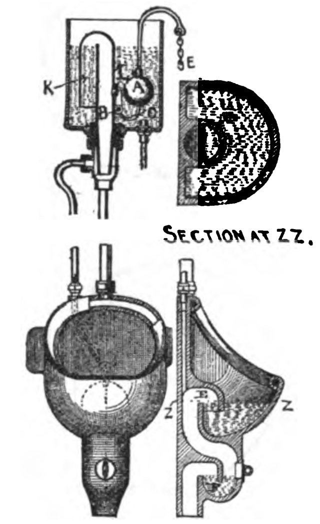


FIG. 1.

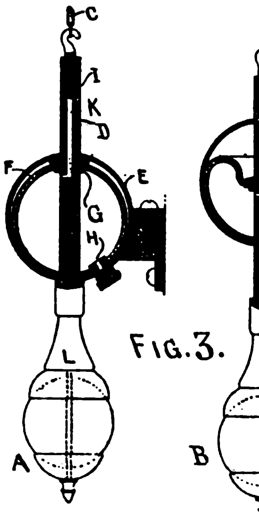


FIG. 3.

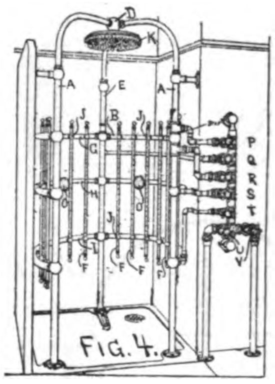


FIG. 4.

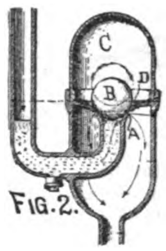


FIG. 2.

Figure 4 shows a "Needle Bath," with curved columns A E A supporting head D, and distributing pipes B H I to which the perforated spray pipes F F F, etc., are attached by hollow knobs J J, etc.; U and V are, respectively, hot and cold water supply cocks. The cock P controls the strainer K; Q controls spray in column E; R and I control distribution through pipes G and I, and S controls distribution through pipe H to sprays O O, etc. George Taylor, Jersey City, N. J., is the patentee.

Figure 2 is a section of a trap having a ball valve B, and an annular outlet A, and air inlet D in the discharge chamber C. William A. Mundy, Philadelphia, Pa., is the patentee.

PAVEMENT AND SEWER WORK IN DETROIT, MICH.

The report of the Department of Public Works of Detroit, Mich., for the year ending June 30, 1890, William Voight, City Engineer, and John Campbell, Secretary, give the following facts regarding new pavement, sewer work and public building:

During the past year about $11\frac{19}{100}$ miles of cedar block and cobblestone pavement, and $4{,}870\frac{88}{100}$ feet of asphalt pavement was laid. The cost of the cedar block and cobblestone pavement amounted to $267,597.90 or an average of about $1.35¼ per square yard. The cost of asphalt pavement amounted to $41.403.44 or an average of about $2.94 per square yard. In addition to the foregoing a portion of Cass Avenue was repaved with asphalt, and cost about $2.18 per square yard. In addition to this amount $3,135,80 was expended for extra paving, making the whole amount expended for repaving Cass Avenue $57,976.25.

With regard to complaints about cedar block pavements the report says:

> "Much has been said in denunciatory terms of cedar blocks as a material for pavement, but with what foundation for credibility the past usage of cedar block pavement will fully demonstrate. Wherever in the city of Detroit cedar block pavement has been laid on a proper grade, and permitted to remain undisturbed, its durability has been unquestionable, and perfectly satisfactory, but when it is constantly disturbed in making underground improvements its utility must, to a certain extent, be affected, and then follows the declamatory remarks as to the utility of cedar blocks for this purpose.
>
> "If the material will meet the requirements of the specifications for paving, and the work is done in accordance therewith, cedar block pavement is considered worthy to be classified with any material not excessive in its cost, therefore, instead of confining the censure to this material, let it be applied to the cause, to wit., the reckless manner in which the public is permitted to remove and replace the pavement after making underground improvements."

Seventy-six lateral sewers were constructed, about $10\frac{88}{100}$ miles long, at an aggregate cost of $44,650.57, an average of $81\frac{88}{100}$ cents per lineal foot. A new municipal court building was completed at $55,475.06, under supervision of the architects, Hess & Rossman. The plumbing pipes are all exposed, and particular attention was paid to the heating and ventilation.

THE NORTH RIVER BRIDGE.

The organization meeting of the North River Bridge Company, which was incorporated some time ago by special act of Congress, was held last week. All the incorporators were present either in person or by their authorized representatives. The minimum amount specified in the incorporating act, $1,000,000, is understood to have been subscribed, and the stockholders proceeded to the election of the following Board of Directors:

Jordan L. Mott, iron manufacturer, New York; John King McLanahan, of Hollidaysburg, Pa., engineer and iron manufacturer in Pennsylvania and in the South; James Adams, an engineer associated with Captain Eads in the St. Louis Bridge and New Orleans jetties undertakings; Thomas F. Ryan, banker, New York; Charles J. Canda, ex-Assistant Treasurer of the United States; Edward F. C. Young, President of the First National Bank of Jersey City, and William Brookfield, banker, of New York.

The Directors met immediately and organized by the election of the following officers: President, Jordan L. Mott; Secretary, M. H. Houseman; Treasurer, Charles J. Canda; General Counsel, Charles F. MacLean; Chief Engineer, Gustav Lindenthal.

The original plans of the bridge as designed by Chief Engineer Lindenthal, are for six railroad tracks on a single span over the river of 2,850 feet, but these plans are now being revised to provide for ten railroad tracks, for several street car tracks, and a promenade for foot passengers, and as soon as the plans are completed they will be submitted to the Secretary of War for his approval under the act of Congress.

THE MAINTENANCE AND OPERATION OF WATER-WORKS BY PRIVATE COMPANIES.

(Continued from page 253.)

12. *Public Hydrant Rental.*—Charge this account, and credit "public hydrant rental accounts receivable" with amount of charges for public hydrant rental as taken from journal.

Credit this account, and charge "cash" with all sums received from the public corporation for the right to use fire hydrants, in accordance with the terms of any contract between the company and the public corporation.

Treat rebates, errors, etc., the same as detailed in account No. 6.

13. *Private Hydrant Rental.*—Charge this account, and credit "private hydrant rental accounts receivable" with amount of charges for private fire protection as taken from Accounts Receivable Book.

Credit this account, and charge "cash" with all sums received from other than the public corporation for the right to use fire hydrants, except in those cases where the premises are supplied through a meter, and only the water used charged for, without any extra or specific sum being charged for the fire protection, which will only occur in special cases where the customer is a large user of water, and an exception is made in his favor.

Included in this account will be all sums received for the use of "stand-pipes," "sprinklers," etc., when used for the purposes of fire protection only and paid for accordingly.

Treat rebates, errors, etc., the same as detailed in account No. 6.

14. *Water Rates.*—Charge this account, and credit "water accounts receivable" with the gross amount of all bills for water rates.

Credit this account and charge "cash" with all sums received for water supplied, except under accounts 12 and 13.

Treat rebates, errors, etc., the same as detailed in account No. 6.

15. *Meter Rents.*—Charge this account, and credit "meter rents accounts receivable" with the gross amount of all bills for meter rents.

Credit this account, and charge "cash" with all sums received for the rent of meters.

Treat rebates, errors, etc., the same as detailed in account No. 6.

16. *Services and Repairs.*—Credit this account, and charge "cash" with all sums received for such items, all as detailed in account No. 10.

Charge this account, and credit "services and repairs accounts receivable and payable" with the gross amount of all bills for services, repairs, etc.

Treat rebates, errors, etc., the same as detailed in account No. 6.

17. *Miscellaneous Accounts.*—Credit this account, and charge "cash" with all sums received for such items as are detailed in account No. 11 as being charged to it.

Charge this account, and credit "miscellaneous accounts receivable," or the other proper accounts, with the gross amount or all bills made out for any purpose not already specified.

Treat rebates, errors, etc., the same as detailed in account No. 6.

18. *Bills Receivable.*—Charge this account, and credit the proper account with all notes received in payment of any account. When the notes are paid, credit this account, and charge "cash." When interest is received, whether included in the face of the note or paid in addition thereto, then credit interest account, and charge this account, or cash as the circumstances call for.

19. *Organization.*—Credit "cash," and charge this account with all sums expended for legal and clerical fees, notices, records, printing, traveling, and hotel expenses, cost of engraving and printing, so far as the same relates to the cost of the continuance of the organization of the company, including expenses of notices for annual meetings of the stockholders, but not special meetings of the stockholders for business purposes, which latter will be chargeable to that account for which the meeting was held.

20. *Construction.*—Charge this account, and credit "cash" with all sums paid for the original construction of the works, if done by contract, or, if the works were built by the company then credit each separate construction account with the amount charged, finally charging the same to "construction," and close the separate accounts. (See Water-Works Construction Accounts.)

After the original works are completed and in operation, charge all sums paid for new work to "construction," whenever it is in the nature of an addition, extension, or enlargement. But if it is merely to maintain, repair or replace in the original manner any particular part of the work, the cost will then be chargeable to other accounts.

21. *Real Estate.*—Charge this account, and credit "cash" with all sums spent in the care of real estate, including fences, bounds, drives, lawns, flowers, etc.; any new land, right of way, easement, etc., that may be bought will be charged to "construction."

22. *Water Supply.*—Charge this account, and credit "cash" with all sums paid to maintain the supply, such as cleaning and repair of wells, galleries, cribs, streams, springs, etc.

23. *Improvement of Water.*—Charge this account, and credit "cash" with all sums paid to improve the quality of the water, either by filtration, settling, aeration, flushing, or otherwise.

24. *Storage.*—Charge this account, and credit "cash" with all sums spent for the maintenance and repair of any dam, reservoir, well, basin, etc., intended and used merely as a place to store water.

25. *Water Power.*—Charge this account, and credit "cash" with all sums spent for the maintenance and repair of all water power, including dams, overflows, head-gates, sluices, waste-gates, wheel-pits, tail-races, but not buildings or water-wheels.

26. *Conduits, Force or Gravity Mains.*—Charge this account, and credit "cash" with all sums spent for the maintenance and repair of all conduits, force or gravity mains, when used exclusively as such.

27. *Distribution.*—Charge this account, and credit "cash" with all sums spent for the maintenance and repair of such pipes, gates, hydrants, blow-offs, etc., as belong exclusively to the distribution system; "force or gravity mains" ending and "distribution" commencing at the first hydrant or other branch.

28. *Buildings.*—Charge this account, and credit "cash" with all sums spent for the maintenance and repair of all buildings, including painting.

29. *Foundations.*—Charge this account, and credit "cash" with all sums spent for the maintenance and repair of all foundations for machinery and boilers, including pump-wells, excepting water wheels, etc.

30. *Water Wheels.*—Charge this account, and credit "cash" with all sums spent for the maintenance and repair of all water wheels, jack and crown shafts and gears, but not power-pumps.

31. *Boilers.*—Charge this account, and credit "cash" with all sums spent for the maintenance and repair of all boilers, including their setting, grate-bars, and all fittings and connections above the foundation and in the boiler-room.

32. *Pumps, either Steam or Water Power.*—Charge this account, and credit "cash" with all sums spent for the maintenance and repair of all pumps, whether operated by water or steam. If operated by steam, then the maintenance and repair of the engine or steam end of the pump will be charged to this account, including all fittings and connections above the foundations, in the engine rooms: include in this account packing, but not oil or waste.

33. *Fuel.*—Charge this account, and credit "cash" with all sums spent for fuel of all kinds and all expenses connected therewith, either in transporting, preparing, or handling the same until it is in its final receptacle, ready for use by the fireman.

34. *Oil and Waste.*—Charge this account, and credit "cash" with all sums spent for lubricating, or cleaning oil and waste used about the works, but not including illuminating oil.

35. *Lighting.*—Charge this account, and credit "cash" with all sums spent for lamps, gas, or electric light fixtures, illuminating oil, gas, or electricity.

36. *Stand-pipe.*—Charge this account and credit "cash" with all sums spent for maintenance or repair of stand-pipe, including connections, foundations and painting.

37. *Distributing Reservoir.*—Charge this account, and credit "cash" with all sums spent for maintenance and repair of reservoirs built and used for the purposes of distribution.

38. *Meters.*—Charge this account, and credit "cash" with all sums paid for meters, including freight, setting, caring for, and reading the same.

Credit this account, and charge "cash" with all sums received from the sale of meters.

At the end of the year, when "meter rents accounts receivable" is closed, it will be closed into this account, and this closed into "balance."

39. *Salaries.*—Charge this account, and credit "cash" with all sums paid the officers (not employees) of the company for services, but not expenses, which latter are chargeable to the account of the department for which they were incurred.

40. *Legal Expenses.*—Charge this account, and credit "cash" with all sums paid for counsel or court fees, together with legal printing, notices, etc., unless the same is connected with organization, when they will be charged to that account.

41. *Superintendent.*—Charge this account; and credit "cash" with all sums paid the superintendent for services. Special expenses of the superintendent will be charged to the account of the department for which they were incurred.

42. *Engineering.*—Charge this account, and credit "cash" with all sums paid for advice, plans, supervision, etc., of a technically engineering nature, either in connection with the maintenance or repair of the works.

43. *Engine-men and Firemen.*—Charge this account, and credit "cash" with all sums paid to engine-men employed in operating machinery, also firemen and watchmen employed about the pumping machinery buildings.

44. *Office Expense.*—Charge this account, and credit "cash" with all sums paid on account of office or office assistants, including rent, fuel, stationery, printing, postage, telegrams, book-keeping and clerical work, either in or out of the office.

45. *Livery.*—Charge this account, and credit "cash" with all sums paid for horses, wagons, harnesses, etc., and the care and maintenance of the same, also for sums paid out for the hire of extra or special teams, to take the place of any of the regular teams, either to relieve the latter or in case of temporary repairs or accidents.

All teams bought and used, or hired for use, exclusively for any purpose which has a separate account should be charged directly to that account, including drayage.

This account is intended to cover the cost of the superintendent's team or any other team used for the general purposes of the company.

46. *Interest.*—Charge this account, and credit "cash" with all sums paid on account of interest on bonds, bills payable, etc.

Credit this account, and charge "cash" with all sums received for accrued interest on bonds, bills receivable, etc.

47. *Discount and Commission.*—Charge this account, and credit "stock," "bonds," "bills payable," or "cash," as the case may be, with the difference between the face value of any stock, bonds, or bills payable, and the amount received for the same, or for expenses incurred in the sale of the same, including collection charges on the same, as well as on drafts or other bills of exchange, *except* when such discounts or collection charges are merely direct interest charges for use of the money during time of collection or until the note or bond is due, when it is charged to "interest."

48. *Taxes.*—Charge this account, and credit "cash" with all sums paid for taxes, whether town, city, county or State.

49. *Insurance.*—Charge this account, and credit "cash" with all sums paid for insurance on buildings, stock, etc., except in case of insurance on stock or material in transit, when it would be charged to the cost of that stock or material.

50. *General Expense.*—Charge this account, and credit "cash" with all sums paid out for anything not properly chargeable to any of the foregoing accounts, or which is not of itself of importance enough to have an account of its own.

(To be continued.)

The British *Journal of Gas Lighting, Water Supply,* etc., in referring to the collapse and sudden emptying of a reservoir at Castleford, England, says that investigation led to the discovery of a large cavity in the bottom of the reservoir through which the water had disappeared. As no flooding of the adjacent parts took place, it is surmised that there must be cavities of enormous dimensions beneath the reservoir, or that the water may have found its way into some of the disused colliery workings of the neighborhood.

CONTRACTING NEWS DEPARTMENT.

A WEEKLY RECORD

OF SPECIAL INTEREST TO CONTRACTORS, BUILDERS AND MANUFACTURERS OF ENGINEERING AND BUILDING SUPPLIES.

CONTRACTING INTELLIGENCE.

For works for which proposals are requested see also the "Proposal Columns, pages i-ii-271.

WATER.

For Additional Water Items see Proposal Columns.

Sheffield, Ala.—The City Council has taken the first steps towards a water-works system by engaging Johnson & Flood, hydraulic engineers, to make the preliminary survey.

Adairsville, Ga.—A new system of water-works is soon to be established at this place.

Lincoln, Ill.—Reports say that a new company has offered to establish a system of water-works at this place.

Jellico, Tenn.—A new system of water-works is proposed for this place. For complete particulars address the Mayor, as above.

Hebron, Iowa.—The sum of $25,000 has has been appropriated at this place for the purpose of establishing a system of water-works.

Helena, Mont.—The Eureka Reservoir Canal and Irrigation Company has been formed at this place. Capital stock, $200,000. Z. T. Burton is President.

Dover, N. J.—Extensions are to be made to the local water mains.

Wilton, Iowa.—The taxpayers of this place have voted to make an expenditure of $14,000 on a system of water-works.

Rockville Center, L. I.—Efforts are being made to have a system of water-works at this place.

Kirkwood, Mo.—The Sunset Hill Electric Light, Water and Power Company has made a proposition to erect an electric light plant and water-works at Meramec Park to supply Kirkwood and neighboring villages with water from the Meramec River.

Mellette, S. D.—The County Commissioners of Spink County have decided to submit to a vote of the people at the general election, November 4, the question of issuing county bonds for a county artesian well system.

Hopkinsville, Ky.—The long discussed water-works question at this place has terminated in the formation of a committee to go ahead with the matter, as it is probable that important steps will be taken at once.

Arkadelphia, Ark.—The City Council has appointed a committee to take the first steps towards establishing a system of water-works.

Trinidad, Col.—This place voted, August 26, in favor of establishing a system of water-works.

Newmanstown, Pa.—Reports say that this place is to have water-works.

Milford, Mass.—An additional stand pipe is to be established at this place.

Halstead, Kan.—It is proposed to revive the water-works question at this place, which was started some time ago but which gradually died out.

Sumter, S. C.—A water supply project is being considered by the City Council. Particulars can be had by addressing W. M. Graham, as above.

Wichita Falls, Tex.—This place is to have a system of water-works.

Columbia, S. C.—The Water-Works Committee recommends the purchase of water wheels and pumps at the cost of $25,000 to increase the supply of water.

Exira, Iowa.—An appropriation has been made at this place for the purpose of establishing a system of water-works.

Sioux City, Iowa.—The Leeds Water-Works Company has been organized at this place.

Marshalltown, Iowa.—A system of water-works is to be established at this place.

Middlebury, Vt.—The people of this place have decided to establish a system of water-works. Charles J. Starr can furnish particulars.

San Diego, Cal.—J. D. Schuyler, of this place, writes: "This city has taken the preliminary steps toward constructing an independent pipe distributing water-works system, with the expectation of buying water from the San Diego Flume Co., whose proposition to furnish as much as is required has been accepted. Mr. James D. Schuyler was employed to lay out a plan for the new system, covering 61.3 miles of pipe and including two distributing reservoirs in the city park. His plan was adopted by the council, and an election was called for October 4, to vote on the issuance of $326,000 in bonds, which is the limit of the city's capacity to bond. The citizens are almost unanimous in the determination to have works of their own, and cheaper and better water, and the bonds will undoubtedly carry."

Gaffney City, S. D.—Reports say that the prospects for establishing a system of water-works at this place are excellent. The question is to be decided by a vote of the citizens to be held at an early day.

Goshen, Ind.—The Town Clerk at this place writes: "The City Council approved and ratified the following contracts for improving our water-works system, at a regular session held September 15: For the Hughes' pumping engine, $3,990; addition to pump house, $1,200; extension to water mains, iron 10-inch pipe, $4,633; water supply additional to what we now have, $4,075. L. W. Wanner is superintendent of water-works."

Westfield, Pa.—The Town Clerk at this place writes: "The only steps taken for water-works so far is the incorporation of the Westfield Water Co., with a capital of $25,000, of which J. H. Millar is president and T. M. Leonard is secretary, both of Westfield, Pa."

Knoxville, Tenn.—Water-Works Superintendent R. N. Hood, writes: "It is contemplated to put in new pumps, build two new reservoirs, additional to the ones we now have, and to add about 12 miles of new mains. The reservoirs we will build will hold 3,200,000 gallons."

Henrietta, Tex.—J. B. Hopkins, and others, have organized the Henrietta Improvement and Water Company at this place, with a capital stock of $50,000.

San Angelo, Tex.—The water supply at this place is to be increased and otherwise improved.

Monticello, Ill.—City Clerk Robert Huston writes: "At our next meeting specifications will be submitted for a tubular artesian well of 6-inch pipe, and operations to commence as soon as possible."

Bay City, Mich.—The people of this place have decided to settle the question of expending the sum of $50,000 on water-works improvements, at a public election to be held in November.

Tacoma, Wash.—Surveys are being prepared for the new water-works system proposed for this place.

Sorrento, Me.—Town Clerk Henry Boynton writes: "No steps have been taken to build the water-works at Sorrento, except voting to do so at meeting of Land Company."

Monmouth, Ill.—City Clerk J. Arthur Stevenson writes: "We are spending $25,000 in extending the water mains in this city. The contractor is W. W. McCullough, of Monmouth, Ill."

St. Paul, Minn.—The Water Board on September 22 opened the bids for the furnishing of the new pumping machinery at the McCarron Lake station. The proposals were three in number, and as follows: H. R. Worthington, of New York (bids covering two different makes of machinery): First bid, $24,700; second bid, $27,000. Holly Manufacturing Company, of Lockport, N. Y. (bids covering two different makes of machinery): First bid, $28,000; second bid, $22,500. To both of these amounts $2,000 must be added for setting the boilers and arranging the steam pipes. E. P. Allis & Co., Milwaukee, $32,000. The bids were referred to Engineer Somers for his report as to which is the lowest bid.

San Antonio, Tex.—An exchange prints the following: "On September 30, the taxpayers of this place are to vote on the proposition to buy the water-works plant from Colonel G. W. Brackenridge for $2,000,000. A call has been issued for a mass meeting of citizens at the court house on Saturday night, when it is hoped to inject life into the campaign. It is pretty generally believed that the proposition will be beaten."

Rochester, N. Y.—At a meeting of the Common Council's additional water supply Committee, held September 19, a request was made to the Chief Engineer to prepare approximate estimates of the cost of obtaining 15,000,000 gallons of water per day for an additional supply from Hemlock Lake on one hand and Lake Ontario on the other; also the approximate cost of the preliminary surveys for the two projects. He is to report at the next meeting of the Committee.

Centralia, Wash.—The surveys for the water-works system which is to supply this place from the Newaukum River have been finished. A. J. Miller, President of the Bank of Centralia, has the contract.

Darlington, S. C.—City Clerk S. S. Burch, writes: "We are erecting water-works here now—it is a corporation, and I respectfully refer you to Mr. C. S. McCullough, President, for any further information."

Aberdeen, Wash.—The City Council has had plans prepared for a new system of works to cost about $50,000, The question of issuing bonds for that amount is to be voted upon. The scheme embraces a 2,000,000-gallon pumping plant, which will pump water into a tank 230 feet above the city. A reservoir will also be constructed.

La Grange, Ill.—This place is to have a system of water-works.

Babylon, L. I.—The taxpayers of this place will settle the water-works question at a public election to be held September 29.

Elmhurst, Ill.—Village Clerk A. Barder writes: "The water-works company has not organized yet, but they will do so in the near future. Engineers are just at work to get a correct survey and particulars. For any further particulars as to organization, contracts, etc., I refer you to Mr. W. H. Emery."

Macon, Ga.—Regarding the report that the water-works at this place were to be improved, City Clerk B. Smith writes: "The water-works are owned by the Macon Gas and Water Company, and I do not know of any steps being taken to improve them."

Hempstead, Tex.—For important information regarding the projected water-works system for this place, address C. C. Amaler, as above.

Water-Works.—See our Proposal Columns for information regarding water-works and water-works furnishings at the following places: Allegheny, Pa.; Atlanta, Ga.; Sutton, Neb.; Fulton, Ky.; Homestead, Pa.; Marseilles, Ill.; West Troy, N. Y.; Dallas City, Ore.; New York City; Ellsworth, Kan.; Austin, Tex.; Toronto, Can.

SEWERAGE.

For Additional Sewerage Items see Proposal Columns

Manchester, Va.—Regarding the report that this place was to have a sewerage system, Auditor J. B. Vaden, writes: "No steps taken in that direction."

San Francisco, Cal.—City Surveyor Smith has filed plans for a sewerage system for Point Lobos District with the Board of Supervisors. The district proposed to be sewered covers about 1,700 acres.

Kansas City, Mo.—Contractor Patrick McDonald has forfeited the contract for the construction of the $50,000 sewer at this place, and the work is to be re-advertised. City Engineer Butts can furnish information.

Sewers.—See our Proposal Columns for information regarding the sewer construction at the following places: Iron Mountain, Mich.; Davenport, Iowa; New York City; Key West, Fla.; Detroit, Mich.; Toronto, Can.; Denver, Col.; Dubuque, Ia.

BRIDGES AND IRON STRUCTURES.

For Additional Bridge Items see Proposal Columns

Quanah, Tex.—It is reported that $10,000 has been raised by citizens of this place for building the bridge across the Red River, which will unite Hardeman and Green counties.

New Haven, Conn.—The County Commissioners of New Haven and Fairfield Counties will, it is said, shortly ask bids for a bridge over the Housatonic River between the towns of Derby and Huntington. They expect to spend about $70,000.

Scranton, Pa.—It is reported the city will issue bonds for the erection of several iron bridges.

St. Paul, Minn.—Bridges are to be built at Como, Lexington and Snelling Avenues, the Great Northern road to bear one-third of the expense.

Reading, Pa.—The County Commissioners have received bids for the construction of a new bridge to span the Little Swatara Creek near Freytown, Bethel township. The bids presented for the iron works were these: Canton, O., Bridge Company, $22.65 per lineal foot; Pittsburg Bridge Company, $22.98; Berlin Bridge Company, $23; Smith Bridge Company, $22.95; Variety Iron Works, $43 40; Dean & Westbrook, $23.87; John Dennithorn, $23.75; Penn Bridge Company, $22.40. The contract for this work was awarded to the Penn Bridge Company, of Beaver Falls. The contract for the mason work was awarded to Joseph P. O'Reilly, this city. The bids for the masonry were: Joseph Rohrbach, $1,617, and additional foundations $7.40 per yard; Joseph P. O'Reilly, $882 and $79; Jared G. Yarnell, $1,224.50 and $4.75; Elias Dieffenbach, $1,150 and 37 cents per yard; A. A. Spannuth, $1,700 and $5.

Rockville, Conn.—The town of Ellington proposes to replace the bridge across Broad Brook River at Ladd's mills with an iron structure.

Norfolk, Va.—It is proposed to build a bridge from this city to Ghent at an estimated cost of $35,000. For particulars address A. P. Thom, as above.

St. Paul, Minn.—The plans for the superstructure and river piers for the Broadway bridge over the Mississippi River, at this place, have been sent to Washington by City Engineer Rundlett for their approval by the federal authorities. When the City Engineer receives official notification of the approval of the plans, bids for the superstructure will be advertised for. The estimated cost of the structure is $350,000.

Pittsburg, Pa.—Reports say that numerous citizens of the West End propose to bridge the Ohio River from that locality to Allegheny.

Washington, D. C.—The House Committee on Commerce has reported favorably the bill to authorize the New Orleans Terminal Railway and Bridge Company to build a bridge over the Mississippi above New Orleans.

Columbus, O.—The Board of Public Works has ordered the City Engineer to prepare plans and specifications for the High Street viaduct. The plan may involve iron or steel or stone columns.

Lincoln, Neb.—The local authorities have decided to construct two viaducts in this city. For particulars address Mayor Graham, as above.

Scranton, Pa.—The Executive Committee appointed by the recent citizens' meeting for the purpose of presenting to the people the advantages to be attained by bonding the city for the new bridges is making every effort to bring the project to a successful termination. It is probable that the City Engineer will soon be instructed to prepare plans, specifications, etc., and then it is likely an opportunity will be offered to bid on the work.

Bridges.—See our Proposal Columns for information regarding bridge construction at the following places: Middlesborough, Ky.; San Antonio, Tex.; Knoxville, Tenn.; Dublin, Ga.

NEW DEPOTS.

Norwich, Conn. — The New London Northern Railroad proposes to erect a depot at this place.

STREET-WORK AND PAVING.

Mt. Vernon, N. Y.—This village has appropriated $10,000 to macadamize the streets. Bids are now being received for part of the work.

Canton, O.—The City Council has instructed City Engineer R. R. Marble to draw up plans for three miles of streets to be paved next spring.

Buffalo, N. Y.—Considerable paving is to be done in this city. The City Engineer can furnish particulars.

Streator, Ill.—This city has decided to pave its principal streets with brick next spring.

GAS AND ELECTRIC LIGHTING.

Wetumpka, Ala.—This city has, it is reported, contracted with a Chicago (Ill.) company, for the erection of an electric light plant.

Orono, Me.—There is talk of lighting the streets and dwellings of this place by electricity. The Committee on Street Lights is ready to negotiate with some parties regarding the question.

Colusa, Cal.—There is a project at this place to establish an electric lighting plant. Address James Anthony, of Chico, Cal., for details.

Delhi, N. Y.—The long projected electric light plant for this place is about to be established.

Leechburg, Pa.—This place is to establish electric lights.

Monroe, Mich. — This place will soon have electric lights.

La Grange, Ill.—Electric lights will soon illuminate the streets of this place.

Hinton, W. Va.—A plant to cost $20,000 is to be established at this place by L. M. Dunn and others.

Pinckneyville, Ill.—A stock company has been formed for the purpose of putting in an electric light plant at this place, provided the citizens will guarantee them sufficient patronage to make the scheme pay.

Cameron, Mo. — A franchise has been granted to J. M. Anderson to establish and operate an electric light plant at this place.

Chicago, Ill.—The Whiteside and Fuller Electric Manufacturing Company has been incorporated here with a capital stock of $100,000. The incorporators are: W. H. Whiteside, W. H. Pettibone, W. D. Carlile and others. The company will manufacture electric machinery and appliances.

Stanberry, Mo.—F. A. Weimer and others have incorporated an electric light company, and a plant will be established at once. Proposed expenditure, $7,000.

Brussels, Ont.—An electric light plant will soon be in operation at this place.

Georgetown, Cal.—Reports say that a company is to light this place with electricity, and that a line will also be run to Silver Plume for illuminating purposes.

Keokuk, Iowa.—There is talk of substituting electricity for gas for public lighting at this place.

Wilton, Iowa.—This place is to have electric lights.

Kingsville, Ont.—The Town Council has agreed to loan to the Citizens' Gas Company the sum of $15,000 for the purpose of enabling the latter to lay its mains through the town.

Richmond, Va.—An ordinance has been passed authorizing the Committee on Electric Light to advertise for bids for furnishing the city with electric light for 12 months or a shorter period, from February 8, 1891.

Clyde, N. Y.—This place will soon have an electric light plant.

Mascoutah, Ill.—An electric light company has been formed at this place.

Marion, Pa.—M. C. Watson can give particulars regarding the gas company which will establish a plant, with a capital stock of $50,000.

Buffalo, N. Y.—Reports say that the authorities of this city are considering the matter of installing and operating on public account an arc lighting plant.

Hopkinsville, Ky.—This place is soon to have electric lights.

Greenville, Tex.—The local officials are considering the question of having an electric light plant.

Jamaica Plain, Mass.—The proprietors of the Jamaica Plain Gas Light Company have voted to extend their mains in the direction of the adjoining district of West Roxbury.

Delphos, O.—It is probable that extensive improvements will shortly be made to the plant of the Delphos Electric Light and Power Company.

Jamaica, L. I.—The following proposals for lighting the public streets, etc., of this place have been opened as follows: Robert S. Nash, of New York City, offered to light the village, furnishing as many electric lights as the Trustees desired, for $19 a lamp per year. The Jamaica Gas Light Company, with gas, at $25 a lamp per year, with an addition of $4 a year for each year for cleaning, lighting and extinguishing; electric light, $18 per lamp. The Woodhaven Gas Light Company, gas, $25 a lamp per year. The National Electric Manufacturing and Construction Company, $17.50 per lamp, 32 candle-power, incandescent light. George B Ellery, Heisler electric light, 32 candle-power, $18 per lamp. The contract was awarded to the National Manufacturing Construction Company.

Electric Railways.—New electric railroads will be built, and improvements will be made to those already established at the following places: Owosso, Mich.; Allentown, Pa.; Amsterdam, N. Y.; Sacramento, Cal.; Tacoma, Wash.; San Francisco, Cal.; Natick, Mass.

BIDS OPENED.

Peru, Ill.—D. C. Harr, postmaster of La Salle, Ill., plumber and steam heating engineer, has been awarded the contract, at $11,240, for heating by steam the new monastery here. There were 18 bidders.

Marion, Ind.—Goehring & Pierson, of Indianapolis, have been awarded the contract at $106,625, for the construction of a hospital and other buildings at the Soldiers' Home.

St. Paul, Minn.—The South St. Paul City Council has let the contract for the steam heating plant in the new city hall to Stewart & Larson, of St. Paul, for $1,511.

The contract for building an addition to the Stickney School was awarded to J. M. O'Grady, of St. Paul, for the sum of $3,000.

Tacoma, Wash.—The following proposals for the erection of the Court House at this place have been opened by the commissioners: John F. Long, $270,000; Lillis & Goss, $279,900; R. Smiley, $307,557; Bassford & Holtz, $308,940; J. D. Milligan, $330,000; Fred Gribble, $341,806; Frank Cantara, $353,064; Sharp & Singleton, $373,300; Nicholas & Crothers, $386,230. Contract awarded to John F. Long.

San Francisco, Cal.—Bids for construction of Section B of the sea-wall, including the filling of the wall, the thoroughfare and the wharf, have been received by the Harbor Commissioners as follows: F. J. & J. V. Owens, $93,320; Antonelli & Doe, $109,890; S. F. Bridge Company, $98,120; Warren & Malley, $103,480; W. C. Wing, $130,600; J. W. McDonald, $131,700; John Kelso, $117,160; B. McMahon & Son, $138,800. The bid of the California Bridge Company was not considered on account of failure to furnish samples of rock to be used. Contract was let to F. J. & J. V. Owens. Their bid was $14,000 less than Engineer Manson's estimate. The section begins at the foot of Powell Street, and extends along the city front to the westerly side of Taylor Street. It is 1,000 feet in length. The specifications call for 70,000 tons of rock, 84,000 cubic yards of earth, and material for the construction of a wharf all along the line.

GOVERNMENT WORK.

Washington, D. C.—The following proposals for the work named were opened on the given dates by the Supervising Architect of the Treasury Department:

Charleston, W.Va.—Low temperature, hot-water heating and ventilating apparatus for the extension of the United States Post Office, Court House, etc., at this place, opened September 24. Bidders: Crook, Horner & Co., Baltimore, Md, $6,043; L. M. Evans Construction Co., New York, $7,841; John Lyons, Washington, D. C., $5,175.75; C. Bayamin, Buena Vista, Va., $4,975.

Watertown, N. Y.—Erection and construction (except heating) of the United States Post Office at this place, opened September 19. Bidders: Peter Pitkin & Son, Rochester, N. Y., Gouverneur marble, $84,000; Warsaw blue stone, $81,000. E. J. Bell, Portland, Conn., Middlesex brown stone, $56,000. McAllister & Dall, Cleveland, O., New York marble, $62,997; Ohio blue stone, $60,728; R. Mara & Co., Syracuse, N. Y., Onondaga, $69,400; Amherst, $70,500; Berea, $68,300; Patrick Philips, Watertown, N. Y., Bannister blue limestone, $52,065.73. William H. Stemburg, Wichita, Syracuse limestone, $54,987. Hughes Bros., Syracuse, N. Y., Berea, $53,870; Amherst, $55,870; Indiana limestone, $56,370; Georgia marble, $59,370; Chaumont limestone, $54,000; Onondaga limestone, $56,850. John Moore, Syracuse, N. Y., Gouverneur marble, $55,000; O'Brien & Hoolihan, Syracuse, N. Y., New York marble, $56,864. George Van Horn, Washington, D. C., St. Lawrence, Gouverneur, New York, $77,284; Berea, $68,284.26.

INDUSTRIAL.

Peoria, Ill.—It is proposed to build a tunnel a quarter of a mile long for the benefit of railway travel. The Peoria Improvement Association can give information.

Weldon, N. C.—A charter has been granted to the Great Falls Water Power Manufacturing and Improvement Company, which has for its principal object the development and utilization of the water power of the Roanoke River between this place and Gaston.

Boston, Mass.—The New England Telegraph and Telephone Company is considering the feasibility of replacing all old cedar poles with iron and steel.

Long Branch, N. J.—The Commissioners at a special meeting September 16, decided to restore the Boulevard and build a bulkhead and jetties the entire length of the town limits. A double track electric railway will be laid. The roadway will have a promenade on one side, a drive on the other, and the tracks in the middle.

New York City.—The Armory Board has decided to build an armory in West Fourteenth Street, on the site of the old Twenty-second Regiment Armory, and upon two additional lots west of it. President Coleman has been authorized to negotiate for the purchase of the site for $390,000. When built the new armory will be used by the Ninth Regiment.

WANTED.

TOO LATE FOR CLASSIFICATION.

AN ARCHITECT OF EXPERIENCE DESIRES to form partnership with an architect having a good practice and doing first-class work, in some eastern or southern city, coast city preferred. Address ARCHITECT, Box 113, office of THE ENGINEERING AND BUILDING RECORD, New York.

A YOUNG MAN WITH FOUR OR FIVE YEARS' experience in civil engineering and surveying, desires a position as leveler or rodman on preliminary surveys or sewer construction; salary moderate; can give good references. Address P. L. R., Box 73, this office.

POSITION WANTED BY A YOUNG MAN with ten years' experience in architect's and builder's office, familar with practical details, construction and drawings; fair draughtsman. Address Q., Box 72, this office.

PROPOSALS.

(Continued from page ii.)

U. S. ENGINEER OFFICE, ROOM 62, ARMY Building, New York, September 24, 1890.—Sealed proposals, in triplicate, will be received at this office until 12 o'clock noon on October 25, 1890, for furnishing materials and **CONSTRUCTING A PILE WHARF** at SANDY HOOK, N. J. The attention of bidders is invited to Acts of Congress, approved February 26, 1885, and February 23, 1887, Vol. 23, page 332, and Vol. 24, page 414, Statutes-at-Large. For specifications, blank forms, and all information, apply to the undersigned. G. L. GILLESPIE, Lieut.-Col. of Engineers. 20

SEPTEMBER 25, 1890.

SEALED PROPOSALS WILL BE RECEIVED at the office of the Supervising Architect, Treasury Department, Washington, D. C., until 2 o'clock P. M. on the 15th day of October, 1890, for all the labor and material and fixing in place complete the low-pressure **STEAM HEATING AND VENTILATING APPARATUS** for the U. S. Court-House and Post-Office Building at CHARLOTTE, N. C., in accordance with drawings and specification, copies of which may be had on application at this office or the office of the Superintendent at Charlotte, N. C. Each bid must be accompanied by a certified check for $100. The Department will reject all bids received after the time herein stated for the opening of the same; also, bids which do not comply strictly with all the requirements of this invitation. Proposals must be inclosed in an envelope sealed and marked "Proposal for the Low-Pressure Steam Heating and Ventilating Apparatus, for the U. S. Court-House and Post-Office Building at Charlotte, N. C.," and addressed to JAS. H. WINDRIM, Supervising Architect. 18

PROPOSALS.

Notice to Contractors.

SEALED BIDS FOR THE GRADING, SEWERING, DRAINING, MACADAMIZING, and otherwise improving the streets and avenues of PELHAM HEIGHTS, WESTCHESTER CO., N. Y., in accordance with the contract and specifications to be furnished by the Engineer in charge, No. 152 Prospect Avenue, Mt. Vernon, N. Y., until 12 o'clock M. of WEDNESDAY, October 15, 1890.

No bids will be received unless accompanied by a certified check for five hundred dollars as a guarantee of signing contract if bid is accepted.

All bids must be made upon the blank forms furnished by the engineer.

The owners reserve the right to reject any or all bids or parts of bids. Bids must be made for the whole work.

The sewers are to be pipe sewers. The property is situated at Pelhamville Station, N. Y., N. H. & H. R. R.

The following is a general summary of the estimates:

Grading	81,399	cubic yards.
Macadamizing	78,615	square yards.
Gutters	49,930	lineal feet.
Sidewalks	27,693	square yards.
Sodding	35,903	" "
Trees to be planted	1,645	
Sewerage	30,318	lin. ft. of pipe with accessories.
Drainage	13,000	" " "
Water pipe	30,986	" " "
Gas pipe	30,000	" " "

Plans can be seen, and specifications and other printed forms obtained upon application to the Engineer in charge.

BEN. L. FAIRCHILD,
GEORGE B. CRUMBIE, } Owners.
JOHN F. FAIRCHILD,
Engineer in Charge. 18

WATER-WORKS, Homestead, Pa.—Proposals are wanted until October 1, for furnishing plans, specifications, etc., and superintending the construction of a system of water-works at this place. Address James M Hoover, Chairman Water-Works Committee, as above.

BRIDGE, Knoxville, Tenn —Proposals are wanted until October 4, for the erection of an iron bridge on Fifth Avenue, this city. Address the City Engineer, as above.

AQUEDUCT, New York City. — Proposals are wanted until October 8, for building 11 head-house superstructures, etc., for the shafts of the new Croton Aqueduct. Address John C. Sheehan, Secretary of the Aqueduct Commission, as above.

PUMPING ENGINES, Toronto, Can.—Proposals are wanted until October 20, for furnishing two duplex pumping engines, with a 10,000,000-gallon capacity, also the necessary boilers, etc., for the same. Address William J. Hill, Chairman Committee on Water-Works, as above.

PAVING, New York City.—Proposals are wanted until September 30, for paving certain streets. Address the Department of Public Works, as above.

PIPE, ETC., Marseilles, Ill.—Proposals are wanted until October 4, for furnishing a quantity of water-pipes, specials, etc. Address C. L Stinson, City Clerk, as above.

DREDGING, New York City. — Proposals are wanted until October 13, for dredging for proposed bulkhead wall at East One Hundred and Second Street section on the Harlem River. Address the Department of Docks, Pier A, North River, as above.

STATE CANALS, Albany, N. Y.—Proposals are wanted until October 6, for doing certain work on the State canals. Address Edward Hannan, Superintendent of Public Works, as above.

WATER SERVICE SYSTEM, West Troy, N. Y. —Proposals are wanted until October 6, for furnishing material and labor complete for a water service system at the Watervliet Arsenal. Address Lieut -Col. C. H. Parker, U. S. A., as above.

CARPENTER AND IRON WORK, Toronto, Can.—Proposals are wanted until October 1, for the rough carpenter work and the constructional iron work of an office building in this city. Address Knox & Elliott, architects, corner Queen and Victoria Streets, as above.

BRIDGE, Dublin, Ga.—Proposals are wanted until October 20, for the erection of an iron bridge across the Oconee River, at this place. Address John F. Duncan, Ordinary, as above.

SEWERS, Detroit, Mich.—Proposals are wanted until October 6, for the construction of numerous sewers in this city. Address the Board of Public Works, as above.

MACADAMIZING, Dunkirk, N. Y.—Proposals are wanted until October 3, for macadamizing certain roads in the vicinity of this place. Address Edward Madigan, City Clerk, as above.

SEWERS, Denver, Col.—Proposals are wanted until October 17, for the construction of certain sewers in this city Address F. B. Crocker, President of the Board of Public Works, as above.

SEWERS, Toronto, Can.—Proposals are wanted until October 7, for the construction of sertain sewers at this place. Address John Shaw, Chairman Committee on Works, as above,

PAVING, New York City.—Proposals are wanted until October 7, for doing certain streets paving. Address the Department of Public Works, as above.

DREDGING, New York City.—Proposals are wanted until October 9, for dredging for a pier at the foot of East Twenty-second Street. Address the Department of Docks, Pier A, North River, as above.

ROADS, Tompkinsville, S. I.—Proposals are wanted until October 13, for the improvement of certain roads at this place. Address Charles M. Todd, Supervisors' Clerk, *pro tem*, as above.

PIPE, BOILERS, ETC., Water Valley, Miss.—Proposals are wanted, no date specified, for furnishing pipe, boilers, pumps, etc., for water-works. Address Mayor W. A. Herring, as above.

Building Intelligence.

NEW YORK.

59th st, s s, 200 w 6th av, br and s school bldg; cost, $40,000; o, J Goldman; a, Schickel & Co.

9th av, s w cor 15th st, br warehouse; cost, $8,000; lessee, C H Southard; a, Berg & Clark.

Columbus (9th) av, e s, 50.5 s 118th st, br and st flat; cost, $18,500; o, A Gallo; a, J Barrett.

616-18 West 52d st, br stable; cost, $10,–000; o, G W Plunkett; a, W H C Hormun.

226 Rivington st, br shop; cost, $7,000; o, J Kern; a, A J Finkle.

S w cor 72d st and av B, br stable; cost, $8,000; o, A Kempt; a, M C Merritt.

S s 72d st, 45 w av B, 2 br tens; cost, $26,000 all; o and a, same as above.

155-59 East 23d st, br store; cost, $100,000; o, Jordan & Moriarty; a, A Wagner.

846 7th av, br flats; cost, $18,000; o, T Buckley; a, French & Dixon.

N s 109th st, 95 e av A, 2 br dwells; cost, $28,000 all; o, J McGunners; a, R C Mc–Lane.

23 Orchard st. br ten; cost, $10,000; o, A J Dworsky; a, Herter Bros.

63 Canal st, br ten; cost, $7,500; o and a, same as above.

E s Linton av, 225 s 166th st, 4 fr dwells; cost, $12,000 all; o and a, W Bloodgood.

S s 123d st, 175 e 7th av, 6 br dwells; cost, $84,000 all; o, E K Smith; a, R R Davis.

13th, Grace, Thompson, Lawton avs, br market; cost, $9,000; o, City of New York; a, not given.

147-49 Clinton st. br flat; cost, $26,000; o, M Jacobson; a, F Ebeling.

ALTERATIONS—NEW YORK.

1448 Broadway, br hotel; cost, $100,000; o, L L Todd; a, T E Thomas.

563-65 Greenwich st, br factory; cost, $20,000; o, L Gordon, a, T G Smith.

236-44 Eldridge st, br factory; cost, $25,000; o, Nayerweather & Laden; a, Romeipe & Stever

BROOKLYN.

S s Bleecker st, 334 w Knickerbocker av, 4 fr dwells; cost, $12,000 all; o, Crons & Montgomery; a, W M Coots.

E s Graham st, 102 n Willoughby av, br school; cost, $60,000; o, Rev Thos Taafe; a, T F Houghton.

N s Himrod st, 175 w Knickerbocker av, 6 fr schools; cost, $25,500 all; o, G Gutting; a, F J Lessing.

N s McDonough st, 90 w Howard av, 6 br schools; cost, $33,000 all; o, T Macdonald; a, A Hill & Son.

N w cor Greene and Sumner avs, br school; cost, $20,000; o, T B Bryant; a, J E Dwyer.

N s Ridgewood av, 70 e Linwood st, 3 fr schools; cost, $7,500 all; o, W Cosly; a, E G Vail, Jr.

W s Vanderbilt av, 75 feet n St Mark's, 4 br schools; cost, $14,000 all: o, D O'Connell; a, I A Remson.

N s Eagle st, 395 e Franklin st, br school; cost, $39,700, o, Board of Education; a, J W Naughton.

N s Pacific st, 212 w Classon av, 2 br dwells; cost, $17,000 all; o, G W Powell; a, not given.

N w cor Herkimer st and Ralph av, br dwells; cost, $10,000; o, C Welsher; a, N Holmberg.

Chauncey st, s s, 325 e Stuyvesant av, 7 br dwells; cost, $3,500 each; o, Michael O'Mara; a, John E Dwyer; b, not selected.

Essex st, e s, 90 s Ridgewood av, 4 fr dwells; cost, $3,000 each; o and b, Andrew Walker.

ALTERATIONS—BROOKLYN.

W s Bedford av, 60 n Madison st, br dwell; cost, $7,187; o, Aurora Grata Association; a, R B Eastman.

N s Stagg st, near Waterbury st, br school; cost, $46,000; o, Board of Education; a, J W Naughton.

MISCELLANEOUS.

BATAVIA, O.—The Jail Commission of Clermont County, Ohio, will build a new jail at this place, from plans they have accepted, to cost $25,000. J R Shaw is President of the Commission.

BUILDING INTELLIGENCE.

BOSTON, MASS.—Brighton av, near Harvard st, stone church; cost, $40,000; o, Allston Congregational Society; a, E L Clark; b, Woodbury & Leighton.

157 Harrison av, br ladder house (B F D); cost, $14,000; o, city of Boston; a, city architect; b, D H Jacobs & Son.

Walker st, cor Russell st, br apart; cost, $10,000; o, I J McCantey; a, G W Capen.

459–61 Sumner st, 2 fr dwells; cost, $7,500; o and b, John McCormick; a, J S Eastman.

Milton av, near Norfolk st, 3 fr dwells; cost, $8,000; o, F L Creesy; a, G F Wallis; b, E O Goodwin.

37 Savin st, fr dwell; cost, $7,000; o, Hannah L Connell; a, A B Pinkham; b, W S Davis.

CINCINNATI, O.—Birr and Dodsworth sts, br church; cost, $10,000; o, Mt Zion M E Church; a, Samuel Hannaford's Sons.

Grand av and Morris st, 3½-story flats; cost, $7,000; o, Francis D Cloud.

3d and Smith sts, 10-story office bldg; cost, $150,000; o, Central Union Depot and R'y Co.

Court and Harriet sts, 3 story br foundry; cost, $40,000; o, John G Morris; a, Samuel Hannaford's Sons.

COLORADO SPRINGS, COL.—John T. Ford, of Baltimore, proposes to build a $100,000 hotel here.

DETROIT, MICH.—268–274 W Fort st, br block enlarged and remodeled for hotel; cost, $25,000; o, Estate of G H Hammond; b, not let.

Woodward av, n of R R crossing, 2-story br schoolhouse; cost, $25,000; o, Board of Education; a, R W Wallace; b, not let.

Farnsworth st bet John R and Brush sts, 2½-story br and s res; cost, $7,000; o, Wm Reid; a, A C Varney & Co; b, not let.

LADD, ILL.—The Diamond Drill Works, of Chicago, will build a $32,000 drill works here next season.

LA SALLE, ILL.—J E Malone, Kawin & Co, T Lucey, A Locke, and Joseph Daily will build a block of 2-story pressed brick stores next spring.

The Turners will build a new hall after plans by Architect Boehm, of Joliet. The contract for plumbing has been awarded to George B Leonard for $1,800.

McGREGOR, IOWA. — Joseph Reynolds, better known as "Diamond Joe," of the barge and steamboat line on the Mississippi, it is said will build a large hotel here.

MADRID, N. Y.—Fr house; o, J E Boynton; cost, $3,500; heat with furnace.

PRINCETON, N. J.—Plans for a large dormitory at the college at this place, have just been completed by architect John L Faxon, of Boston, Mass. The estimated cost is $120,000.

PROVIDENCE, R. I.—Lincoln st, Swedish church; o, Swedish Gloria Der Parish.

STREATOR, ILL.—Howland & Co., furniture dealers, will erect a brick block next season.

SIOUX CITY, IOWA.—Lynn addition to Sioux City, shoe factory, 35x300; cost, $20,000; o and a, Geo Parsons & Co; b, Younglove & Smith.

TACOMA, WASH.—The Tacoma Land Company has received plans for a $750,000 hotel.

WEST ELGIN, ILL.—Brick school-house; cost, $24,000; o, City of Elgin; a, C L Stiles.

WORCESTER, MASS.—Main corner of Austin st, br block; cost, $20,000; o, R C Taylor; a, J William Patstone; b, S I Howard.

YONKERS, N. Y.—The Committee on Buildings of the Palisade Club, of Yonkers, have had plans prepared for a new club house, to cost $21,000. The architect is Mr Henry C Rapelye, of Mount Vernon.

BUILDINGS.—There is nothing over $7,000 in value to report at the following places: Geneva, N. Y.; Warren, O.; Charleston, S. C.; Findlay, O.; Dennison, O.; Harrisburg, Pa.; Topeka, Kan.; Canton, O.; Dayton, O.; Madison, Wis.; Wheeling, W. Va.; Saginaw, Mich.; Milwaukee, Wis.

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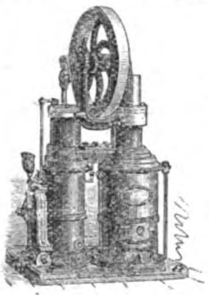

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VISIT OF THE FOREIGN ENGINEERS TO THE UNITED STATES.

THE New York meeting of the American Institute of Mining Engineers, which was held this week, was remarkable in several respects, having been not only a gathering of that body alone, but, in a measure, also of many members of the sister societies of civil, mechanical and electrical engineers to welcome to the United States visiting members of the British Iron and Steel Institute and of the Verein Deutscher Eisenhuettenleute. The meeting was of a decidedly international character, the foreign engineering institutions being largely represented, several hundred members being present.

The plan of having a meeting of the British Iron and Steel Institute in the United States is one of several years' standing and has been talked over a good deal, but its execution seems to have finally been hastened by the visit to Europe last year of the mining, civil and mechanical engineers' societies of this country. The simultaneous coming of the German engineers, who represent industries closely allied to those of the Iron and Steel Institute, adds to the importance of the gathering, and has helped to bring about an opportunity for at least a partial return of those courtesies which were extended so lavishly to the American engineers during their stay abroad. How well this return is to be effected can at present best be indicated by a brief review of the programme which has been mapped out by the American Committee of Arrangements and Entertainment.

Besides excursions on Tuesday and Wednesday, specially arranged for the ladies in attendance, there was an excursion up the Hudson River, by boat, on Wednesday afternoon, while for yesterday afternoon three others had been arranged to different points; one by boat up the East River to the Navy Yard, the De La Vergne Refrigerating Machine Company's Works, and to the Washington Bridge over the Harlem; another, by train, to the Tilly Foster Iron Mine and Electrical Separating Works; and the third, by train, to the Edison laboratory at Llewellyn Park, N. J. Invitations had also been extended to visit the Hudson River Tunnel and various noteworthy manufacturing establishments in the vicinity of New York.

To-day, the members and guests proceed, by special train, to Philadelphia; on Tuesday, October 7, to Lebanon and Harrisburg; and on Wednesday to Johnstown and Altoona, arriving Wednesday evening at Pittsburg, according to the programme of the General Reception Committee. At Pittsburg, two joint international sessions will be held by the Mining Engineers and the Iron and Steel Institute and their guests, for the reading of papers.

The general excursion will proceed from Pittsburg to Chicago, and at the close of the visit to Chicago will divide into two parties, going respectively north and south. According to the programme of the General Reception Committee, the northern excursion will visit the Menominee, Gogebic and Marquette iron ranges and the Lake Superior copper district, returning to New York *via* the Sault Ste. Marie Canal, the Sudbury (Canada) nickel and copper mines, and Niagara, while the southern excursion will go from Chicago to Birmingham, Shelby and Anniston, Ala., returning to New York *via* Chattanooga, Tenn., Middlesborough, Roanoke, Cripple Creek iron mines and Pocahontas coal mines, Luray, Va., and Washington. Both excursions will reach New York about October 28.

Considering the proceedings of the week just past, it was scarcely to be expected that much work would be accomplished at the various sessions in the way of reading and discussing papers. Of such papers there was certainly no lack, but the attractions of sight-seeing and unconventional social intercourse among the members were sufficient to keep all but a relatively small proportion away from the business sessions. The foreign visitors were naturally anxious to see all there was to be seen in and around New York, and the American engineers, ably assisted by a local committee of ladies, were correspondingly anxious to prove themselves agreeable and satisfactory guides. The slim attendance at the sessions, though unfortunate, was, therefore, not to the discredit of the papers. It is, moreover, not to be expected that the experiences in connection with the sessions next week will be remarkably different. However much the tendency may have been criticised to spend a large share of the time during engineering conventions in excursions to different points of interest, the fact remains that a good deal of information, not otherwise readily obtainable, is made available by this plan, and even in the present instance it is not likely that there will be any murmurs that time has been needlessly wasted.

So far as the foreign guests are concerned, it seems almost needless to say that they will not be permitted to leave the United States without having been given good opportunities to form reasonably fair impressions of the natural and industrial resources of the country.

RAPID TRANSIT IN CITIES.

SOME very interesting and valuable figures, illustrating the development of rapid transit in cities, are given in Census Bulletin No. 11, devoted to transportation, and just issued from the Census Office at Washington. Street railroads have never before been brought within the scope of the census statistics of transportation, and some peculiar difficulties were met with in collecting the figures. Of the 286 street railroads to which the statistics relate, having a total length of 3150.93 miles, thirteen with a total length of 135.75 miles had not made reports up to the time of publishing the bulletin, and the information in regard to them was obtained with approximate correctness from other sources. In several other cases the returns received were so imperfect that it was necessary to resort to approximations. Taken altogether, however, the work would seem to have been carried out with commendable attention to details and the published tables are, no doubt, the most reliable now existing. They show the growth of rapid transit facilities from 1880 to 1889, inclusive, in cities of the United States having over 50,000 inhabitants.

There are, in all, five tables replete with valuable data. Table I. gives the number of miles operated in each city during the years stated, and also the aggregate mileage of the 56 cities for each year; Table II. shows the increase and percentage of increase in the aggregate mileage of the different roads; Table III. the total mileage operated in each city on December 31, 1889, is subdivided so as to show the number of miles operated by each of the various kinds of motive power; Table IV. shows the percentage of total mileage operated by each kind of motive power on the same date; and Table V., finally, shows not only the total length of line in each city on December 31, 1889, but also how much of this line is laid with single and how much with double track. The length of all tracks, including sidings, is also given.

It appears, that of the cities considered, Omaha has made the greatest increase. Starting with 4½ miles of track in 1880, there are now nearly 45 miles. Denver has grown from 8 to 63½ miles; Minneapolis has increased to 42½ miles; Chicago, in the ten years, has laid 104 miles, increasing 129.6 per cent.; Philadelphia, which is near the bottom of the list, has added 34¼ miles, or 13.76 per cent. in the ten years. Of electric roads Boston has 49 miles, Scranton 23, Pittsburg 20, Omaha 23, and Cleveland 18. Denver has 29 miles of cable road, Kansas City 38, San Francisco 47, Chicago 24, St. Louis 20, Philadelphia 23. New York has 32½ miles of elevated roads, Brooklyn 24¼, and Kansas City 5⅛. Of surface roads operated by steam, Birmingham, Ala., has 60 miles, Kansas City 32½, Los Angeles, Col., 25¾; Nashville, Tenn., 20; Minneapolis 23; and San Francisco 13.

It is out of the question to reproduce all the tables here, but to the more particularly interested reader reference to them will prove instructive. As an illustration, however, of the extent to which the various kinds of motive power are in use we append Table IV.:

Motive Power.	Miles.	Per cent.
Animal power	2,351.10	74.62
Electricity	260.36	8.26
Cable	255.87	8.12
Steam (elevated roads)	61.79	1.96
Steam (surface roads)	221.81	7.04
Total	3,150.93	100.00

These figures tell their own story. Among the comparisons which the other tables make possible, it may be of interest to briefly state that the table giving the length of line in 1889, shows Philadelphia far ahead of all other cities. The length assigned to each of the leading five cities is as follows: Philadelphia, 283.47 miles; Boston, 200.86; Chicago, 184.78; New York, 177.10; and Brooklyn, 164.44. In the table, however, which gives the length of all tracks, we find that, as regards the position of Philadelphia, the table is reversed, and that New York rises from fourth to first place. The number of miles assigned to each city in that table is: New York, 368.62; Chicago, 365.50; Boston, 329.47; Brooklyn, 324.63; and Philadelphia, 324.21. The reason of these changes becomes clear by the statement that the length of double track in each of the five cities is as follows: Chicago, 176.05 miles; New York, 161.90; Brooklyn, 138.84; Boston, 104.54; and Philadelphia, 39.99 miles. From this it is seen to be a peculiarity of the Philadelphia roads, and, to some extent, of the Boston roads also, that the tracks usually occupy different streets in going to and from a terminus, instead of being laid upon the same street. The result of this is that roads in the cities named traverse a greater length of street in proportion to track length than in New York, Brooklyn or Chicago.

As to rapid transit facilities in cities of the United States generally, the statistics show that on December 31, 1889, 476 cities and towns had street railroads, and that the total number of these in independent operation was 807.

It is announced that Lieut. L. N. B. Wyse has obtained from the United States of Columbia an extension of the time for completing the Panama Canal, probably adding six years to the present concession, which ends in 1892.

STORAGE BATTERY STREET CARS AT PARIS.

Experiments with the working of tramways by electricity, says the London *Electrician*, are being continued in Paris by the Northern Company on the line between Levallois and Madeleine. Four cars are practically worked, and the Société Francaise d'Accumulateurs Electriques (Faure-Sellon-Volckmar), who supply the motive power at the rate of 3*d*. per car and kilometer, are of opinion that the traffic will be permanent. The motive power is furnished by Faure-Sellon-Volckmar accumulators, with double plates. The batteries are divided in 12 boxes, each containing nine elements coupled in series, 108 cells in all, and as each element weighs 15 kilograms, the total weight of the battery is 1,620 kilograms.

The 12 boxes are placed in cupboards in the corners of the car—four in front and eight behind. The connections are so arranged that the elements, when the boxes are fixed in their places, become automatically ranged in groups of three by three boxes behind each other, so that there are four groups in all of 27 elements ranged after each other. These four groups may be connected for work in four different ways, as at the Birmingham tramway. The various connections are effected by the aid of a commutator, consisting of a wooden cylinder, with contacts on the surface. The cylinder is turned by a handle. The electrical motor is of Siemens' construction, and situated below the car in front. The number of revolutions may be raised to 1,600 a minute, but under normal working it is 1,000. The power is transmitted to the wheels of the car through gearing, which reduces the speed in the proportion of 26 to 1.

The motor is reversed by the use of a double set of brushes. The cars weigh 3,500 kilograms, there being 1,600 kilograms of accumulators, and they carry 50 persons. During ordinary speed of 11 kilometers (6.85 miles) an hour the electrical work required is as follows: On level road, 4.3 h. p. (16 ampères × 200 volts); on incline of 1 in 100, 7.8 h. p. (29 ampères × 200 volts); on incline of 1 in 50, 11 h. p. (42 ampères × 200 volts). With a speed of 9 kilometers (5⅝ miles) an hour and an incline of 1 in 33, 12.3 h. p. (46 ampères × 200 volts) are required. On an incline of 1 in 25, 15.3 h. p, (57 ampères × 200 volts). Finally, with a speed of 5 kilometers (3 miles) an hour and an incline of 1 in 20 the force is 10.2 h. p. (38 ampères × 200 volts), and on an incline of 1 in 18, 10.75 h. p. (40 ampères × 200 volts).

JARRAH WOOD.

The last number of the *Kew Bulleton* contains a note on the properties and uses of the jarrah wood, a species of eucalyptus, native to Western Australia. The main difficulties in connection with its use in this country are the cost of freight for such heavy timber from Australia and its intense hardness, which makes it difficult for ordinary English carpenters' tools to work it. The tree which produces it grows generally to a height of 100 feet, and sometimes 150 feet. It is found only in Western Australia, extending over the greater portion of the country from the Moore River to King George's Sound, forming mainly the forests of these tracts. According to Baron Mueller, when selected from hilly localities, cut while the sap is least active, and subsequently carefully dried, it proves impervious to the borings of insects. Vessels constructed solely of it, have, after 25 years' constant service, remained perfectly sound, although not coppered. It has been tried at three places in the Suez Canal, and after having been down seven years, the trial samples were taken up in order that a report on their condition might be sent to Paris.

Under the head "The City House in the West," Mr. John W. Root, of the firm Burnham & Root, architects, of Chicago, Ill., contributes an interesting article to the October number of *Scribner's Magazine*. As implied in the title, the article concerns itself with one line of Western city architecture, and the reader will find, besides Mr. Root's well written account, a series of finely executed engravings illustrating the subject.

THE ARCHITECTURAL LEAGUE OF NEW YORK.

The next meeting of the League will be held on Monday evening, October 6, at the "Arena," No. 41 West Thirty-first Street. Dinner will be served at 6.30 o'clock. Mr. F. S. Dellenbaugh will speak on the subject of "Architectural Forms in Nature."

The Committee on Current Work announces that arrangements have been made with Mr. C. H. Blackall, of Boston, to read a paper on "Portuguese Architecture." at the November meeting.

MEETINGS OF ENGINEERING SOCIETIES.

The **American Society of Civil Engineers** holds its regular meetings on the first and third Wednesday in each month, at the House of the Society, 127 East Twenty-third Street, New York.

The **Boston Society of Civil Engineers** holds its regular meetings at the American House, Boston, at 7.30 P. M., on the third Wednesday in each month.

The **Western Society of Engineers** holds its regular meetings at its hall, No. 67 Washington Street, Chicago. at 7.30 P. M., on the first Wednesday in each month.

The **Engineers' Club of St. Louis** holds regular meetings in the club's room, Laclede Building, corner Fourth and Olive Streets, St. Louis, on the first and third Wednesdays in each month.

The **Engineers' Club of Philadelphia** holds regular meetings at the House of the Club, 1122 Girard Street, Philadelphia.

The **Engineers' Society of Western Pennsylvania** holds regular meetings on the third Tuesday in each month, at 7.30 P. M., at its rooms in the Penn Building, Pittsburg, Pa.

The **Engineers' Club of Cincinnati** holds its regular meetings at 8 P. M. on the third Thursday of each month at the Club rooms, No. 24 West Fourth Street, Cincinnati.

The **Civil Engineers' Club of Cleveland** holds regular meetings on the second Tuesday of each month, at 8 P. M., in the Case Library Building, Cleveland. Semi-monthly meetings are held on the fourth Tuesday of the month.

The **Engineers' Club of Kansas City** meets in Room 200, Baird Building, Kansas City, Mo., on the second Monday in each month.

The **Engineering Association of the Southwest** holds regular meetings on the second Thursday evening of each month at 8 o'clock, at the Association headquarters, Nos. 63 and 64 Baxter Court, Nashville, Tenn.

The **Civil Engineers' Society of St. Paul** meets at St. Paul, Minn., on the first Monday in each month.

The **Montana Society of Civil Engineers** meets at Helena, Mont., at 7.30 P. M., on the third Saturday in each month.

The **Civil Engineers' Association of Kansas** holds regular meetings on the first Wednesday in each month at Wichita, Kan.

The **New England Water-Works Association** holds quarterly meetings in Boston at Young's Hotel.

The **Canadian Society of Civil Engineers** holds its regular meetings on each alternate Thursday, commencing with the 9th of October, at the House of the Society, 112 Mansfield Street, Montreal.

The first fall meeting of the Engineers' Club of Philadelphia will be held at the Club House to-day at 8 o'clock P. M.

The convention of the American Institute of Architects will be held in Washington, D. C., beginning on October 22, and continuing until the business has been completed. Papers on art, construction and kindred topics are solicited from the members. The titles of such papers should be forwarded to the Committee of Arrangements by October 8, so they can be arranged for in the Order of Proceedings

The corner stone of the new Chamber of Commerce building at Boston, Mass., was laid on September 29.

OBITUARY

William Johnson, architect, died at Brooklyn, N. Y., last week, of a complication of diseases and old age.

Frederick Billings, ex-President of the Northern Pacific Railroad, died on September 30, in Woodstock, Vt., from the effects of a paralytic stroke and advanced age.

Stephen P. Perkins, an old and well-known builder, of Woodbridge, Conn., died suddenly on September 27. Among numerous prominent buildings which Mr. Perkins constructed are the Yale Art School, the Peabody Museum at Yale, the Alumni Hall on the campus, Yale Divinity School, North Sheffield Hall of the Scientific School, the Church of the Sacred Heart, and the old railroad station at Hartford.

PERSONAL.

Willis W. Casey, C. E., was recently appointed Deputy County Surveyor at Joliet, Ill.

Mr. A. P. Cutting, architect, of Worcester, Mass., has just returned from a two months' trip in Europe.

Hon. John Bogart, State Engineer New York, and Secretary American Society of Civil Engineers, arrived from Europe on September 29.

Arthur H. Williams, a prominent contractor of Camden, N. J., was killed at a Camden and Atlantic Railroad crossing on September 30.

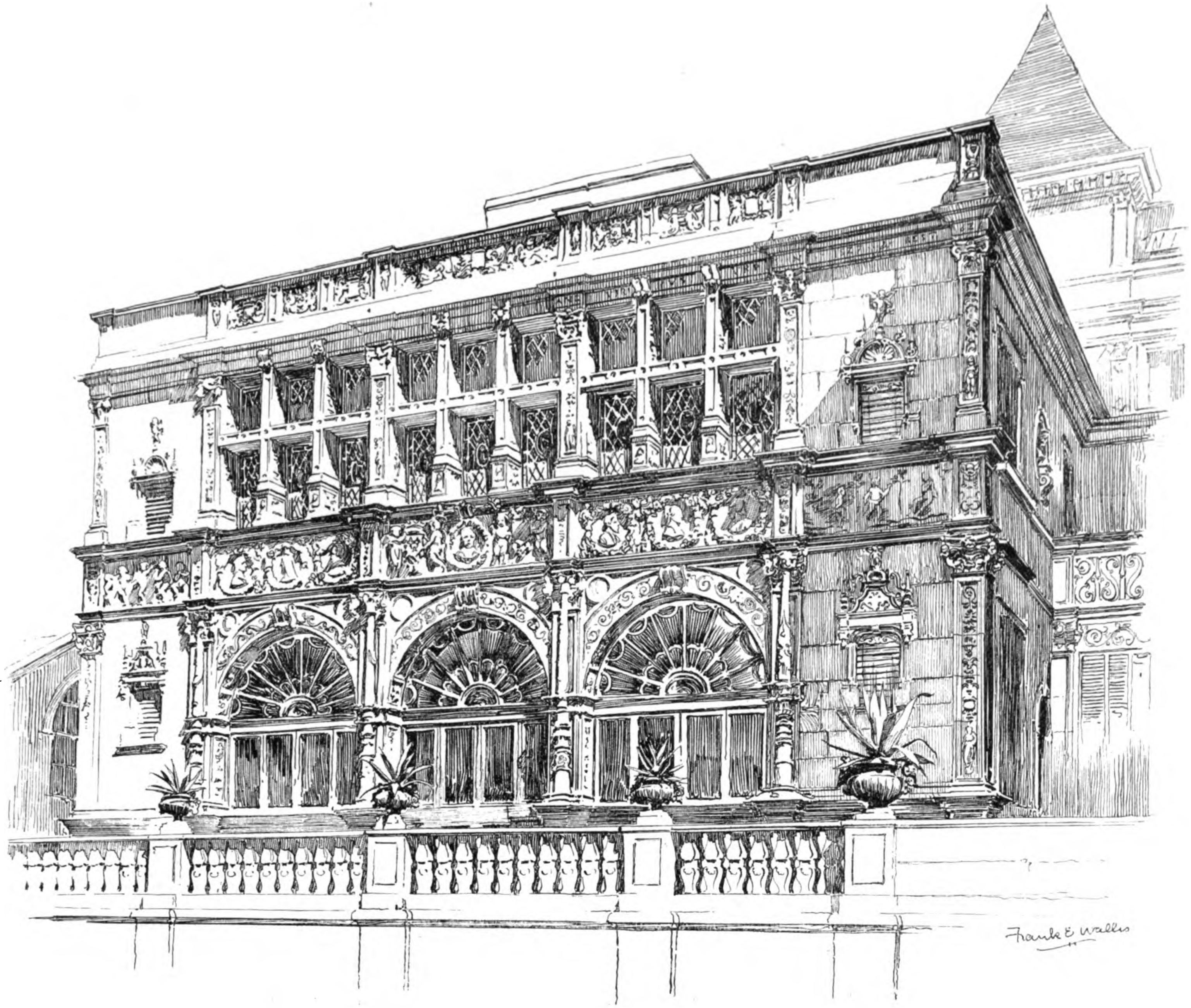
At the New York meeting of the British Iron and Steel Institute, Sir Frederick Abel, C. B., F. R. S., of London, was chosen to succeed Sir James Kitson, Bart., as president for the ensuing year.

Henry W. Cannon, President of the Chase National Bank, has been appointed by Mayor Grant of New York, to fill the vacancy in the Aqueduct Commission caused by the death of Walter Howe.

Among other prominent members of the British Iron and Steel Institute now at New York, are: Sir James Kitson, Bart., Sir John G. N. Alleyne, Bart., P. C. Gilchrist, E. P. Martin, E. Windsor Richards, G. T. Snelus and J. S. Jeans.

OUR ARCHITECTURAL ILLUSTRATIONS.

SHOOTING LODGE OF FRANCIS I., PARIS.



THE ENGINEERING AND BUILDING RECORD ILLUSTRATED SERIES.

SHOOTING LODGE OF FRANCIS I.

TAKEN FROM FONTAINBLEU AND SET UP IN PARIS.

NEW YORK, VOLUME XXII.

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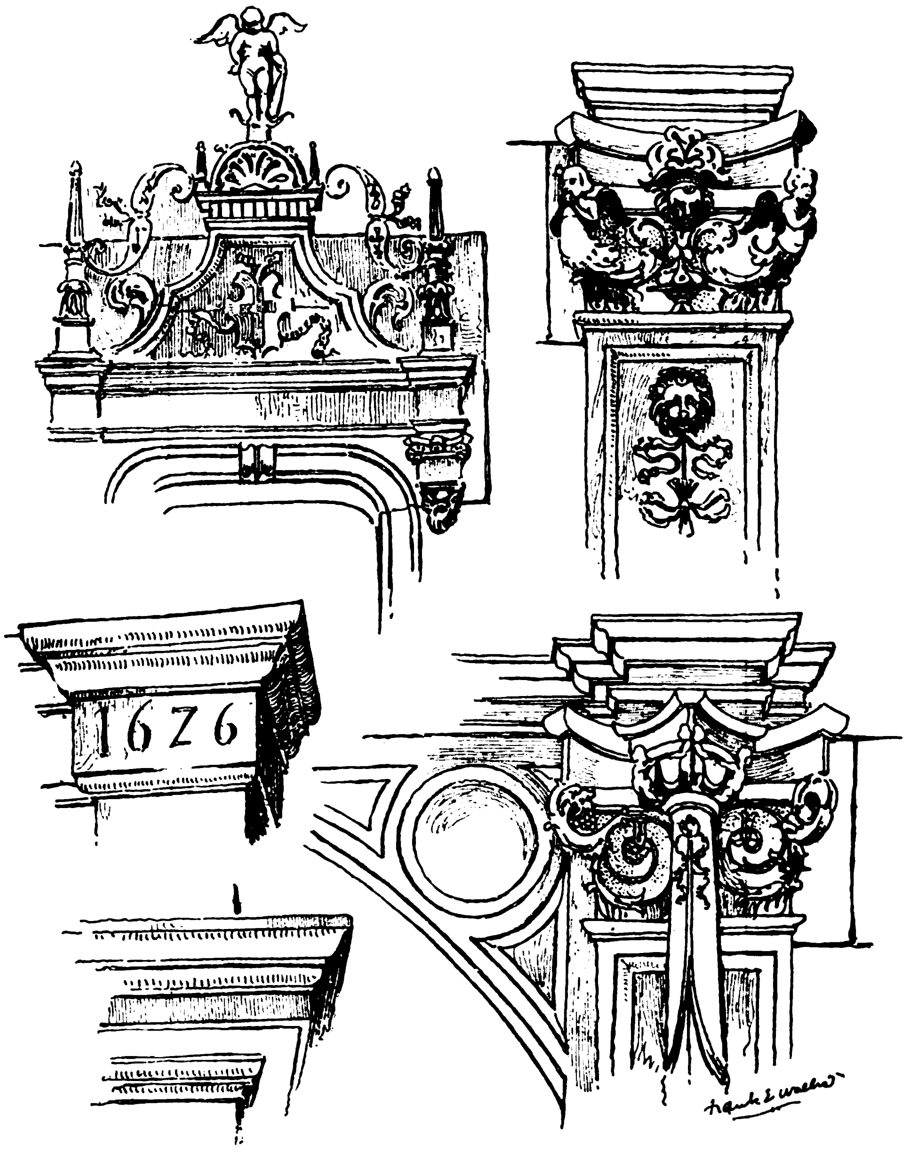
ENGINEERING SOCIETIES.

A MEETING of the Western Society of Engineers, of Chicago, was held on Wednesday, September 3, at 8 o'clock P. M., President L. E. Cooley in the chair, and some 80 members and visitors present. The minutes of the previous meeting were disposed of and the Secretary made a report of the meeting of the Board of Directors.

The following members were elected: Rudolph B. Bourland. C. F. Theodor Kandeler, Edward L. Abbott, Charles H. Miller.

The following applications for membership were received: Charles E. Hopkins, Charles V. Weston, Theodore Starrett, Jacob A. Harman, Henry E. Gamble, Ira Smith Dunning, L. C. B. Holmboe, Charles J. Morse, William E. Miller, Ridley H. Lawrence, Harold A. Boedker.

The special topic of the meeting was the World's Fair Site.



SKETCHES FROM SHOOTING LODGE OF FRANCIS I., PARIS.

A REGULAR meeting of the American Society of Civil Engineers was held October 1, with President W. P. Shinn in the chair. Regular business was transacted and invitations read to join the meetings and excursions of the Mining Engineers and their guests from Germany and England, who are now in convention, with headquarters in New York.

The Secretary announced the recent deaths of the following members of the Society: W. H. Atwood, Cleveland. O.; M. S. Belknap, Savannah, Ga.; Theodore Allen, So. St. Louis, Mo.; C. Ackenheil, Elizabeth, N. J.; J. L. Gillespie, St. Paul, Minn.; and J. F. Wells..

A paper by J. Fras. Le Baron, M. Am. Soc. C. E., on "The Fallacy of the Contract System of the U. S. Land Surveys," was read by the Secretary, and discussed by R. L. Harris. Adjournment was followed by the usual light collation.

The following candidates were elected:

As Members.—Guilliaem Aertsen, Manager Latrobe Steel Works, Latrobe, Pa.; William Sinclair Bacot, Water-works Engineer, New York City; George Irving Bailey, now Assistant Engineer in charge of New York State canal work, Albany, N. Y.; Charles Backus Ball, Assistant Engineer Sewer Division, Engineer Department of District of Columbia, Washington, D. C.; Percy Mortimer Blake, at present completing the Andover (Mass.) Water-Works, and engaged as Expert and Consulting Engineer, Hyde Park, Mass.; John B. Bott, Principal Assistant Engineer Maryland Central Railroad and Baltimore Belt Railroad, Baltimore. Md.; Albert Newman Connett, Principal Assistant in charge of construction Baltimore Traction Company, Baltimore, Md.; Herbert Franklin Dunham, Chief or Consulting Engineer City Water Board, Wheeling, Va., reconstruction of water-works, Massillon, O., and new works for Coshocton, O.—address, Cleveland, O; Oscar Anton Frederik Saabye, Resident Engineer in charge Construction Maintenance of Way, Norfolk and Western Railroad, Roanoke, Va.; Archibald Alexander Schenck, Chief Assistant Engineer New York Central and Hudson River Railroad, New York City; Hood Tucker, Resident Engineer Charleston, Cincinnati and Chicago Railway, White Story, Tenn.

As Associates.—Patrick Henry Griffin, General Manager St. Thomas Car Wheel Company, Canada Iron Furnace Company, and President New York Car Wheel Works, Buffalo, N. Y.

As Juniors.—Robert Augustus Cummings, Assistant Engineer Norfolk and Western Railroad, Roanoke, Va.; Charles Robert Beltes, Assistant in office of Charles B. Brush, M. Am. Soc. C. E., in charge of many survrys and improvements, etc., Hoboken, N. J.; William Chauncey Hawley, Assistant to Chester B. Davis, M. Am., Soc. C. E., Chicago, Ill.; Ezra Booth Naylor, Assistant Engineer New York Central and Hudson River Railroad, New York City; Homer Reed Stanford, Assistant Engineer with Johnson and Flad, Members Am. Soc. C. E., St. Louis, Mo.; Richard Collier St. John, Assistant to Rudolph Hering, M. Am. Soc. C. E., Princeton, N. J.

THE most powerful artificial light in existence is the electric lamp in the lighthouse of St. Catherine's Point on the Isle of Wight, England. The ordinary light is equal to 3,000,000 candles, but a light of 6,000,000 candle-power can be and has been obtained.

NEW YORK MEETING OF THE MINING ENGINEERS.

THE fifty-seventh meeting of the American Institute of Mining Engineers was held at New York during the week just closing, and was made more particularly noteworthy by the fact that it was attended by a large number of members of the British Iron and Steel Institute, and of the Verein Deutscher Eisenhüttenleute.

The first session was held at Chickering Hall on Monday afternoon and was opened by brief introductory remarks by James F. Lewis, Chairman of the Local Committee, and Abram S. Hewitt, President of the Institute. The first paper was by James C. Bayles, on "Explosives from Unknown Causes," and is referred to more at length elsewhere in this issue. It was followed by brief presentations of the following papers, the session being adjourned at an early hour in the afternoon.

"Magnetic Concentration at the Michigamme Iron Mine, Lake Superior," by John C. Fowle; "Ore Dressing by Electricity at the Tilly Forster Iron Mine," by F. H. McDowell; "Magnetization of Iron Ore," by Clemens Jones; and "The Ball and Norton Monarch Magnetic Separator," by C. M. Ball

The evening session on Monday was devoted to an exhibition of lantern views of "The Iron Mountain Mine," by Professor W. B. Potter, of St. Louis, and to an interesting review of "American and Foreign Practice with the Diamond Drill," by W. F. Durfee, of Birdsboro, Pa. Extracts from the latter are published in another column.

The Tuesday morning session began with a paper on "Electric Power Transmission in Mining Operations," by H. C. Spaulding, of Boston, Mass. It was followed by other papers on "Amalgamation at the Comstock Lode, Nevada," by A. D. Hodges, Jr., and "Notes on the Excavation ot the New Croton Aqueduct," by J. P. Carson. Portions of this are given in this issue.

The papers of the Tuesday afternoon and evening sessions were, in the main, of a mining and metallurgical character. They included one by R. M. Daelen, of Dusseldorf, Germany, on "Recent Improvements in German Steel Works and Rolling Mills;" one by S. T. Wellman, of Thurlow, Pa., on "Machinery for Charging of Heating and Melting Furnaces;" another on "Pneumatic Hoisting," by H. A. Wheeler, of St. Louis; one by E. R. Walker, on "The Walker Anti-Vibration Regulating Shutter or Slide for Guibal or other Inclosed Fans;" "Coal Mining in Oregon," by R. H. Norton; "The Resources of the Black Hills and Big Horn Country, Wyoming," by H. M. Chance, and "The Copper Resources of the United States," by James Douglas, Jr. Magic lantern views were also given in the evening to accompany the paper on "The New York Aqueduct," by A. Fteley.

A large number of papers besides these could be presented by title only.

On Wednesday, Thursday and Friday mornings there were sessions of the British Iron and Steel Institute, the remaining portions of the week being given up to a number of local excursions. To these and to the programme of the next few weeks further editorial reference is made in this issue.

THE BERLIN ELECTRICAL WORKS.

A VERY interesting application of electric transmission of power is to be found at the works of the Allgemeine Electricitats Gesellschaft, at Berlin, Germany, where all the machines for building steam engines, dynamos, electromotors, electric elevators, etc., are driven by electromotors. *Kuhlow's German Trade Review* describes the plant as follows:

Two compound steam engines of 100 horse-power each are coupled direct to suitable large dynamos of 110 volts pressure, which supply the electric current both for lighting purpose and for the electric motors. There is no need for belting or any other form of mechanical transmission. A net-work of cables supplies the energy into the smallest, and otherwise quite inaccessible corners, and renders it possible to alter the position of the different machines according to the special purpose. This is of great advantage for very heavy and large pieces to be shaped or worked at, since the tool may be brought to the work piece, and not *vice versa*. Although part of the energy expended is wasted in the primary dynamos and in the electromotors, it is stated that this waste is far below the loss that would be caused by a mechanical transmission plant requisite for this factory. There is, besides, another drawback of mechanical transmission. The plan of the buildings, is, to some extent, dependent upon the general disposition of the belts and pulleys, while with the electric transmission of power every space of the building, no matter how this was designed, can be easily reached, without complicated belting, friction, and cogwheel apparatus, and the control of the bearings, couplings, and the dangerous management of belting is entirely avoided. As to the working expenses it must not be overlooked that as each motor may be used independently from the others, considerable saving of running power can be obtained, because it never occurs, as with the mechanical transmission, that for only one small working machine a very heavy countershaft, with all its supplements, must be run idle. The lighting of the workshops is interesting, and is obtained by 85 arc lamps and 300 16-candle lamps; the former are suspended only 7 feet from the ground, but inclosed below by a parabolic reflector, which throws the rays up against the whitewashed ceilings and walls, so that there is a very splendid day-like illumination, and no workman is compelled, in order to see the details of his job, to approach the lamps.

THE papers and plans connected with the scheme of making Paris a seaport have been deposited at the Hotel de Ville for public inspection. They are to be accessible there until the 15th of November, so that they may be carefully examined. The proposed canal from Rouen to Paris is to have a length of 180 kilometers and a depth of 6 meters. The docks are to be constructed between St. Denis and Clichy. The expense is estimated at 135,000,000 francs. The duration of the voyage from Rouen to Paris will be 17 hours, and the dues 6 francs 50 cents. a ton going and coming.

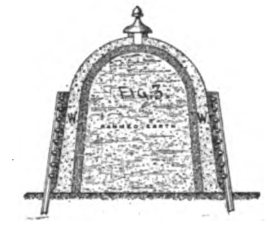
CONCRETE HOUSES IN INDIA.*

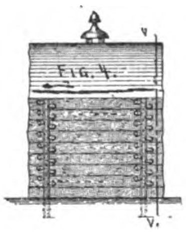
THE excessive cost of housing the native lower staff of Indian railroads has caused the adoption of concrete dwelling houses for this occupation, and the following advantages are claimed for them: Ease of erection, almost universal local supply of materials; small amount of skilled labor and supervision required; cheapness (one-half cost of masonry): durability, imperviousness and coolness.

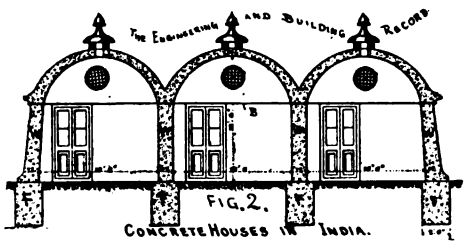
Figure 1 is a plan of a house; F F, etc., are lines of foundation footings; W W, etc., the concrete walls; P P, etc., the brick partitions, and B B, etc., wrought-iron tie rods. Figure 2 is a vertical section at Z Z, Fig. 1; Fig. 4 is an elevation at X X, Fig. 1, and Fig. 3 is a section at V V, Figs. 1 and 4.

Centering and Aligning.—This can be cheaply and expeditiously done by simply raising a mound of earth the whole length, and in contour, of the inside section of the building, in rammed layers, and having the outer surface dressed off with clay. After construction the earth is easily removed through the doorways. The outer surface of the concrete is supported either by a clay wall 1 inch thick, banked with earth, or by a framework of rails and sleepers or boards, Figs. 3 and 4, attached, and, as is preferable, and as cheap, where several blocks are to be erected, the centering can also be put up of the same.

In erecting the centering, it will be found useful in setting out the work, and for purposes of check afterwards, to put up light poles with cross-piece, from which to stretch aligning cords to pegs in the ground; this at either end of the block. A light template is required for he curved roof, Fig. 5.





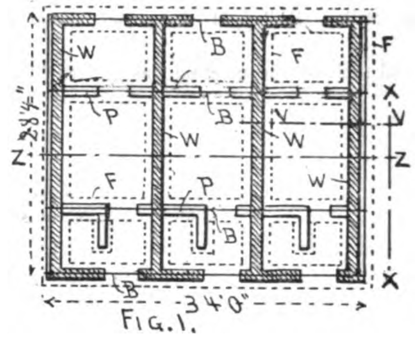

THE ENGINEERING AND BUILDING RECORD
B
FIG. 2.
CONCRETE HOUSES IN INDIA.

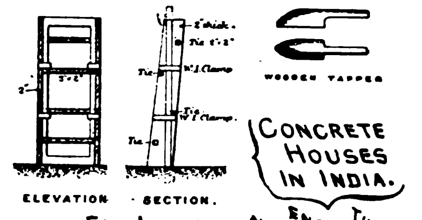
Methods of Construction.—1. After the concrete foundations have been rammed solid, the centering and outer framework should be erected, and the door-frames fixed in position. The frames to have projecting pieces 6 inches down into the concrete, and 3 inches upwards to fit into sockets in the stone lintels. They should also have temporary flanges, Fig. 6, clamped on either side, to retain the concrete walls during construction. The stone lintels should be as light as possible, say 1½ inch thick, and not overhang more than 6 inches, being laid nearly horizontal across, and bedded 12 inches in the concrete at either end. The lintels should be kept ½ inch clear of the top of the door-frame to allow for settlement, and be supported till the concrete sets. The lintels can be plastered with a slope on the top to shed rain.

2. The concrete should be laid in a 6-inch layer, and well consolidated with wooden hand-tappers; the top surface should then be slightly picked up, preparatory to laying the next course, and so on. The tie-rods, fitted with their large washers, 6"x6"x¼", and cotters, or roughly forged heads, are laid in position about one inch above the springing of the arch, the concrete being carefully packed against the washers. The walls are given a slight batter to meet the thrust of the arch, so that tie-rods are not necessarily required, but are simply intended to lend additional stability to the structure.

3. The concrete in the arch should also be laid in 6 inch courses, and carefully beaten in the direction of the thrust, and with a face parallel to the radius; a movable board with slightly curved face, and which can be adjusted as required, can be used to retain the outer surface while being consolidated. Usually the centering, etc., can be removed in about 15 days after completion of the concrete, the outer surface smoothly, and the inner roughly, plastered, and the partition walls dividing off the units erected of sunburnt brick, or country burnt brick set in clay mortar. The interior can then be whitewashed. This method of putting in the partition walls last, and of such material, is found to save the concrete from cracking over the walls, as it usually does on other works where the walls are erected first, expansion or contraction being thus interfered with. Another advantage is, that the centering can be more easily placed as well as removed.

Concrete.—Broken stone, hard brick or kunkur cubes, not exceeding 1½-inch in foundations, and ¾-inch in superstructure.





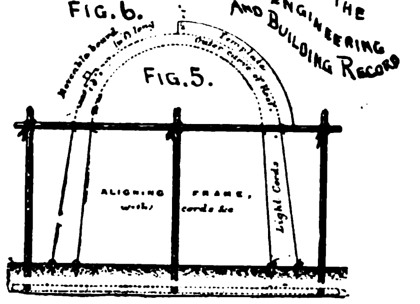


FIG. 6.
THE ENGINEERING AND BUILDING RECORD
FIG. 5.
ALIGNING FRAME, with cords &c
Light Cords

Mortar, composed of 2½ parts of sand or soorki to 1 part of lime, thoroughly ground for say six hours in a bullock-power mill.

The above to be well worked up together in the proportion of 1 part of mortar to 2 parts of metal.

STORAGE BATTERY TRACTION.

THE *Electrical World*, in a recent issue, very aptly remarks:

> "There seems just now to be a marked increase of interest in the use of the storage battery At least half a dozen varieties of electric cars thus equipped are being thoroughly tried in an experimental way, aside from the three or four roads that have such a system in regular operation. The cars on the Fourth Avenue line in this city are growing to be a conspicuous part of its equipment. By all means let the good work go on until something thoroughly practical is evolved. There is a good time coming in urban electric traction, and it behooves electric railway engineers to see that it is not unduly delayed by the advent of the cable abomination. This probably will soon obtain a resting place on Broadway, and will manage to set its fangs into other streets unless its attacks are vigorously combatted."

A WONDERFUL example of erosion is shown in an illustration accompanying Professor Michie Smith's article on the eruption of Bandaisan in the *Proceedings of the Royal Society of Edinburgh*, Vol. xvii., page 70. The valley there depicted was produced by the erosive power of a small stream within the short space of ten months. Its depth, when Professor Smith visited the neighborhood, was 80 feet, and in some places little short of 150 feet.

THE British Association at its last meeting recommended the adoption of a new value for the ohm, the unit of electrical resistance. The proposed B. A. ohm is 1.0028 times the legal ohm of 1884, and consequently resistances measured in legal ohms are numerically too great by a trifle less than three-tenths of 1 per cent.

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* Abstract of a paper by Thomas Ker, published in the Excerpt Minutes of the British Institution of Civil Engineers.

BUILDERS' AND CONTRACTORS' ENGINEERING AND PLANT.

No. C.

(Continued from page 213.)

ERECTION OF THE HOOGHLY JUBILEE BRIDGE, INDIA*.

PART I.—PIERS, CAISSONS, ABUTMENTS AND VIADUCT.

At the site of the Jubilee Bridge the River Hooghly is 1,200 feet wide at low water, and the crossing for two railroad tracks is effected, Fig. 1, by one 360 feet 6 inch cantilever span, and two connecting spans, each 420 feet, together with brick arch viaduct approaches at the Hooghly and Naihati ends, of 3,280 feet and 450 feet, respectively.

The river bed on the right side is 66 feet deep below datum, or mean sea level. The right bank is well above the highest flood level. On the left side the river is comparatively shallow, and there is a wide stretch of low ground which is inundated in the flood season. The deep channel on the Hooghly side is scoured out to the clay by the flux and reflux of the tide, while the depth on the left side of the river varies with the movement of the sand or silt which there forms the bed of the river. In the freshets a variable thickness of silt is displaced. When the floods are strong the river bed is removed to a depth of 29 feet or more below datum.

The tides vary from mean sea level or a foot below in the dry season, to 20 feet above in the freshets; the maximum velocity of the tides is 4½ miles per hour when the flood tide comes in with a strong bore, and 5¾ miles an hour on the ebb tide in the freshets.

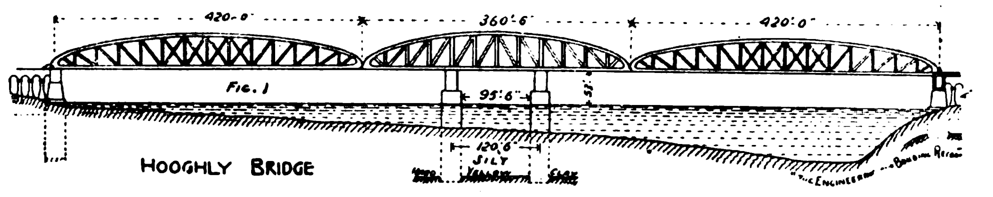
Fig. 1

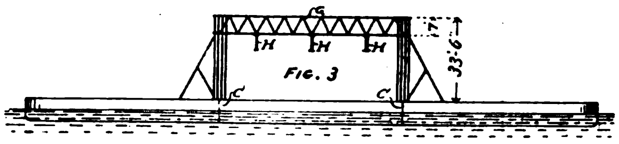
Fig. 3

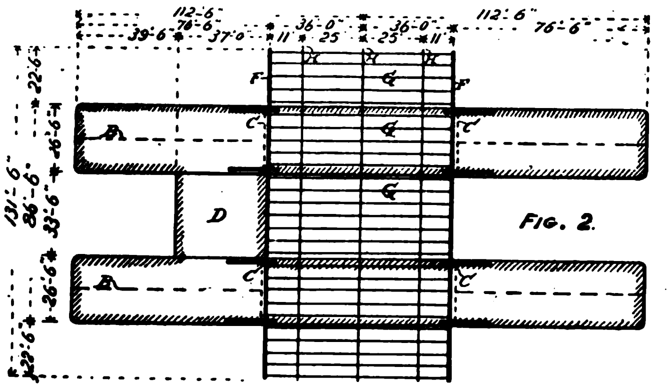
Fig. 2.

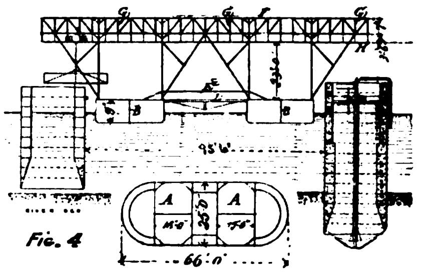
Fig. 4

HOOGHLY BRIDGE

"The Engineering and Building Record"

River Piers.—The site of the river piers is in about 27 to 30 feet of water at low spring tides in the dry season; the bed of hard yellow clay is met with at a depth of about 89 feet below datum at this part of the river, and the piers had to be sunk through about 60 feet of silt to reach the clay. The piers are 66 feet long, up and down stream, by 25 feet wide, with semicircular ends and flat sides. To sink these, two wrought-iron caissons, 108 feet high by 66 feet long by 25 feet, with semicircular ends, and each weighing 453 tons, were provided. The caissons (Fig. 4) were divided into three excavating chambers open from top to bottom, by two transverse compartments A A, each 15 feet wide on the longitudinal axis of the caissons (Fig. 5). These compartments afforded the buoyancy necessary for floating the lower portion of the caissons from the shore, where they were built, to the site of the piers, and until they reached the bottom of the river. The semicircular ends of the caissons were strengthened by horizontal shelf plates 3 feet broad, at vertical intervals of 4 feet, the space between these being filled with brickwork as the caisson went down. For a height of 36 feet above the bottom of the caisson, the central chamber also had two lateral buoyancy compartments, which contributed to the stability of the caisson while afloat, though they reduced the area of the central excavating chamber to 10 feet by 17 feet, while the end chambers were semicircles 19 feet in diameter. In the upper portion of the caisson the lateral compartments were replaced by shelves 3 feet broad at vertical intervals of 4 feet. The combined horizontal area of the three chambers was 480 square feet, being 32 per cent. of the total area of caisson. To facilitate sinking through the river bed the lower portion of the caissons and of the transverse compartments was built with internal inclined surfaces, extending from the bottom of the caisson to a height of 12 feet. The bottom of the caisson is an angle iron 5"x5"x⅝", which, with the vertical skin plate and 3'x⅝" external stiffening plate, forms the cutting edge; the angle bar was filled by beveled timber inside, so that there was no horizontal surface at the bottom of the caisson. The wedge spaces between the internal inclined plates and outer vertical skin of the caisson were filled with cement concrete. The lower 16-foot length of each caisson was riveted up complete on the river bank, and launched on ways laid for the purpose, and when afloat it drew 9 feet of water. The upper portion of the caisson was built up in rings or zones, each 4 feet high and weighing 15 tons; these were connected with the completed portion of the caisson by internal 3½"x3"x$\frac{7}{16}$" angle bars, and ⅞-inch rivets, 3-inch pitch. The skin or outer plate of the caisson was ⅝-inch thick for a height of 44 feet, ½-inch thick for a further height of 32 feet, above which it was ⅜-inch thick.

Pontoons.—To afford a working platform for men and material, and to enable the caissons to be pitched correctly in position, two pontoons (Figs. 2, 3 and 4) were built of $\frac{5}{16}$-inch and ¼-inch plates, riveted to 2"x3" longitudinal angles 17 inches apart on 3½"x2½" transverse angles that were spaced 9 feet centers, and had interior bulkheads, a longitudinal one, B, in the center, and two transverse ones, C C, that were 72 feet apart. (These really coincide, in Fig. 2, with the trusses F F, but are there moved aside to show separately). They were built at the works on the river bank, and were launched sideways on ways laid under the transverse bulkheads, with a length of 75 feet overhanging at each end. The weight of each pontoon was 151 tons. The pontoons were equipped with powerful capstans, one at each end of each pontoon, or four in all, besides bollards, fair leaders, etc.

The pontoons were connected together by means of an intermediate iron platform D, level with the decks, also by an overhead staging constructed of old rails connected by bolts and castings; the two main trusses F F, of this staging, were fixed to the decks of the pontoons immediately over the transverse bulkheads, and therefore 72 feet apart from center to center. The pontoons were also connected by auxiliary trusses (E E, not showing in Figs. 2 and 3) nearer to the ends, the object being to preserve the decks in one plane. The main trusses were connected at the top by 27 girders, G G, etc., at intervals of 5 feet from center to center, below which were suspended three transverse railways, H H H.

When the pontoons were moored in position at the center of the bridge, there was a clear space of 4 feet 6 inches between the gunwales of the pontoons and the sides of the caissons as moored at the sites of the piers. The overhead transverse railways commanded the centers of the caissons, so that material brought into the dock between the pontoons on an iron punt could be lifted by crab winches traveling on the overhead rails, and deposited on either caisson or on the deck of the pontoons. This arrangement, coupled with double sets of excavating gear, enabled work on both caissons to be proceeded with simultaneously. One pontoon contained the steam power and pumps for excavating earth from the caissons, the other the steam power for driving the boring gear. The pontoons were cross-moored by four 3-ton anchors with 1¾-inch chain cables adjusted by chain tackles, by which a considerable strain was always kept on the moorings, the rise and fall of tide being allowed for by the long sweep of cables; thus moored, the pontoons kept exactly in position without drifting or being otherwise affected by the tides.

The lower 16 feet of the caissons were towed at slack water into position alongside the pontoons. The caissons were moored by means of girdle or bridle chains, suspended round them at a height of 10 feet above the cutting edge by rope lashings passing through cast-iron pipes bolted to the inside of their skin, in which holes were cut to allow lashings to pass through the pipes; by this arrangement when the caissons were pitched the lashings could be cut by the diver and the girdle chains removed, and there was no external projection to impede the sinking of the caissons through the earth.

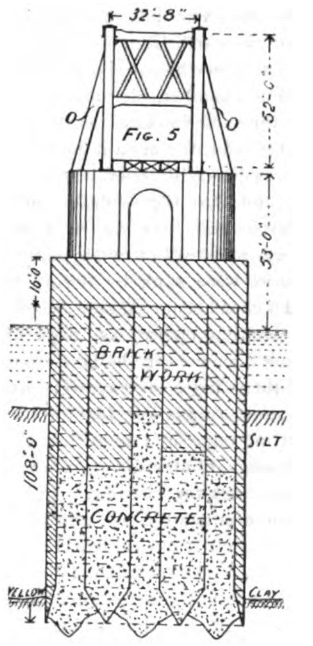

Fig. 5

HOOGHLY BRIDGE

The bridle chains of the caissons were connected by 1-inch chain tackles to up and down stream moorings, 3-ton anchors and 2-inch chain cables for adjusting the upstream and the down-stream position of the bottom of the caissons. Breast moorings of a lighter description for adjusting the lateral position of the caissons at the bottom were also used. It was necessary to hold the caissons by moorings near the bottom, as on account of the great grip of the tides on the open botton and transverse partitions of the caissons it would have been impossible to control them, when drawing over 30 feet of water, merely by topside tackle.

The sinking of the caissons through the water was effected by the weight of additional caisson rings, brickwork between the shelf plates of the semicircular ends, and concrete deposited in the buoyancy compartments. As the cutting edge approached the bottom of the river care had to be taken that it did not ground at low water. A sufficient height or free board of caisson having been built up to allow for sinking into the river bed and for rise and fall of the tides, the caisson was finally pitched by admitting water into the buoyancy compartments by means of syphons. As the caissons were sunk through the bed of the river the buoyancy compartments were filled with concrete of Portland cement and stone to the level at which it was safe to bale them dry, after which they were filled with solid brickwork affording weight for sinking them through the river bed

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*Condensed from a paper by Sir Bradford Leslie, K. C. I. E., M. Inst. C. E., published in the Excerpt Minutes of Proceedings of the Institution of Civil Engineers. Vol. xcii.

One day, just after all hands had left work, the No. 1 caisson on the west side of the river, which was afloat ready for pitching, drawing 32 feet of water, and weighing 750 tons, was caught by the bore at an angle with its axis. The great pressure carried away the chain-lashings by which the top side of the caisson was secured to the pontoons ; this, and probable dragging of the bottom breast moorings, allowed the caisson to cant still more across the tide, and the enormous strain then carried away the chain tackles of the up and down stream moorings, and all the bollards and holdfasts on the pontoon decks, tearing to pieces the wrought-iron blocks, in which the 1-inch chain tackles wererove. The caisson was carried on the bore nearly ½ mile up the river and grounded across the stream, but on tolerably hard bottom. Fortunately the tide which did the damage was not the highest of the springs. When it slackened a barge was secured alongside, and the caisson was lightened by the removal of about 40 tons of cement brickwork, and with the assistance of strong warps hauled on by steam anchor barges suitably moored, and with the help of the bridge steam tender the caisson was dragged off the bank and floated at high water the next day. All the pontoon gear and ground moorings of the caisson being broken and lost, it could not be moored in position again. So it was temporarily moored by ropes made fast to trees on the river bank, and also by anchors till the dead neap tides, when it was towed out at slack water into position, and, the buoyancy compartments being filled by the syphons, was successfully deposited correctly in its permanent site.

Immediately a caisson was pitched the tide began to undermine it by scouring away the river bed outside, so that it was necessary to lose no time in starting to sink it by removing the earth from the inside. The dredging of the earth was done by special boring gear, one set in each excavating chamber, identical in principle, and, indeed, almost the same in detail as that used at the Gorai Bridge* in 1868–69, the main differences being that the boring gear was driven by steam instead of by air pressure or turbines, and that the syphons through which the earth was discharged into the river were charged by Körting's ejectors instead of by air pumps. Through the silt the caissons were sunk by boring heads 10 feet in diameter. To check scour outside, when it threatened to overtake the sinking operations, bags filled with dense black clay were deposited in the holes scoured out ; many thousands of these bags of clay were used. It was not safe to use stone rubble for fear of its working down under the cutting edge and impeding the sinking of the caissons ; the bags of clay did occasionally so get drawn in, but did not check the sinking. On one occasion the scour so far undermined the No. 2 caisson when it was 60 feet high, as to cause it to cant over to an angle of 1 in 8, and communication was established between the external water and the north boring compartment. The condition of the caisson was precarious. Heavy mooring anchors were laid out and connected by chain and rope tackles "luff upon luff" to the top side of the caisson, so that an estimated strain of 200 tons was exerted tending to right the caisson ; then by boring steadily in the chambers which were water-tight the caisson gradually righted, the tackles being constantly set up to keep the maximum strain as the caisson came over. The righting of this caisson shifted the position of the cutting edge slightly, so that the caissons are really 120 feet 10 inches apart instead of 120 feet 6 inches as originally pitched.

When the caissons got down to the hard yellow clay they stood firm on the cutting edge and did not penetrate it. The 10-foot holes excavated 8 feet in advance of the cutting edge, which were sufficient in sinking through the silt, had no effect. The boring gear had then to be lifted out of all the compartments, and two of the arms of each boring-head extended, so that they excavated holes 14½ feet in diameter, and, in fact, to a certain extent undercut the transverse compartments. The excavation of these large holes in advance of the cutting edge caused the clay to break in and the caisson to sink. When the cutting edge was far enough into the clay to make it safe to remove water from the caisson, the level of the water inside the excavating chambers was lowered 24 feet by special pumps, which increased the effective weight of the caissons by 700 tons and helped to sink them through the clay. The caissons were thus got down until their cutting edges were over 100 feet below datum, at which depth, being firmly embedded 10 or 12 feet in the solid clay, further sinking was stopped, and the excavating chambers were filled to a height of 46 feet below datum with concrete of Portland cement and broken stone, and above that level with solid brickwork, Fig. 4. The concrete was lowered through the water in iron boxes with four inclined bottom leaves, or flaps, hinged to the sides and released by the disengagement of a central bolt from the lifting-chain ; in this manner the concrete was deposited with very little disturbance and set very hard. Anchor-castings and sixteen 3-inch bolts, 24 feet long, for holding down the steel standards which carry the cantilever girders, are built into the upper portion of brickwork of each caisson.

The total dead-weight of one pier, including the steel standard and superstructure, is 12,567 tons, and the maximum moving load, consisting of two trains weighing one ton per lineal foot, is 1,320 tons, or together 13,887 tons; deducting the frictional support of the river bed on the surface of the caisson at 5 cwt. per square foot, or say 2,500 tons, the pressure on the base of each pier is 11,387 tons, or at the rate of 7 5 tons on the square foot. The normal pressure of earth and water at the same depth is 4.5 tons on the square foot.

To protect the piers from scour, since they have been sunk about 40,000 cubic feet of heavy stone rubble, averaging 2 or 3 cwt. each stone, has been deposited round each pier, and more will be added if required; but the large-sized rubble appears to be very effective in resisting scour.

The steel standards or pedestals, are simply vertical cellular structures, 30 feet high, of plate and angle-bars riveted together and secured to the brickwork of the piers by holding-down bolts and anchor-castings. These standards weigh 205 tons each, and carry the cantilever girders at a clear height of 53 feet above datum ; being slightly elastic they allow for the expansion and contraction of the girders in the span of 120 feet 6 inches between the river piers.

ABUTMENTS.

On the Hooghly side, where the deep channel runs, the bank is of stiff clay that resists the action of the water. Theabutment on this side was founded by sinking an iron curb 65 feet long by 28 feet wide by 8 feet deep. The curb had two cross partitions dividing it into three excavating chambers, open at top and bottom. The curb was, in fact, the taper shoe of the block foundation of the abutment; it was of sheet iron, ¼ inch in thickness, strengthened by gussets. The outsides of the curb were vertical and the inner sides inclining inwards from the cutting edges at an angle of 60 degrees; both sides of the inner transverse partitions were inclined. The curb was filled with concrete, on which the brickwork of the abutment was built, the sides of the excavating chambers being corbelled over until their size was reduced to 12 feet by 6 feet. To prevent dislocation of the brickwork during sinking, it was connected with the curb by a framework or crating of angle-bars, vertical and horizontal, securely riveted to the gussets of the curb. When sufficient weight of brickwork was built, the curb was sunk through peat and blue clay, additional brickwork being added as weight was required, until it finally rested 4 feet in the hard yellow clay at a depth of 34 feet below datum. This block foundation was excavated by hand, as but little water leaked in, which was easily removed by baling. When the curb had reached the desired depth, the excavating chambers were filled with concrete well rammed and brickwork. The neat work of the abutment started upon the block foundation at the level of 10 feet above datum.

The Naihati abutment was founded on a similar sheet-iron curb to that used on the Hooghly side ; but being pitched in sand, or rather silt, through which the water percolated, the soil had to be removed from the excavating chambers by Bull's dredgers worked by steam winches, the weight necessary for sinking being imposed by building up brickwork on the curb, leaving openings 12 feet by 6 feet for excavating from the three chambers. When the cutting edge of the curb reached 50 feet below datum the abutment began to hang by side-friction, and notwithstanding the addition of as much weight as possible, the quantity of stuff removed by dredging greatly exceeded the net displacement of the depth sunk, multiplied by the area of the curb. This drew in the soil from the outside, disturbing and cracking the surrounding earth for a distance of 100 feet on the land side of abutment ; however, it was finally sunk through the river silt till the bottom of the curb was 73 feet below datum, or 84 feet below the river bank. The excavating chambers were then filled with Portland cement and broken stone concrete to the level of 33 feet below datum, after which ordinary brickwork was used.

APPROACH VIADUCTS.

The approach to the bridge is by an arched viaduct of brickwork. The total length of viaduct through the town of Hooghly is 3,280 feet, of which a length of 450 feet adjoining the bridge was specially designed for the erection of the girders of the main side span on its spandrel walls. The extreme width of this viaduct at top is 37 feet 9 inches, and the piers are 15 feet apart from center to center, the clear span of the arches being 10 feet 10 inches. The foundations of concrete are spread over a large area, and the whole structure was made very massive, to sustain the severe strains to which it was subjected in the erection and launching of the girders of the main side spans.

A similar approach viaduct, 450 feet long, was erected on the Naihati side of the river ; on this side the height from ground level to the rails is 43 feet. The foundation of the greater portion of the viaduct consisted of a layer of concrete at a depth of about 8 feet below ground level, with an area of about 50 square feet per lineal foot of viaduct. In rear of the left abutment of the main bridge, however, the ground has been disturbed by excavation from the chambers of the abutment curb drawing in the earth from outside as previously described, and to bridge over this disturbed area it became necessary to have recourse to a block foundation. This consisted of a rectangular block of brickwork, 60 feet square, with 25 excavating chambers, each 6 feet square at the top, through which the earth was removed by Bull's dredgers worked be steam winches ; the block was sunk to a depth of 10 feet below datum, or 20 feet below ground level. The block foundation was built at the level of 12 feet above datum, on a grating or curb of old rails with wedge timbers to serve as a cutting edge bolted to the underside ; on this rail grating and bolted to it 36 vertical rails were erected at suitable spaces, with horizontal connecting rails at intervals of 5 feet, the whole forming a substantia skeleton framing as a bond for the brickwork during the process of undersinking. The lower portion of the brickwork inside the chambers was taper to facilitate sinking through the silt, and the bottom length of 3 feet was built in cement. The total height of the 60-foot block is 20 feet When sunk to the depth of 10 feet below datum the excavating chambers were filled with concrete and brickwork, making it a solid mass weighing some 4,000 tons. After giving time for the setting of the brickwork and concrete and for settlement, the viaduct was completed over the block foundation and connected with the abutment. A crack has since occurred between the viaduct and the abutment, probably due to the fall of the water level in the river, reducing the upward pressure on the base of the 60-foot block.

(To be continued.)

Prof. Elihu Thomson has recently devised a method of case-hardening iron or steel by means of the heat produced by the passage of an electric current. His process consists essentially in heating the object electrically, and then applying to the metal so heated a surrounding envelope—either gaseous, fluid or solid—for the purpose of changing or preventing change in the quality of the material, according to the special end to be attained.

A sum of money sufficient to establish an annual prize of $120 has been donated by Mr. Charles Macdonald, of the Union Bridge Company, to the Rensselaer Polytechnic Institute. The prize will be given to the student who presents the best graduating thesis involving an original design of an engineering work, or an original investigation of a process which may be of special interest to civil engineers.

In the recent armor tests at Annapolis, Md., with Creusot solid steel and nickel steel plates, and Cammell compound plates, the solid steel plate was penetrated and cracked from circumference to center by a shot from an 8-inch rifle; the nickel plate was penetrated, but intact; the Cammel plate was completely wrecked.

A force of about 1,500 men is now employed by the construction company on the Nicaragua Canal.

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* Minutes of Proceedings Inst. C. E., Vol. xxxiv., p. 1.

LOUVRE FOR VENTILATOR FOR TRAIN-SHED ROOF TO LET OUT SMOKE AND EXCLUDE SNOW.

THE following letter from P. A. Petersen, Chief Engineer of the Canadian Pacific Railroad Company, refers to the articles in Volume XVIII, pp. 307 and 321, in which were published his original communication, and responses describing two structures, intended to meet the given conditions. One of the designs was by C. L. Stroble, C E., for train shed ventilators on the Chicago, Milwaukee and St. Paul Railroad, and the Chicago and Great Western Railroad, and the other was a detail of the louvre in the Metropolitan Opera House, New York.

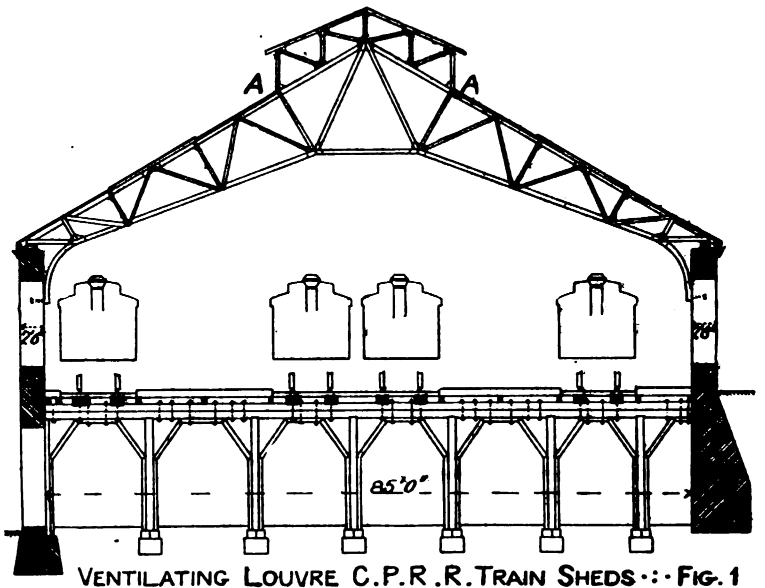
THE CANADIAN PACIFIC RAILWAY CO.
MONTREAL, September 11, 1890.

To the Editor of THE ENGINEERING AND BUILDING RECORD:

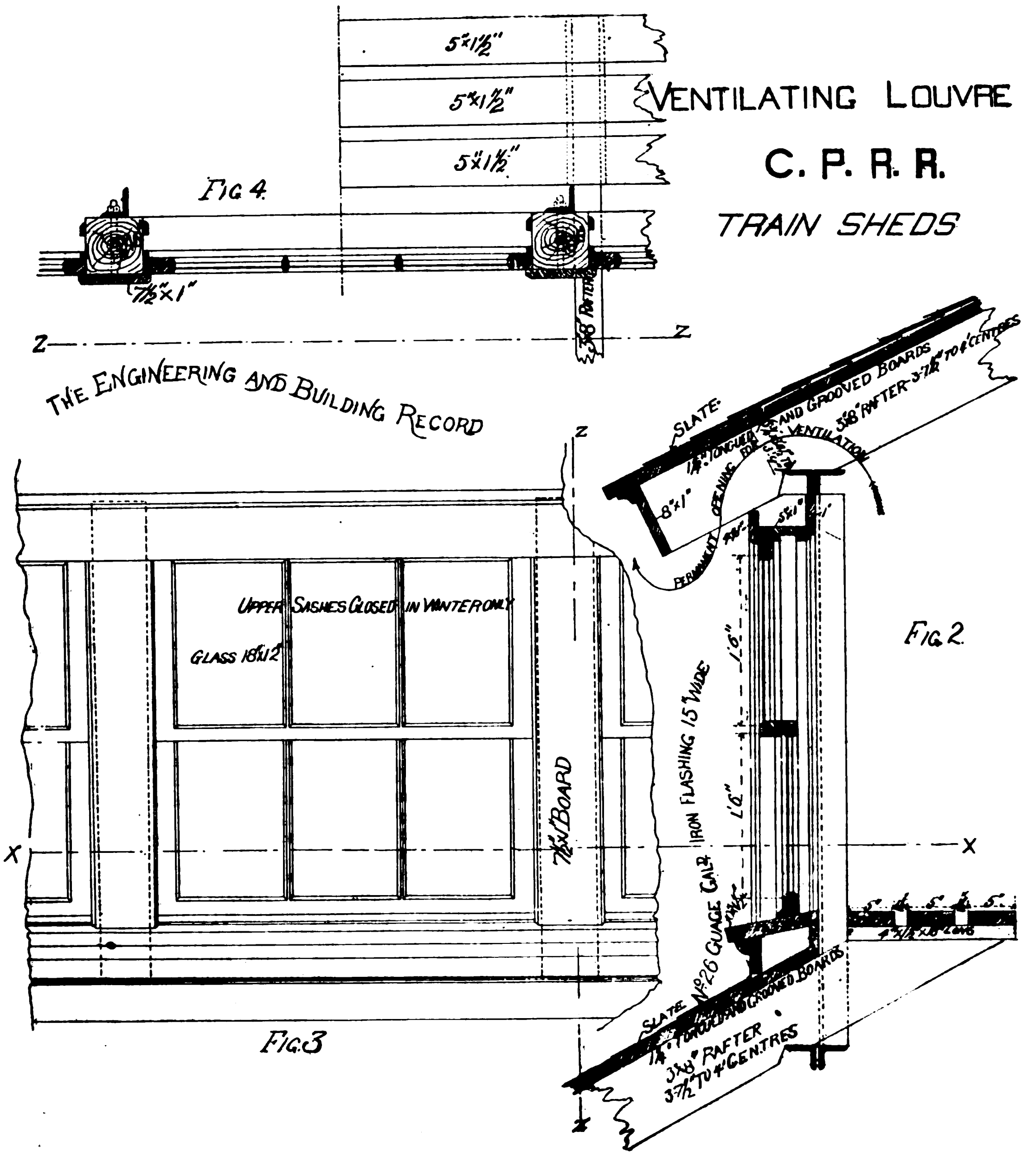
SIR: You will remember that on the 1st of November, 1888, I wrote you asking where I could find a drawing or description of a louvre that would act satisfactorily as a ventilator for a train shed roof, so arranged that it would carry out all the smoke and at the same time keep the snow from drifting in. I obtained, through your paper, descriptions and sketches from several correspondents. I did not think that any of them would be quite satisfactory in keeping out the fine drifting snow. I now inclose you a drawing of one that has answered every purpose. In summer, with the upper windows open, it ventilates the train shed thoroughly, and lets out all the smoke. In winter, with the windows closed, it keeps out all fine drifting snow and the smoke passes freely through the openings between the rafters, over the windows, and under the roof boards.

Trusting this may be of use to some of the correspondents who were kind enough to answer my letter, believe me. Yours very truly, P. A. PETERSON,
Chief Engineer.

We publish herewith full illustrations of the construction adopted by Mr. Petersen, and found satisfactory under the exacting conditions and wide climatic variations where it was used. Figure 1 is a general cross section of the train shed; Fig. 2 is an enlarged elevation of the louvre details at A A, Fig. 1; Fig. 3 is an elevation at Z Z, Figs. 1 and 4; and Fig. 4 is a section at X X, of Figs. 2 and 3.



VENTILATING LOUVRE C.P.R.R. TRAIN SHEDS : · FIG. 1
"THE ENGINEERING AND BUILDING RECORD"


VENTILATING LOUVRE
C. P. R. R.
TRAIN SHEDS
FIG 4
5"x1½"
5"x1½"
5"x1½"
7½"x1"
3"x8" RAFTER
Z
Z
THE ENGINEERING AND BUILDING RECORD
Z
SLATE
1¼" TONGUED AND GROOVED BOARDS
3"x8" RAFTER 3'-7½" TO 4' CENTRES
PERMANENT OPENING FOR VENTILATION
8"x1"
5"x1"
UPPER SASHES CLOSED IN WINTER ONLY
GLASS 18"x12"
7½"x1" BOARD
No. 26 GUAGE GALV. IRON FLASHING 15" WIDE
1'6"
1'6"
FIG. 2
X
X
SLATE
1¼" TONGUED AND GROOVED BOARDS
3"x8" RAFTER
3'-7½" TO 4' CENTRES
FIG. 3

EXPLOSIONS FROM UNKNOWN CAUSES.

As the first of several mysterious explosions, described in a paper presented this week at the New York meeting of the American Institute of Mining Engineers, Mr. James C. Bayles mentioned the bursting of a 16-inch pipe carrying air under a pressure of about one pound. The pipe was made of light galvanized iron with soldered seams. Into it a rotary fan-blower delivered air, and from it smaller pipes were carried to furnaces. The blower was run continuously. Neither the main pipe or its branches has any connection with the gas conduits. Both air and gas pipes delivered into the furnaces; but although the gas was under much higher compression than the air, there appeared to be no good reason why, having free escape in case of leakage, it should ever make its way back into the air-pipe. One warm afternoon in June the main air-pipe exploded with great violence. Every window in the mill was blown out, a considerable section of the roof was raised an inch or two, and in several places it was blown through. The pipe was torn into a thousand pieces.

The pipe in which the explosion occurred extended the whole length of the mill. The pipe welding machines to which the air was supplied were placed together near the end connected with a blower, leaving some 80 feet of what may be called dead end. It was in this dead end that the explosion occurred. The portion of the pipe from which outlets were taken were substantially uninjured, but 75 feet of the 80 feet beyond the furthest outlet were utterly destroyed. The fact that with very little mending the part of the pipe which the explosion had not reached continued for some months to supply the machines with air shows how local the explosion was, and the damage to the mill building gave sufficient evidence of its violence.

The natural explanation of this explosion is that gas found its way into the air-pipe and was packed away in the dead end, and that when mixed with air in explosive proportions it reached a furnace and exploded. The most rigid investigation failed to explain how the gas got into the air-pipe against the pressure it carried, and why an explosion beginning at a furnace should have restricted its effects to the dead end of the air-pipe. Mr. Bayles thought that it was, undoubtedly, a gas or vapor explosion and that the vapor was formed by the volatilization of the oil consumed in lubricating the trunnions of the blower. He thought it conceivable that the large amount of oil consumed by the blower is volatilized, and that it becomes a hydro-carbon gas which would behave like any other gas of similar composition. This gas, being lighter than air, would occupy the upper part of the pipe and remain undisturbed while air was drawn from outlets taken from its under side. This light gas may have worked along and accumulated in the dead end of the air-pipe until it reached, in admixture with air, the explosive condition. How it was fired, however, still remained unanswered.

The second of the curious accidents was the explosion of a No. 6 Sturtevant Blower. The blower was inside the mill, and was driven by two belts from pulleys on the main line of shafting. It was used to furnish blast for gas generators. Some trouble with the main driving belt necessitated a stoppage of the mill engine, and the blower stopped. In a few minutes the engine started again, and with it the blower. Suddenly it disappeared. Fragments weighing 20 to 50 pounds were distributed in all directions. The explosion was accompanied by a violent report, and succeeded by a dense cloud of yellow-brown, offensive-smelling smoke, which rose to the roof, rolled right and left, and finally escaped at the monitor.

The conclusion was that during the stoppage of the engine some gas from the producers had worked back through the pipe into the blower. When the blast was resumed these products of imperfect combustion were carried with the air current into the producers, and being mingled in explosive proportions, had been fired by contact with the incandescent fuel and exploded. This explanation was never quite satisfactory. An explosion which began in the producer could only reach the blower through two branches of a tee, 6 feet of vertical pipe, an elbow, 25 feet of horizontal pipe underground, another elbow, 6 or 8 feet of vertical pipe, another elbow, and 4 feet, more or less, of pipe connected with the outlet of the blower. Some of these pipes were light and some heavy, and the section underground was much larger than the section at either end of the run. If an explosion violent enough to wreck the blower completely had occurred through the whole length of this very circuitous pipe, there should have been some evidence of it in the pipe itself. It was intact. Not a joint was started. Furthermore, as the blower had been running at least four minutes immediately before the explosion, what could have remained in it to explode? The fact was, however, that the blower was shattered, while the pipe was undisturbed, even the delivery nozzle of the blower remaining coupled to the length of pipe on the mill floor, which was not thrown out of line.

STONE PIPES FOR WATER SUPPLY.

In an interesting paper on American and foreign practice with diamond drills, presented by Mr. W. F. Durfee, of Birdsboro, Pa., before the American Institute of Mining Engineers, at New York, on Monday evening last, it was pointed out that while Professor Rudolph Leschot, a French engineer, was the first in modern times, 1862, to perforate rocks by means of a hollow, cylindrical drill, armed with diamonds as cutting agents, and thus leaving a core of solid material in the center of the hole, he was not the first to suggest the idea of drilling a hole by means of a rotating, hollow tool.

As early as the beginning of the century James Murdoch, one of the principal assistants of James Watt, conceived the idea of making pipes of stone for conveying water. Mr. Murdoch's invention was carried into effect by means of a thin, hollow cylinder of soft iron, to which was given an alternate rotary motion, the lower end of the cylinder being copiously supplied with sand and water.

Such stone pipes were, in the early part of this century, an article of manufacture, and it is a matter of record that the pipes for the first water supply of Manchester, England, were made by this process. This fact appearing of curious interest in its relation to the history of the water supply of that city, Mr. Durfee took pains to procure some authoritative information in regard to it, and obtained from the Hon. James G. Blaine, Secretary of State, the following data, secured at his request, by the Hon. W. F. Grinnell, U. S. Consul at Manchester, from F. H. G. Berry, C. E., of the Manchester Corporation Water-Works.

Mr. Berry says that the old Manchester and Salford Water-Works Company, in whose hands the water-supply was, previous to 1857, laid down stone service pipes, in the years from 1810 to 1814, in the streets, for supplying water. These pipes were bored out of soft, oolitic limestone, procured from a quarry in the west of England, and were cut into about 2-foot lengths, with spigot and socket joints which were united with Roman cement. Their bore was from 3 to 18 inches. The prices paid for the pipes were:

3-inch bore	4s. 11d.	per yard.
4 "	7s. 8d.	"
6 "	11s. 6d.	"
7 "	13s. 9d.	"
8 "	16s 0d.	"
9 "	18s. 8d.	"
12 "	30s 9d.	"
15 "	35s. 0d.	"
18 "	45s. 0d.	"

On being charged with water, however, most of the pipes were found to be incapable of bearing the pressure, and their use, except in the higher parts of the district where the pressure was low, was abandoned in favor of cast-iron pipes. Some of the stone pipes taken out of the ground can still be seen. Pieces have also been placed in the public parks at Manchester.

According to London *Engineering*, Japan has now 10,402 miles of railroad in operation and 874 miles in course of construction.

COST OF ROAD-MAKING MACHINERY AND MAINTENANCE.

The Manchester, N. H., *Mirror and American* recently published a most sensible and timely article on the cost of maintaining good roads, with special reference to road-making machinery. In view of the general applicability of the remarks made we reprint the article in full:

"Many a community has been scared out of improving its roads by the bugbear of 'expensive machinery.' This is wholly a bugbear, for road-making machinery is not expensive. It is far less costly than are poor roads.

"It may be interesting to describe the outfit which would be required, give its cost and estimate the expense of running it.

"If a town decides that its roads should be macadamized the first requisite is crushed stone. The old method of breaking stone by hand is very expensive, and has been generally abandoned in these days of improved and cheap machinery, so a stone crusher is essential.

"On a country road the total width of which may be too great to cover entirely with broken stone, there should be at least a macadamized width running through its center of 15 or 18 feet, and this roadway should be made with not less a depth of consolidated and screened broken stone than 9 inches. A cubic yard of broken stone will in such case cover an area of about 3½ square yards; and the material named, with a small quantity of good clean sand or fine gravel for binding material, will be all that is necessary, except intelligent labor and intelligent supervision to complete the work. It is hardly necessary to say that neither the work nor the supervision can become intelligent or satisfactory without the aid of the proper machinery for carrying out the construction of the road.

"A stone crusher costing $1,200 with engine, will break 75 to 100 tons per day. The engine will consume about half a ton of coal daily, costing probably $2. Besides this an engineer will be required at a daily wage of about $2.50, and two laborers will be necessary to feed the crusher. Their wages will average $1.75 a day. This makes the daily cost of running the stone crusher, with other incidental expenses, about $10.

"It is impossible to estimate the cost of getting the unbroken stone to the crusher and the broken stone back to the road again, for that depends entirely upon the distance which has to be traversed in cartage and the condition of the ground over which the loads are hauled. This is a matter where a grain or two of common sense in the placing of the crusher, etc., will have a decided effect on the expense. If the loads have to be hauled a considerable distance to or from the crusher, or if heavy grades have to be climbed or rough ground traversed, the time occupied in hauling each load will be increased and less can be hauled in a day, thus lessening the work done by horses and drivers for each day's wages. It is sometimes even an economical thing to devote the first stone and the first labor to preparing a smooth roadway between the quarry and crusher and the road to be improved. In this way time in hauling the loads is saved, and if the surface over which they are drawn is smooth the pulling power of each horse is largely increased.

"Where stone is to be obtained in more than one place along the line of the projected road, it is sometimes more economical to take the crusher to the stone than to have to haul the broken stone a great distance. For this purpose a stone crusher can be mounted on wheels and the steam roller (mentioned hereafter) be used to haul and drive the crusher without the expense of a fixed plant for crushing stone.

"In addition to the crusher a heavy steam road roller is more or less necessary. Of course the work can be done if necessary by horse rollers, but the results are never so good, and the difference in endurance of a road prepared by a heavy steam roller over one prepared with the comparatively light rollers drawn by horse-power is inevitably enough to pay the first cost and expense of running the steam roller over and over again.

"The first cost of a steam roller weighing from 10 to 15 tons will be from $3,500 to $4,500. To manipulate this roller only one man will be required, and his pay is not likely to be more than $2.50 per day. Placing the cost of fuel at $1.50 per day (a large estimate), the roller costs the community only $4 per day of operation. One of these rollers of good make can easily consolidate 1,000 square yards in a day at a cost of less than one cent per yard. Aside from this the roller can be put to other uses, if handled by intelligent men. When not in use as a roller its engine can furnish power for the crusher, it can, as has been said, haul the stone, or, as was done in an English town, 'pull stumps and drag heavily loaded wagons over unfinished portions of the roadway.'

"The only machines, aside from the steam roller and stone crusher, which can be spoken of as absolutely necessary, are rock drills to be used in the preparatory duty of blasting the stone, and these are generally to be found in every neighborhood where any quarry work is done. In case it is necessary to buy them they will cost $300 or less each. One man at $2.50 a day will operate them, and the steam supply will cost but little.

"If one estimates the cost of improving the roads of a district at $100,000, exclusive of machinery, it is not fair to add more than 10 per cent. to that sum as the sum to be expended on crusher, roller and drills, and this may be materially decreased by co operation. One crusher and one roller are quite capable of doing the work of several communities if each takes its turn, and thus, providing each district pays its share of the original expense, or if one district buys the machines and rents them to the others at reasonable rates when not at work on its own roads, the expense of the machinery becomes really a very minor affair."

EXCAVATION OF THE CROTON AQUEDUCT, NEW YORK.

In a paper on the above subject presented this week before the American Institute of Mining Engineers, Mr. J. P. Carson gave a series of interesting notes relating to the mining part of the great work. Mr. Carson's description of the tunneling through the bad ground found near Shaft 13 is in substance as follows:

On June 1, 1885, the tunnel at the foot of the shaft was commenced, and advanced at the rate of 80 feet a month for 392 feet through hard dolomitic limestone, which then became softer. Fifteen feet further, at station 777 + 59, on the east side of the heading, a fissure was cut on December 9, and the trouble began. There poured out a mixture of decomposed limestone, clay, sand and dirty water, which soon partially filled the tunnel for 125 feet, and amounted to about 100 cubic yards. After three days the water became clear, the fissure was plugged with straw, and the heading advanced 20 feet further. Then, on December 22, without warning, another outpour three times greater than the first occurred. The men were driven out, and everything in the heading for 50 feet was covered out of sight.

Timbering so as to allow for 20-inch brickwork was then commenced at the soft rock. At the end of two months the heading had been cautiously advanced 34 feet to 778 + 13, and 17 sets of timber placed, the last two being reinforced with heavy hemlock spreaders. A bulkhead was then built at the end of the timbers, at 778 + 09, this being the edge of the soft ground on the east side. The bench during this time had been brought up, and was 32 feet behind at 777 + 77.

For several days the clay and mud in the face of the heading were continually forced inwards. Some idea of the pressure may be formed from the fact that 24-inch oak logs used as rakers at the bulkheads became so crushed after 24 hours that they had to be continuously renewed. A small cave on the surface then occurred; finally, on February 20, this was followed by a much larger one, about 25 feet east of the center line. It was directly in the line of a small stream, which partly filled it with water. The stream was immediately diverted and a pump rigged to remove the water from the hole. This cave was supposed to be the mouth of the original fissure, and an abortive attempt was made to clog it up by throwing in bales of hay, cedar-brush, logs and stumps. Either from the fact that the course of the brook had not been properly diverted, or by reason of the sudden thaw or local conditions, this debris gently glided down into the tunnel, completely filling it for 70 feet, and gradually sloping down to a depth of 1.5 feet for 312 feet, or to within 75 feet of the foot of the shaft. It amounted to about 1,189 cubic yards.

Faith in the theory of a fissure in the limestone led to the plan of a crib. It was aimed to strike the fissure, which was to be arched over, or otherwise closed. The dimensions were 12x12 feet on the outside. It was sunk to a depth of 50 feet, when, hardpan occurring on the west side, it began to sink irregularly. After three weeks' work and the expenditure of about $900, the contractors concluded that they had expended the amount allowed "for any work they should do on the surface, to be paid after the tunnel was through," and stopped.

At this time several plans were proposed. Among the most feasible were the following: Charles M. Kalmbach, a well-known tunnel expert, proposed to drive a heading below sub-grade and fill with concrete; to then gradually widen out and thus obtain a foundation. The division engineer in charge, Alfred Craven, proposed instead, a timber platform of oak or Georgia pine, upon which the concrete should be laid, and to change the section from the horseshoe to the circle. This was generally conceded to be right, but in the following August it was decided to use white oak for the platform and return to the horseshoe section; and this plan was formally approved January 10, 1887, but not fully adopted by the contractors until the year after. In the next year the work was carried on with a series of experimental drifts, conforming to no regular system of timbering, and the means adopted were entirely inadequate to the work in hand.

In March there occurred an entire change in the management. The English system was introduced, and the work, without serious interruption, was completed in a year and two months.

Mr. Carson further gave some miscellaneous information as follows:

The amount of brickwork laid in the New Croton Aqueduct is estimated at 312,258 cubic yards, or about 163,000,000 of bricks, which would build 33 structures the size of the *Tribune* building.

The total area of the inside surface of the aqueduct from Croton Lake to One Hundred and Thirty-fifth Street gate-house is equal to 7,092,823 square feet, or 162,83 acres, or about equal to one-fifth the area of Central Park.

The total excavated material of the entire aqueduct exceeds 2,800,000 cubic yards.

The total excavated material plus the masonry placed exceeds 3,250,000 cubic yards. This is equivalent to 83 per cent. of the volume of the great pyramid of Cheops.

This material would be sufficient to build a wall 10 feet thick and 55 feet high around Manhattan Island, 30 miles in length on the water front.

The amount of dynamite used in blasting on the aqueduct, exclusive of the amount used in sinking the shafts, was over 5,800,000 pounds, or over 2,900 tons.

The flowing capacity of the aqueduct, 318,000,000 gallons per 24 hours, is equivalent to a stream 50 feet wide and 10 feet deep flowing 59.1 feet per minute, or about one foot per second, or about seven-tenths of a mile per hour.

DIAMOND DRILL PRACTICE.

IN reviewing American and foreign practice with the diamond drill in a paper read before the American Institute of Mining Engineers at New York last Monday, Mr. W. F. Durfee stated that the art of penetrating the earth's crust by drills of various kinds is a very ancient one, and has been practiced in Asia from the earliest times.

A French missionary, the Abbé Imbert, relates that, when in China, he "had seen many bored wells, of a diameter of five or six inches, and a depth of 1,500 to 1,800 feet," and his description of the method followed would answer for that in use at the present day for boring wells with percussion tools, by merely substituting steam for manual power, the apparatus used for boring being nearly identical. In fact, it is to the ingenuity of the Chinese that we owe the system of boring wells by the use of a steel implement suspended at the end of, and operated by, a rope, as distinguished from the more modern method, in which the operating tool is secured to the lower end of a series of screw-jointed rods by which a turning and percussive movement is communicated to it.

The method of action of the present form of diamond drill involves no percussive shocks whatever, but operates by a movement of continuous rotation and progression, the rock being abraded by the action of a number of black diamonds firmly imbedded in the end as well as the inner and outer circumference of a short hollow cylinder, called a "bit." This is attached to the lower end of an externally grooved tube, called a "core barrel," which, in turn, is attached to a succession of hollow rods properly coupled together, end to end, until they reach the boring machine, where they pass through and are secured to a hollow spindle to which rapid rotary motion can be given by power. To the upper end of these hollow rods is attached an apparatus called a "water swivel," to which is connected a "water hose," the swivel being so contrived that the hollow drill rod can turn without winding up the hose. Through the latter is constantly forced a stream of cold water under sufficient pressure to maintain a continuous current downward through the hollow revolving drill rods and core barrel, and upwards between the outside of these and the inside of the hole to the surface of the ground, or to some fissure in the rock through which the water can escape. The rapid flow of this water not only carries off the fine particles of rock removed by the bit, but serves, at the same time, to keep the latter cool.

It will be understood that the diamond drill does not remove the whole of the rock by its abrasive rotation, but that a central portion, or core, is left, which can be removed from the hole in a solid form in lengths of from 8 to 10 feet. It is further manifest that a succession of such "cores," arranged in the order of their extraction will give an exact record of the character and order of the strata through which the hole is being driven.

The active and indispensable part of this core-making apparatus is the already mentioned diamond-mounted bit. The bits are, in fact, diamond-toothed rasps, the teeth being formed of black diamonds, or carbonadoes, as they are more properly called. These were first discovered in the diamond gravels of Brazil, in 1842, and it is from that country that the world still derives its supply. The metal of the bit is soft steel, in which holes of various sizes, suited to the sizes of the diamonds, are formed. Each diamond being placed in its cavity, the surrounding metal is closed against it and made to overlap it in some degree by means of punches. Some of the diamonds project on the outside and others on the inside of the bit, and are for the purpose of cutting an external and internal clearance, so that the core produced will not fill the core barrel completely, and that the latter will have freedom of movement in the hole. The bit is provided with a screw by which it is attached to the "core lifter" case. The latter, with the little apparatus within it called the "core lifter," performs an important office in the work of the drill, as it passes freely over the core while the drill is revolving and penetrating the rock, but grasps it firmly whenever the drill is lifted. Whenever the core barrel is filled with the core, it is raised from the hole, the core lifter meanwhile holding the core. The lifter consists of two parts, the core lifter ring and its enveloping case. These are combined and operated together.

The speed, or rather the number of feet per day that can be bored in a given hole, depends upon the hardness of the rock and the depth at which the boring is being done; for while the actual boring can be done at the same rate when the hole is deep as when it is shallow, the time lost in drawing the rods in a deep hole is so great as to seriously influence the depth of drilling in a given time. It is, therefore, difficult to name a figure that will represent the average rate of boring. One hundred feet per week of cored 2-inch hole is probably not far from an average speed. Holes have been drilled at the rate of one foot per minute in sandstone, but the durations of the run was short, and this speed could not be maintained continuously for any great length of time. Holes have been driven in anthracite coal at the rate of 22 inches per minute. The fastest drilling in regular work, within Mr. Durfee's knowledge, was done in sinking a shaft for the Westmoreland Coal Company, in which a 1¾-inch hole was driven, with a solid bit, 171 feet in 10 hours. As the speed is irregular and uncertain, so is the cost. Mr. L. A. Riley, in a previous paper to the American Institute of Mining Engineers, gives as the average cost of drilling 24 holes for the Lehigh Valley Coal Company, $2.22 per foot, to which he adds 20 cents per foot for royalty, interest, and wear and tear, making a total of $2.42 per foot. His greatest cost is $4.08 per foot, and the cheapest, $1.18. These figures are without margin of profit to any one. Under ordinary conditions contracts are taken, for 2-inch holes, at from $2.50 to $4 00 per foot, the price depending, in no small measure, upon the quantity of work at a given location.

THE FRESH-WATER WELLS OF THE ATLANTIC BEACH.

DR. PERSIFOR FRAZER, writing in the September number of the *Journal* of the Franklin Institute, says that anything which will throw light upon the character of the drinking water which is supplied to the hundreds of thousands of sojourners by the New Jersey sea coast, must necessarily have interest to the public.

The practice, during the last five years, has tended toward sinking artesian wells near most of the larger summer hotels. The supply of water by this means was so abundant and excellent that the New Jersey State Geological Survey, under the late Professor George Cook, determined the water-bearing planes, and published the depths at which these might be expected in bore holes along the sea coast from Sandy Hook to Cape May. The wells which have since been driven have amply proved the soundness of the data.

But in numbers of cases it is not possible to resort to deep boring, and in these cases the supply is by surface wells sunk a short distance below the sand. Of course, these wells are permissible only in cases where, for a considerable distance around them, the population is sparse and there are few cesspools or collections of decaying matter, and in some cases these conditions obtain sufficiently to justify the use of surface wells, but sooner or later these must be abandoned and recourse must he had to artesian borings, which, fortunately, need not be very deep, to furnish an ample supply for all needs.

In order to give to the layman an idea of the condition of the strata and their relation to the water supply of the coast, it may be said that the famous marl beds of New Jersey, with the clays and sands which divide and intermingle with them, form impervious beds through which water cannot percolate. They cross the State from about Long Branch to the old town of Salem, near Fort Delaware, running approximately southwest, and inclining or dipping in a direction perpendicular to this (or southeast), at a gentle angle of about 20 feet to the mile. These are the water-bearing floors which supply the greater part of the artesian wells sunk along the coast between Long Branch and Cape May, though there are other and higher planes along which more or less good water is constantly flowing downward to and entering the sea at a greater or less distance from the coast. The permanence and purity of a supply will depend upon the extent of country which pours its rainfall upon the upper edges of these marl strata or the overlying clay beds. The outcrop of these strata is not parallel with the coast line, but runs inland to the southwest; it is, therefore, obvious that the farther one goes to the south from the intersection of these strata with the ocean border, the deeper must the well be bored in order to find water. One of the upper marl beds touches the sea line at Asbury Park, and the next higher marl at about Branchport. To reach the water flowing along the upper planes of the first deposit at the Beach House, Sea Girt, for instance, one would be obliged to sink about 160 feet; and to reach the probably larger supply of the marl next below at the same point, a depth of 240 feet would be required. But before coming upon these well-known horizons of good water, it is extremely probable that others would be found, representing higher clays, as was the case at Berkeley, on the Barnegat Beach.

But to return to the surface wells. There is at the Beach House a well sunk by Commodore Stockton, when the middle house was his seaside home. This well is a prominent object on the lower porch of the hotel, and furnishes all the water consumed for drinking and cooking purposes. The depth of the bottom of the well is 20 feet 5 inches from the surface, and its average depth of water is 3 feet. One of its peculiarities, which astonishes those unfamiliar with the behavior of streams of water at points near their confluence with another body of water of varying depth, is that the level of the perfectly sweet and fresh water rises and falls with the tide in the ocean 150 feet to the east of it. This is not at all remarkable when one reflects that the same ocean tide causes the fresh water of the Delaware and Schuylkill to rise, and their surface currents to retreat towards the mouths of those streams, though eighty-odd miles from the ocean.

The water which fills this well represents the drainage of a few square miles around Sea Girt, and is simply the rain water filtered through the sand and gravel of the coast belt, and collected on the surface of some local intercalated bed of clay. Were the region thus drained as thickly populated as a few other parts of the coastal belt the water would probably be unfit for drinking purposes; but it happens that the settlement of this area is sparse and its contamination from putrifying substances small.

For the purpose of investigating whether or not it were potable as well as to learn something of the nature of the water from similar wells on the New Jersey coast, having first filled and rinsed a perfectly clean five-gallon demijohn 12 times with water, Dr. Frazer collected a fair average sample. Subjoined are the results of this examination.

Water slightly alkaline.	In a Million Parts.	Grains per Gallon.
Free ammonia	0.033	.....
Albuminoid ammonia	0.030	.
Chlorine	...	4.2
Total solids in solution	.....	29.0

As to the two forms of ammonia this corresponds closely with an analysis by Wanklyn, of the water of the river Lea, supplied by the East London Water Company to the citizens of London. The percentage of albuminoid ammonia is only 0.01 higher than that found by the same distinguished analyst in the water of Loch Katrine, which supplies the people of Glasgow. While not extraordinary on account of its purity it is well within the limits beyond which chemical analysis indicates danger.

The same is the case with the chlorine and total solid constituents. They present no ground for suspicion of dangerous contamination, and indicate what a subsequent examination of the drainage system proved, viz: That the latter was in good condition, and carried all sewage in closed pipes to an inlet connecting with the Manasquan River about a mile away from the house. This is but one instance, and it may be an exceptional one, on the coast of New Jersey, where a surface well is still utilizable. The time will come when such supply can no longer be resorted to, but in this case it has not yet arrived.

ACCORDING to *Kuhlow's German Trade Review*, the entries which have already been made for the electrical exhibition to be held at Frankfort-on-the-Main, Germany, appear to promise an exceptionally fine showing.

VICTORIA, B. C., by popular vote, has decided to have sewers. The Victoria *Daily Colonist* emphasizes the desirability of losing no time in beginning the work of construction.

THE PANAMA CANAL.

THE report, just published, of the Engineering Commission sent to the Isthmus of Panama by the Liquidator of the Panama Canal Company is not of a nature to give much hope for the enterprise. Primarily it sets forth that the problem should be resolved by the study of two questions: first, what will it cost to finish the canal? second, what will be the income of the canal when finished? that is, immediately after its opening or after a given time.

"Before discussing the two questions," says the report, "it will be necessary to consider the spot on which this great work is to be done. In short, it is a place resembling nothing with which we are familiar as the scene of a great work. It cannot be compared with any great undertaking of our times, and to judge of it by European experience and work will be to lay ourselves open to the most serious misconstruction. Under the hot, humid, enervating climate of the isthmus, surrounded by the emanations of a rich, clayey soil, amid swamps, in a country but sparsely populated, covered by a dense tropical vegetation that nothing can check, the white race cannot undertake steady work of a laborious character without returning from time to time to a healthier climate to reinvigorate themselves. Under such conditions they can exist, handle machinery, and work under cover away from the sun and rain. But to dig into the earth and do steady manual labor in the open as men do in our climate is impossible, unless they expect the early failure of their health and strength."

Dr. Wolfred Nelson, who has spent a number of years at Panama, says that the year on the isthmus is divided into two seasons—the dry season or Verano, from the middle of December to the middle of May, and the wet season, lasting the remaining seven months. The annual rainfall is 3 meters—over 118 inches. The effect of these enormous downpours on a clay soil is to turn the rivers into raging torrents. On this subject the engineers say:

"The most important of the rivers is the Chagres, in whose valley fully one-half the canal must be constructed. The river in the wet season rises from 10 to 12 meters in 36 hours. At its maximum it discharges 1,500 cubic meters a second, and may double that. On this score we are reduced to conjecture, and cannot say what difficulties will have to be overcome in combatting this torrent.

"Next, as an obstacle between the two oceans is the Cordillera, which must be divided to open a way for passage of vessels. The height of the mountain above the sea is about 339 feet, and whatever solution may be adopted, a cut of over four miles long must be made. This work will require great time." Next the geological formation is treated, its peculiarities, and the impossibility of making sharp-angled sides to the huge cut. Again, the report of the engineers dwells on the fact that no European standards of work can be applied to isthmian work. Then it deals with earthquakes and reports as follows:

"To these inherent difficulties must be added a danger peculiar to the country, namely, earthquakes, the importance of which has been denied by some and exaggerated by others." Regarding the great cut to be made in the Culebra it says: "During an earthquake what effect might result on the sides of a cut 100 to 150 meters in height? Would it not shake from the hills great masses of rock, damaging the walls or sides of the cutting, in short, disturbing their stability? Here an inevitable uncertainty develops, regarding which the Commission expresses no opinion."

While the physical difficulties that must be overcome are severe, Dr. Nelson is inclined to think that far more important questions are those of time and expense. These matters he has made subjects of considerable investigation. The concession lapses in 1892, but an extension of six years may be granted by the President of the United States of Columbia. Even though this is done, Dr. Nelson does not deem the six years sufficient to complete so huge a work.

The highly important question of supposed revenue—which is a matter of extreme uncertainty -has been figured on by French scientists ever since the project was begun. In the light of recent developments Dr. Nelson says that for the first four years a revenue of 51,250,000 francs is expected. This is calculated at 12 francs a ton, which, less working expenses and dues to the Government of Columbia, leaves a net revenue of 38,678,500 francs. Four years later it should be 63,750,000 francs, on a traffic of 5,100,000 tons at 12 francs, which, less maintenance, etc., leaves 13,187,500 francs a net revenue of 50,562,500 francs. Again, four years later, on a tonnage of 6,000,000 the gross revenue should be 75,000,000 francs, which, less a maintenance of 13,750,000 francs, leaves a net revenue of 61,250,000 francs.

As to the question of cost, he estimates that 899,000,000 francs, including interest, will have to be expended to complete the ditch, that is, if the old share and bond holders are willing to come to an agreement by which they forego all interest for many years to come and trust to a future development of traffic. The working expenses and maintenance of the plant, he estimates, will reach 2,000,000 francs ($400,000) per annum.

Despite the desire to see a clear horizon, Dr. Nelson says that French engineering experts cannot dissipate the doubt that the canal's future is less assured than that of the Suez Canal; that the expense at Panama and the annual charges will be heavier, the tariff higher, and the facilities for shipping less.

Correspondence.

Communications giving information or opinions on matters of general interest to the engineer, the architect, the contractor, or the municipal officer, will be welcomed in this column. Fairness will suggest that when communications are sent simultaneously to this and other journals we should be informed of it at the time. Anonymous letters will not be noticed.

LARGE SIZE VITRIFIED PIPE FOR SEWERS.

PROVIDENCE, R. I., September 26, 1890.

To the Editor of THE ENGINEERING AND BUILDING RECORD:

SIR: I read with interest, mingled with some surprise, the quotation from an address delivered at Columbus on the subject of sewerage, as published in THE ENGINEERING AND BUILDING RECORD of September 13.

It would have been interesting if the author of the address had given us the data of his experience, which led him to state so emphatically that the material of which 18, 20, and 24-inch vitrified pipe is made is not a safe one to use in these large diameters. That pipes 24 inches, or 20 inches, or 18 inches in diameter have failed, there is no doubt, nor is there any doubt that failures have occurred in the use of 15-inch, or 15-inch, or 8-inch, or even in 6-inch pipe. It would, therefore, have been interesting to know the data which the author had in drawing the line of safety at 15 inches in the use of vitrified pipe for sewer work. My own opinion is that pipes as large as 24 inches in diameter are made, which, if properly laid, are safe and reliable.

In regard to the thickness of brick sewers, as you have stated, much depends upon the nature of the material in which the work is laid. Doubtless sewers three feet in diameter may often be built of a single course of brick, and give good results, in which case it is probable that good materials would be selected, and care taken in the construction of the work; but why it should follow that if any "engineer, contractor or inspector" be allowed to use two rings, "he may put in anything he likes," I do not understand. Why cannot the same good material be used, and the same care be exercised in the construction of work of two rings, as in one-ring work? Carrying the principle laid down by the author a little further, as for instance in the use of 12 or 16-inch work, would the material deteriorate in proportion? If not, why not?

SAMUEL M. GRAY, City Engineer.

PHILADELPHIA'S WATER CONSUMPTION.

IN ten years the daily consumption of water at Philadelphia has risen from 57,707,082 to 116,490,191 gallons, and it is thought that the daily average for 1890 will be 125,000,000 gallons.

This great increase in consumption is explained by the growth of the city and the fact that the more water that is given the people the more they want. It is estimated that only 10 per cent. of the water consumed is used for drinking and culinary purposes. Three years ago the storage capacity of all the reservoirs was 195,000,000 gallons; now it is 900,000,000 gallons, owing to the completion of the East Park Reservoir. Plans are now under consideration for two more reservoirs, which will add 600,000,000 gallons to the city's storage capacity.

HIGHWAY ENGINEERING.

THE Executive Committee of the Massachusetts Institute of Technology has accepted an offer of Colonel Albert A. Pope, of Boston, Mass., to contribute such sums of money as the institute may need during the next five years, up to the amount of $6,000, for the promotion of an option in highway engineering connected with the course in civil or mechanical engineering. This sum is to be used by the institute in preparing some competent graduate, by studies at home and abroad, for a nominal instructorship on this subject in the institute, and who will gather material and facts on the subject for the benefit of the institute, will deliver a course of lectures thereon yearly, and will be open to consultation by the officials of towns and cities not employing permanent city engineers. It is expected that the option will eventually lead to the establishment of a department on highway engineering.

CHINA has 136 telegraph stations. The system is mainly controlled by the government.

Questions and Answers.

All questions relating to building construction, paving, sewerage, water supply, or kindred subjects, will be welcomed in this column provided they relate to matters of general interest and are not such as should properly be referred to a consulting engineer. Answers will be carefully prepared and a proof of both question and answer mailed to the inquirer as early as proper consideration will permit. They will be published for the benefit of other readers as soon as convenient. The full name and address should be given, not necessarily for publication, but as a guarantee of good faith, and to facilitate further correspondence in case the question is not sufficiently explicit.

Inquiries of the Editor, in order to secure prompt attention, should *not be written on the same piece of paper as a communication* to the *Publishing Department.* Letters renewing subscriptions are sent to a clerk in the publishing office, and matter for the Editor, if in the same enclosure, is likely to be overlooked unless it is on a separate piece of paper, so that it may be promptly sent to the Editor.

LOWERING A WATER MAIN.

W. L. CAMERON, Superintendent of the Artesian Water Company, at Memphis, Tenn., writes:

"In your issue of September 13, I notice a very elaborate plan for the lowering of a 10-inch pipe. With no desire to criticise, still I would suggest a more simple, and, I think, less expensive method.

"We lowered some 1,000 feet of 12-inch pipe, from 2½ to 4 feet, which was successfully accomplished by simply digging the trench to the necessary depth under the pipe, and a little wider on *one side* to prevent *jam* of *joints*, leaving under each bell (behind the bell) a support of earth 1 foot wide. When all was clear, we simply cut the bank an inch or so at a time and allowed the pipe to settle. One or more calkers were on hand to keep joints calked up.

"All fire hydrant branches were handled in the same way, and the pipe was lowered without the pressure (some 50 or 60 pounds) being taken off. No blocking or rods were used. In a rock trench, jacks can be placed under every second or third joint, and the pipe lowered by simply moving blocking, as same goes down.

"In this manner we lowered some 300 feet of 24 inch suction pipe, through which a 6,000,000 pump was deriving its supply, and the engine never felt any air leaks during the progress of the work."

HOW TO KILL GRASS AND WEEDS IN GUTTERS AND SIDEWALKS.

HENRY M. NOURSE, architect, of Boston, Mass., writes: "Replying to the query in your issue of September 20, 'How to Kill Grass and Weeds in Gutters and Sidewalks,' I would say that turpentine, used clear or very slightly diluted, applied with a fine-spray watering-pot, will take the nonsense out of the proudest weed that grows.

"A client of mine is taking the above measures to rid his lawn of weeds and bunch-grass; and as for its death-dealing qualities, he has not the slightest doubt, as it takes root and all.

"Rock salt, or a strong brine or pickle, I have known to give like results."

W. T. CASGRAIN, C. E., Superintendent of the Kimbell & Cobb Stone Company, of Chicago, Ill., writing with reference to the same subject, says: "Use common salt if grass and weeds are very plenty, and sprinkle with water until salt is dissolved. Where the joints in material used are close make a solution of salt (or brine strong enough to float a potato) and sprinkle over joints two or three times. This I found the easiest and quickest remedy for killing grass and weeds in gutters and walks of public parks."

STILL another correspondent recommends covering the gutter or sidewalk with about half an inch of dry sand on a hot day. This will burn the grass, and one hot day will generally kill it. The sand can then be scraped or swept off. This should be applied before the grass attains any great strength. If it has attained much growth the sand should be thicker, and would have to remain on longer.

MAKERS OF WROUGHT-IRON CEMENT-LINED PIPE.

JOS. S. KERN, JR., General Manager of the American Pipe Manufacturing Company, of Philadelphia, Pa., writes: "Noticing the inquiry about wrought-iron cement-lined pipe manufacturing companies in your issue of September 20, I beg leave to inform you that the New Haven Patent Water Pipe Company are not the only makers.

"We have manufactured under the Phipps patent for the past four years. The New York Pipe Manufacturing Company, with office in New York *Times* Building, and works at Hastings-on-the-Hudson, also makes it."

DOMESTIC PLUMBING HEATING LIGHTING & VENTILATION ENGINEERING

ELECTRIC MOTORS.

THE electric motor business, which was in a nascent state a few years ago, has, of late, been developed at a remarkably rapid rate, and a large number of motors are now in use, and are constantly being added to, for a wide variety of power purposes.

In a general way, it may be said that they are employed in all those industries and lines of work formerly supplied by a small amount of steam power or by gas engines and water motors, which have been quite extensively employed during the last few years. Electric motors are now used for driving air compressors, bookbinding machinery, bakers' machinery, blowers, cranes, carpenters' machinery, cash carriers, coffee mills, churns, drug mills, dumb waiters, dentists' lathes, drill presses, elevators, grindstones, hydraulic presses, hatters' machinery, ice-cream freezers, jewelers' lathes, knitting machines, lathes, laundry machinery, looms, paper-box machinery, polishing machines, pile driving, printing presses, quotation transmitters, sewing machines, stamping machines, ventilating fans, and a hundred other small uses.

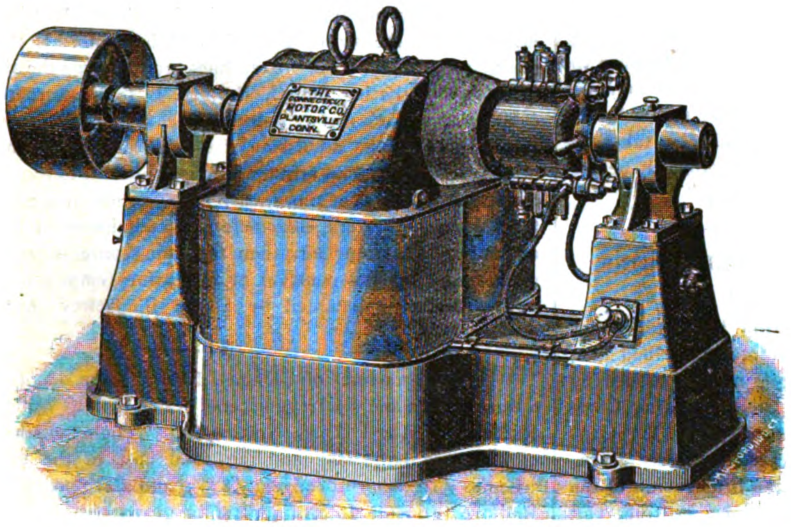

THE CONNECTICUT MOTOR CO. PLANTSVILLE CONN.

FIG. 1.—MOTOR OF THREE H. P.

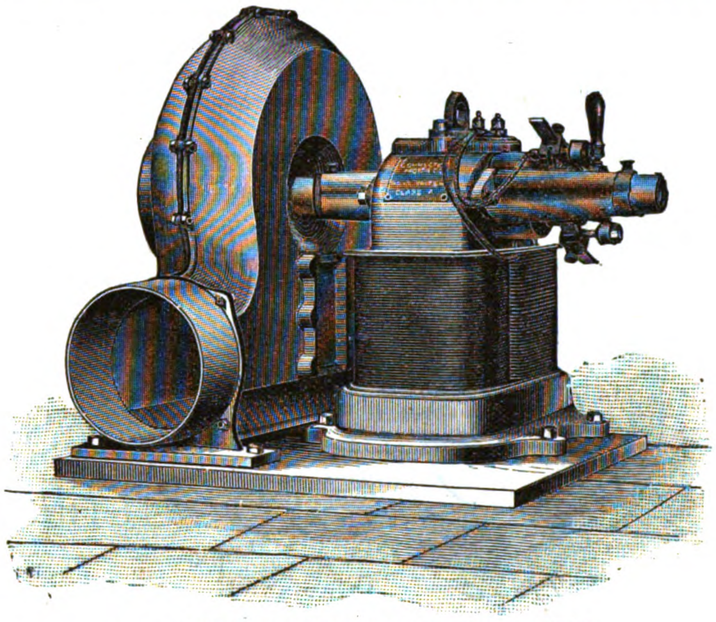


FIG. 3.—ONE H. P. MOTOR COUPLED TO BLOWER.

THE CONNECTICUT MOTOR, MADE BY THE CONNECTICUT MOTOR COMPANY, PLANTSVILLE, CONN.

Nothing more surely indicates the confidence now placed in the electric motor than the extent of its use by elevator men. In the case of belt driven elevators it is much used in localities where current is obtainable. With hydraulic elevators, worked from tanks, the motor is used to actuate the force pumps, which it does automatically without working to waste. Combinations in which the motor is geared direct to the elevator are now claiming the attention of the engineer in locations where space is of primary importance, though as yet this method has not found so much favor as those above mentioned. Under this heading comes a host of similar appliances, such as hoisting and winding engines for mines, and building work; cranes and gins for factories and warehouses. Printers have from the first appreciated the advantages of the electric motor. Newspaper men commonly require their power at night, and not by day. Job printers often use power for but a small proportion of their working hours, and, generally speaking, the printers who can make an economic use of steam plants are far outnumbered by those who cannot—with the result that the electric motor is now indirectly responsible for a large proportion of the reading matter placed before the public.

From among the lighter industries we select the application of sewing machines as one most frequently met with. Sewing machines usually require about one-twelfth horse-power each. This figure will be found high where many machines are run from the same shaft, and low if their number be small. The class of work done makes but little difference to the power absorbed, on account of the speeds varying almost inversely to the heaviness of the material sewed.

Wherever a moderate amount of power is needed the electric motor can supply it. The economy of the electric motor over small steam and gas engines is, moreover, claimed to be considerable, being based on the fact that the electric current is generated mainly in central stations by large engines, which consume much less coal for the power furnished than do an equivalent number of small engine and boiler plants. As to the cost of the electric current, it has been pointed out that electric light companies can afford to sell the power cheap, as the motor business is of great and positive advantage to them in giving employment and earning capacity to their plant when it would otherwise be idle and profitless. This will be understood when it is considered that most of the electric lighting is done at night, and the machinery and plant of the company is then employed, while during the day time it would be idle. As to the cost of the motors, it may be said that prices are constantly tending to become more reasonable, owing both to increasing competition and more rapid progress towards greater perfection in manufacturing facilities. Taking into consideration, further, that electric motors appeal at once to prospective users because of their greater neatness, cleanliness, and compactness, as compared with most other forms of engines, and that they require practically no attendance except for starting and stopping, their more general introduction would seem to be inevitable. As it is, their value is already widely appreciated, and those desiring to use them have a number of patterns from which to make selections.

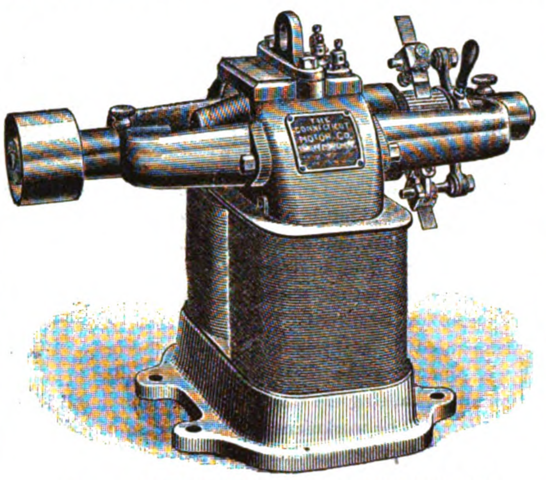

THE CONNECTICUT MOTOR CO.

FIG. 2.—MOTOR OF TWO H. P. AND UNDER.

In view of all this an examination of what is now available in the electric motor line cannot fail to be of interest to many of our readers, principally, perhaps, architects and contractors having in hand the equipment of buildings with ventilating and water pumping machinery, etc.

We commence, therefore, in this issue the publication of brief illustrated descriptions of the various electric motors now on the market, having endeavored to make the list of manufacturers as complete as possible. The principal features of the motors are pointed out, the sizes in which they are made are given where they have been available, and some of their special applications are shown. The matter is not presented on the score of novelty since a number of the motors to be described have been for sale and in use for several years. It will, no doubt, be appreciated, however, as of practical value, by many who are confronted in every-day work with the problem of installing power plants to the best advantage for special service.

THE CONNECTICUT MOTOR.

The Connecticut electric motor, of which two forms are shown in Figs. 1 and 2, is made by the Connecticut Motor Company, of Plantsville, Conn.

The simple horseshoe magnet has been adopted in this, the poles being turned upwards, in order, it is claimed, to avoid the leakage which might otherwise occur through the bed plate, while, at the same time, the breech or neutral portion of the magnet becomes a solid base on which the machine rests. There are no magnetic joints, the whole field being in one casting of soft iron. The armature proportions are medium, the length being equal to about two diameters. The journals of the shafts are in all cases arranged to be self-oiling. In the type of machine shown in Fig. 1, designed for three horse-power and upwards, the shafts are fitted with oil wells, and in the smaller motors, of two horse-power and less, Figure 2, the bushings are lined with graphite. The holders for the brushes, which collect the current from the machine for further transmission, are of a new and improved pattern, having a light and fine spring adjustment. In Fig. 3, a one horse-power Connecticut motor is shown, coupled direct to a No. 2 Sturtevant exhaust fan. Fans, working usually at high speeds, are well adopted for such direct coupling, and, where not more than one fan is driven by a single motor, this arrangement is often used. It has proved to be of great value in cramped situations, such as are always found on shipboard, and usually provided by architects on shore.

The Connecticut Motor Company, some time ago, furnished the Pratt & Whitney Company, machine tool builders, of Hartford, Conn., with a motor for driving a large planer, to be run overtime. The planer required about three horse-power to operate it. The question came up as to the advisability of placing a motor in position to operate that planer, or to operate the regular engine and consume at least 10 or 15 horse-power uselessly in turning the shafting transmitting the power from the engine room to the planer. The motor was finally installed and answered every purpose most satisfactorily. This is but one instance out of many where the electric motor could be used with good results, and yet its employment in the machine shop is so rare as to always excite comment wherever and whenever it is found.

The motors are wound for potentials of 110, 220, and 500 volts, and should be placed in dry situations, well insulated from the earth. A safety fuse should be placed in the circuit, so as to prevent damage to the motor in case the current should exceed the normal working value. Twelve sizes of this motor are made, varying from ½ to 50 H. P.

(TO BE CONTINUED.)

ECCENTRIC STEAM FITTINGS.

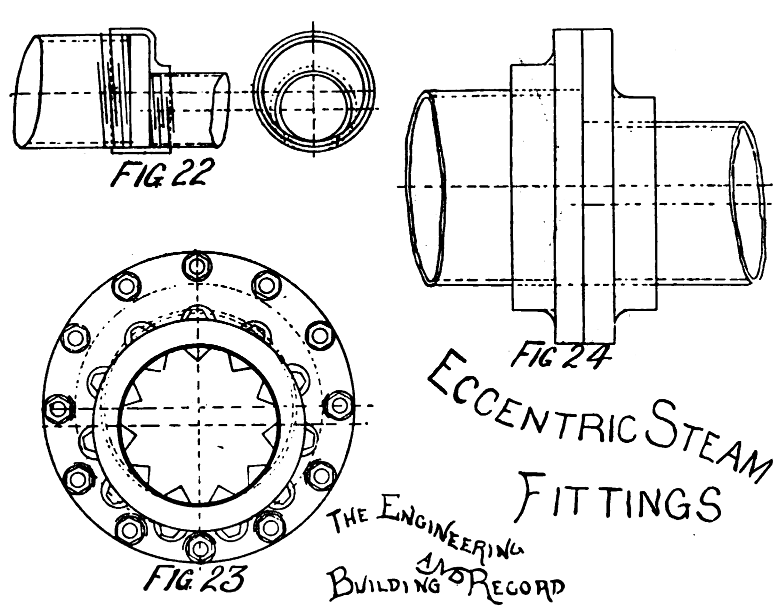
CONTINUING its articles on steam pipes and fittings, *The Locomotive* says that the application of the eccentric principle to main steam pipe connections can be extended with advantages to couplings for long lines of pipe and with especial advantage to fittings used in steam heating systems.

With the ordinary style of couplings, when the size of a steam main is reduced, it is necessary to put in a relief or drip pipe, sometimes at considerable expense and trouble, whereas if an eccentric reducing coupling were used, which would cost no more than one of the ordinary kind, the water of condensation would flow freely onward.

Figure 22 shows, in section, a form of reducing coupling which could be used with advantage on all sizes of pipe up to eight or ten inches in diameter. Figures 23 and 24, end and side views, of flange couplings for the larger sizes of pipe. The construction will be readily understood from an inspection of the cuts. The offset is just sufficient to bring the under sides of the pipes on the same level.

It will probably be urged as an objection to this style of fitting that they are not made and kept in stock by manufacturers of pipe fittings. This objection will vanish as soon as there is any demand for them. They will be found of far more use, and would probably be used a hundred times at least where a cross-valve is used once; still the latter is a standard fitting because it is occasionally called for.

While we have illustrated and described such eccentric fittings in earlier issues, their importance warrants recurrence to the subject.



Notes and Queries

on Domestic Engineering.

Communications relating to the practical details of plumbing, heating, lighting and ventilation will be welcomed in this column. The writer's true name and address must always be given, but an assumed name may be used for publication if preferred.

STEAM HEATING DATA.

"C. P. W. F.," Minneapolis, Minn., writes: "Will you kindly refer us to any articles on central heating plants, and answer any of the following points.

1. What amount of steam can be conducted by steam pipes for a difference in pressure of 2, 5 and 10 pounds between supply and return ends when the pressures are 60 or more pounds?

2. Same for water return mains, when they discharge into open tanks, and pressure is 10 pounds and under.

Above are far long distances 200, 400, 600 and 1,000 feet.

3. Do you consider expansion joints sleeve pattern preferable to offsets or loops?

4. In case an expansion joint is used, would not an all cast iron one, which would become coated with magnetic oxide, be preferable to present method of brass and iron?

5. Would you consider it where mains run on a level more desirable to carry 5 pounds on heating apparatus discharging into return mains through simple trap in case pressure would return water, to using mechanical return traps, or tank and pump?"

[In reply to our correspondent we would say:

First.—THE ENGINEERING AND BUILDING RECORD has published accounts of the New York Steam Company's plant.

Second.—The Transactions of the Am. Soc. of C. E. contains papers by Mr. C. E. Emery on central steam plants. The secretary's office is No, 127 East Twenty-third Street, New York.

Third.—Robert Briggs' little book on steam heating, Van Nostrand publisher, give much valuable data on loss of heat or pressure in steam pipes. It has tables for conditions of low pressure steam.

Fourth.—Expansion joints are a nuisance, and never should be used if there is any way of getting along without them.

Magnetic oxide covered joints are impracticable. The slipping tube must be brass or gun metal.

The mechanical means of returning with pump and pump governor is the best, unless you can return by gravitation.]

CRACKED STEAM PIPES FROM WATER HAMMER.

ACCORDING to the London *Engineer*, five steam pipes were burst in England in 1889. Three of these were of cast iron, and their failure was attributed to the "water-hammer" action—*i. e.*, through the water therein, produced by condensation, not being properly drained off before steam was admitted. Two of these failures were accompanied by fatal results. In another case, a large copper pipe at an electric lighting works failed in a similar manner, causing the death of one person and injury to ten others. The workmanship in this case was stated to have been defective; but the failure was attributed chiefly to the action referred to. A steam pipe connected with some colliery boilers burst in a similar manner. Mr. Henry Hiller, Engineer to the National Boiler Assurance Company, very properly says: "All these cases manifest the great importance of steam pipes being arranged so that the liability to accumulation of water may be avoided. If this is unavoidable, special care should be taken to drain the pipes thoroughly before admitting the steam."

TRADE PUBLICATIONS.

HOT-WATER BOILERS.

THE Plaxton hot-water boiler is illustrated and described in a new catalogue recently issued by the Eureka Steam Heating Company, of Rochester, N. Y. General and detail views are given, together with a brief review of the subject of hot-water heating, and directions for setting the boiler.

BRIDGES AND ROOFS.

A HANDSOMELY illustrated catalogue has been issued by the Berlin Iron Bridge Company, of East Berlin, Conn. The illustrations represent a variety of structures put up by the company at different places, and give a good idea of the classes of work done by them. They were prepared direct from drawings or photographs and show exactly how the structures were built.

LINK BELT MACHINERY.

WITHIN the past six or seven years important developments have been recorded in the different kinds of conveying machinery, not the least interesting of which have been in connection with link belting. The different uses to which this product may be successfully applied are well illustrated in a pamphlet published a short time ago by the Link Belt Engineering Company, of Philadelphia, Pa. It is profusely illustrated, and besides matter of purely descriptive character gives also tables of sizes and prices of the different appliances.

PYROGRANITE is the name of a new artificial stone of Russian origin. It is made by mixing ordinary and refractory clays in different proportions, according to the uses to which it is to be put, molding them into desired shape, and finally roasting in a furnace.

ACCORDING to foreign reports, a great impetus has of late been given to the cement industry in Sweden. Among others a large manufactory has been erected on the Island of Gothland, the first industrial establishment of any importance on the island. There are six mills, each capable of producing between three and four barrels of raw cement per hour.

Novelties.

Devices are described under this head purely and strictly as news; because believed to be new and calculated to interest readers.

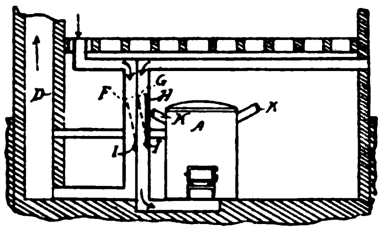
In no case is pay accepted, directly or indirectly, for publishing a novelty notice.

As the subjects are selected for their supposed novelty and interest merely, it will, of course be understood that the selection does not imply indorsement.

SWITCH GATE FOR HOT AIR FLUES.

IN the accompanying diagram A is a hot air heater which receives external fresh air through conduit B, and delivers it, warmed, to the room L through pipes K K, etc. C is a ventilating flue through which the air is ordinarily removed from the room thus heated to the shaft D. Flues B and C are at some point placed adjacent, and a section, F, of the partition wall between them is connected at H with a corresponding piece G, and both G and F are hinged to move freely about I I as axes.

Usually they are set as shown by full lines, both flues thus remaining distinct and operating separately. If, however, it be desired to keep up a continuous circulation of the same air, heating and reheating it without admitting more cold air, the switch gate F G H is revolved to the position indicated by the broken lines, and returns the air from the ventilating flue C, through B, to the furnace chamber, and back through pipes K K, at the same time that it shuts off the admission of outside air through the upper part of B. This arrangement is applicable to rooms continuously heated at times when they are not in use, as for churches, theaters, etc., before the admission of the audience. The same air, then remaining pure, may be maintained thus at a constant or increasing temperature.



The device is patented by Hosea B. Dewey, Milwaukee, Wis.

THE Town Council of Clonmel, Ireland, have adopted a water-works and sewerage scheme drawn by Mr. W. H. Radford, of Angel Road, Nottingham. The population of the town is 12,000, and the total cost of the two schemes £19,000, respectively £8,000 and £11,000. Mr. Radford proposes to bring water by gravitation from a mountain stream, with a water-shed of some 1,700 acres, at a distance of some three miles from the town. The water is stored, after passing through filter beds, in a covered reservoir on a hill in the vicinity of the town. It is estimated that the delivery at the reservoir will be 548,600 gallons per day. For the sewerage the proposal is also for gravitation, the existing system being adapted for taking surface water to the river. Centrifugal pumps will lift the sewage from the storage tanks transferring it to precipitating tanks, after which it will be passed through filter beds, and the effluent passed off into the Suir. Sufficient storage will be afforded by a chamber underneath the pumps to contain the sewage flowing through the night.

BOOK NOTICES.

CHALLEN'S ENGINEER'S LOG BOOK OF DAILY RUNS. Published by Howard Challen, New York. Price, flexible covers, 75 cents; half roan, $1.

The above heading practically tells nearly all there is to be said of the little book. The different pages are ruled so as to make blank tables, and have headings giving the month, day of the week, average gauge pressure, number of hours run, vacuum, piston speed and revolutions, indicated horse-power, temperature of hot well, water per horse-power per hour, etc. The desirability of keeping records of this kind and the convenience of the blanks offered are obvious. The book will save the labor of ruling the blanks and has the further advantage of keeping the records together for easy reference. There is a leaf for each week in the year.

THE fifty-ninth annual exhibition of the American Institute, of New York, opened on October 1, and will continue until the end of November.

THE NEW RIVER AND HARBOR BILL

THE following is a revised copy of the River and Harbor Bill as signed by President Harrison September 19.

A list of the places at which the Secretary of War has been directed to cause examinations to be made, with a view of making improvements, will be published in a subsequent issue.

MAINE.

Improving harbor at Rockland, continuing improvement, $37,500; improving harbor at York, continuing improvement, $10,000; for the construction of a breakwater from Mount Desert to Porcupine Island, continuing improvement, $50,000; improving harbor at Portland, continuing improvement, $40,000; improving harbor at Camden, continuing improvement, $6,000; improving harbor at Back Cove, Portland Harbor, continuing improvement, $25,000; improving harbor at Rockport, completing improvement, $5,000; improving Moose-a-bec Bar, continuing improvement, $15,000; improving harbor at Belfast, $10,000.

Improving Bagaduce River, continuing improvement, $4,000; improving Penobscot River, continuing improvement, and for dredging near Stern's mill, $25,000; improving Narragaugus River, continuing improvement, $7,500; improving Kennebec River, continuing improvement, $50,000; improving Saco River, continuing improvement, including breakwater and the construction of a proposed jetty opposite the same, $65,000: *Provided*, That the whole of said sum may be used in the discretion of the Secretary of War in the construction of said proposed jetty; improving Harrisseckit River, $10,000; improving Saint Croix River, $35,000, but upon the condition that the Goverment of the Dominion of Canada shall expend a like sum in the improvement of said river; improving Kennebunk River, at or near its mouth, $20,000, the entire amount to be expended in repairs if necessary; improving Pleasant River, to complete improvement, $3,500.

NEW HAMPSHIRE.

Improving Portsmouth Harbor, to complete improvement, $13,000; improving harbor of refuge at Little Harbor, continuing improvement, $40,000.

Improving Bellamy River, continuing improvement, $10,000; improving Cocheco River, $25,000.

VERMONT.

Improving harbor at Burlington, for repairs, $20,000; improving harbor at Gordon's Landing, Lake Champlain, to complete breakwater, $6,000; improving Otter Creek, continuing improvement, $5,000,

MASSACHUSETTS.

Improving harbor at Boston, continuing improvement, $145,000, of which sum $7,000 to be used in widening Nantasket Beach Channel, $25,000 in extending main ship channel, and $20,000 for continuing improvement of Charles River, provided, that no expenditure of said $20,000 shall be made until the draws in the Arsenal Street and Market Street bridges shall be made to conform to the projected channel without cost to the United States; improving harbor at Lynn, continuing improvement, $15,000; improving harbor at Nantucket, continuing improvement, $25,000; improving harbor at Newburyport, continuing improvement, $25,000; improving harbor at Plymouth, continuing improvement and repairs of work on Long Beach, $8,000; improving harbor at Provincetown, completing existing project, $7,500; improving harbor at Scituate, continuing improvement, $10,000; improving harbor at Gloucester, continuing improvement, $15,000; improving harbor at Wareham, continuing improvement, $5,000; improving harbor at New Bedford, continuing improvement, $10,000; improving harbor at Hingham, continuing improvement, $5,000; improving harbor at Winthrop, continuing improvement, $5,000; improving harbor at Hyannis, continuing improvement, $8,000; improving harbor at Vineyard Haven, continuing improvement, $10,000; improving harbor at Wellfleet, continuing improvement, $4,000; improving national harbor of refuge at Sandy Bay, Cape Ann, continuing improvement, $150,000; improving harbor at Manchester, continuing improvement, $5,000; improving Martha's Vineyard inner harbor at Edgartown, for dredging, $2,000; improving Salem Harbor, including South River, $14,000; improving Stage Harbor at Chatham, $5,000; improving Westport Harbor and East and West Branch of Westport River, $1,000, to be applied in extending the jetty on Horse Neck Point and to dredging in Westport Harbor.

Improving Powow River, continuing improvement, $5,000; improving Taunton River, continuing improvement, $7,000; improving Merrimac River at Mitchell's Falls, continuing improvement, $10,000; improving Weymouth River, $10,000.

RHODE ISLAND.

Improving Pawtucket River, continuing improvement, $30,000; improving Providence River and Narragansett Bay, continuing improvement, $50,000; improving Green Jacket Shoal, Providence River, continuing improvement, $25,000; improving Pawcatuck River, completing improvement, $16,600.

Improving harbor at Block Island, continuing improvement, $15,000; improving harbor at Newport, continuing improvement, $12,500; improving harbor at Greenwich Bay, to complete, $2,000; improving cove near southeast extremity of Coaster's Harbor Island, and water-way between said island and Rhode Island, to complete, $5,500; constructing national harbor of refuge at or near Point Judith, commencing construction, $75,000.

CONNECTICUT.

Improving harbor at Bridgeport, continuing improvement, $20,000, of which $15 000 shall be expended in constructing breakwater between the Tongue and inner beacon, and $5,000 to complete improvement above the bridge; improving harbor at Black Rock, continuing improvement, $5,000; constructing breakwaters at New Haven, in accordance with the plans submitted by Chief of Engineers in report for 1889, continuing improvement, $120,000; improving harbor at New Haven, continuing improvement, $15,000; improving harbor at Norwalk, completing improvement, $4,000; improving harbor at Wilson's Point, for widening and deepening channel, $30,000; improving harbor at Stonington, continuing improvement, $12,500; improving harbor at Stamford, completing improvement, $5,000; improving harbor at Five Mile River, continuing improvement, $5,000; improving harbor at Milford, completing improvement, $2,500; improving harbor of refuge, Duck Island Harbor, on Long Island Sound, $25,000; improving harbor at Clinton, continuing improvement, $3,500.

Improving Connecticut River below Hartford, continuing improvement, $12,500; improving Housatonic River and for breakwater, continuing improvement, $35,000; improving Thames River, continuing improvement, $20,000, which may be expended at any point between Norwich and New London; improving Mystic River, $10,000.

NEW YORK.

Improving harbor at Buffalo, continuing improvement, $300,000 for continuance of concrete construction and repairs and extension of breakwater; improving breakwater at Rouse's Point, continuing improvement, $15,000; improving harbor at Canarsie Bay, continuing improvement, $5,000; improving harbor at Charlotte, continuing improvement, $25,000; improving harbor at Dunkirk, continuing improvement, $20,000; improving harbor at Flushing Bay, continuing improvement, $20,000; improving channel at Gowanus Bay, continuing improvement, $60,000; improving Bay Ridge Channel in Gowanus Bay, by dredging, $100,000; improving harbor at Great Sodus Bay, continuing improvement, $10,000; improving harbor at Little Sodus Bay, continuing improvement, $13,000; improving harbor at Greenport, continuing improvement, $5,000; improving harbor at Oak Orchard, continuing improvement, $5,000; improving harbor at Ogdensburg, continuing improvement, $42,000, including new project; improving harbor at Olcott, continuing improvement, $30,000; improving harbor at Oswego, continuing improvement, $30,000; improving harbor at Rondout, repairing existing works, $5 000; improving Tonawanda Harbor and Niagara River, continuing improvement, $75,000; improving New York Harbor, completing improvement, $160,000; improving harbor at Saugerties, continuing improvement, $10,000; improving harbor at Port Chester, continuing improvement, $5,000; improving harbor at Glen Cove, continuing improvement, $15,000; improving harbor at Pultneyville, $2,000; improving channel between Staten Island and the New Jersey shore, New York and New Jersey, continuing improvement, $15,000; improving Arthur Kill, between Staten Island and the New Jersey shore, New York and New Jersey, dredging and straightening channel near Staten Island Bridge, and removing the point of land westerly of same, $7,000; improving harbor at Port Jefferson Inlet, $25,000; improving harbor at Plattsburg, for repairs and extension of breakwater, to complete, $32,500; improving harbor at Larchmont, on Long Island Sound, $5,000; improving harbor at Huntington, Long Island, $10,000.

Improving Hudson River, continuing improvement, $150,000; improving Newtown Creek and Bay, continuing improvement, $35,000; improving East River and Hell Gate, removing obstructions, $200,000; improving Harlem River, continuing improvement, $250,000; and the Secretary of War is directed to cause the low bridges now crossing said Harlem River to be replaced by other bridges at the expense of the owners thereof as soon as the necessary legislation, if any such legislation be necessary, shall have enabled the change in grade to the approaches of said bridges, thus required, to be made, the owners of said bridges being allowed a reasonable time in which to complete the work necessary for said approaches. Said bridges shall leave a clear space, between the under sides thereof and the high water of spring tides, of 24 feet, and shall be provided with draw spans and draws of the width and length to be determined by the Secretary of War, and shall in all respects comply with this law and conform to the requirements of the Secretary of War: *Provided*, That, the Secretary of War shall prescribe the times and regulations for the opening and operating of the draws in said bridges; improving Grass River, completing improvements, $6,000; improving Great Chazy River, from its mouth on Lake Champlain to Champlain Village, $10,000; improving Patchogue River, $15,000; improving Ticonderoga River, continuing improvement, $2,000; improving Wappinger's Creek, from the falls to its mouth, $13,000; improving Brown's Creek, Sayville, Long Island, $12 000; improving shoal between Sister Islands and the Cross over light, St. Lawrence River, $5,000.

NEW JERSEY.

Improving Passaic River above Newark, continuing improvement, $5,100, $1,500 of which, or so much thereof as may be necessary, shall be expended in making an examination and survey of said river; improving Maurice River, continuing improvement, $8,000; improving Passaic River below Newark, continuing improvement, $40,000; improving Raritan River, continuing improvement, $50,000; improving Shrewsbury River, continuing improvement, $10,000, half of which shall be expended on the South Branch; improving South River, continuing improvement, $5,000; improving Squan River, by the removal of obstructions placed by the Government at the mouth of said river, if, in the discretion of the Secretary of War, the same should be done, $2,000; improving Shoal Harbor and Compton's Creek, so as to give a channel 4 feet deep at mean low water, $5,000; improving Elizabeth River, $5,000; improving Mattawan Creek, $2,500; improving Alloway Creek, $6,000.

Improving harbor at Raritan Bay, continuing improvement, $40,000, one-half of which may be used in dredging bar between South Amboy and Great Beds Light.

PENNSYLVANIA.

Improving harbor at Erie, continuing improvement, $40,000; improving the harbor of Philadelphia, for removal of Smith's Island and Windmill Island, in the State of Pennsylvania, and Petty's Island, in the State of New Jersey, or such parts of them and the shoals adjacent thereto as may be required, and for the improvement of the harbor between the cities of Philadelphia, Pa., and Camden, N. J., $200,000: *Provided*, That contracts may be entered into by the Secretary of War for the work required for the improvement of the Delaware River between the cities of Philadelphia, Pa., and Camden, N. J., according to the plan reported by the Board of Engineers and transmitted to Congress April 7, 1888, also: *Provided*, That the cost of the improvement shall not be thereby increased, to be paid for as appropriations may from time to time be made by law; improving ice-harbor at Marcus Hook, continuing improvement, $5,000.

Improving Allegheny River, continuing improvement, $20,000; improving Schuylkill River, continuing improvement, $45,000; improving Delaware River, Pennsylvania and New Jersey, continuing improvement from Trenton to its mouth, $250,000, $10,000 of which shall be expended in continuing improvement on the Rancocas River, one of the tidal tributaries of said river; for continuing construction of the dam at Herr's Island in Allegheny River, near Pittsburg, $35,000; improving the Ohio River by the construction of a movable dam at or below the mouth of Beaver River, at such locality as the Secretary of War may consider most advantageous, $250,000.

OHIO

Improving harbor at Ashtabula, continuing improvement, $40,000, improving harbor at mouth of Black River, continuing improvement, $12,000; improving harbor at Cleveland, continuing improvement, $75,000; improving harbor at Fairport, continuing improvement, $30,000, of which $8,700 may in the discretion of the Secretary of War be expended in dredging and deepening the channel of Grand River from its mouth to the new docks on the west side of the same; improving harbor at Huron, continuing improvement, $16,000; improving harbor at Sandusky, continuing improvement, $45,000; improving harbor at Toledo, continuing improvement, $200,000; improving harbor at Toledo, for clearing the old channel, $5,000; for ice harbor at the mouth of Muskingum River, for repairs, $30,000; improving harbor at Port Clinton, continuing improvement, $3,000; improving harbor at Vermillion, for preservation of piers, $2,000.

Improving Sandusky River, $1,500.

DELAWARE.

Improving Delaware Breakwater, continuing improvement, $80,000; improving ice-harbor at New Castle, completing improvement, $8,100; improving harbor at Wilmington, continuing improvement, $30,000. The Secretary of War is directed to appoint a commission of three persons, one of whom shall be a civil engineer of experience in the improvement of rivers and harbors, who shall proceed to make an accurate survey of the tidal streams which form the harbor of Wilmington, Del., making all necessary observations to obtain all the data required for a plan for the permanent improvement of the harbor to suit the present and prospective wants of commerce and navigation; and that said commissioners shall, as soon as possible, make to the Secretary of War a report, submitting with it a plan for the improvement of said harbor.

Improving Appoquinnimink River and the mouth of the same, $5,000, improving Smyrna River, continuing improvement, $5,000.

MARYLAND.

Improving Choptank River, continuing improvement, $7,500; improving Susquehanna River, Maryland and Pennsylvania, continuing improvement, $4,000, to be expended above the Philadelphia, Wilmington and Baltimore Railroad Bridge; improving Fairlee Creek or Inlet, continuing improvement, $5,000; improving Patuxent River, continuing improvement, $6,000; improving Wicomico River, $10,000; improving Manokin River, $7,500; improving Chester River, $5,000, from Crumpton to Jones' Landing; improving Elk River, $10,000; improving North East River, Maryland, $2,500

Improving harbor at Baltimore, continuing improvement, $340,000; improving harbor at Breton Bay, continuing improvement, $5,000; improving harbor at Cambridge, continuing improvement, $5,000.

DISTRICT OF COLUMBIA.

Improving Potomac River at Washington, continuing improvement, $280,000, of which $20,000, or so much thereof as may be necessary, may be expended on the channel in the Eastern Branch between the navy yard and Giesborough Point.

VIRGINIA.

Improving Appomattox River, continuing improvement, $15,000; improving Chickahominy River, continuing improvement, $2,500; improving James River, continuing improvement, $200,000: *Provided*, That $3,500 of this amount, or so much thereof as may be necessary, may be expended in the discretion of the Secretary of War in removing the bar at the mouth of Turkey Island, Creek or Bayou; improving Mattaponi River, continuing improvement, $3,000, $1,500 of which may be expended above Ayletts; improving channel at Mount Vernon, to complete, $2,500; improving Nomini Creek, continuing improvement, $5,000; improving Pamunkey River, continuing improvement, $3,000; improving Rappahannock River, continuing improvement, $15,000; improving Staunton River, continuing improvement, $8,000 on the consolidated project; improving Urbana Creek, continuing improvement, $3,000; improving York River, continuing improvement, $30,000; improving by dredging and otherwise the inland water-way from Chincoteague Bay, Virginia to Delaware Bay at or near Lewes, Delaware, to be used from Chincoteague Bay to Delaware Bay, continuing improvement, $50,000, no part of which shall be expended until the right of way is secured free of cost to the United States; improving Nansemond River, continuing improvement, $10,000; improving Hampton Creek and Bar, to complete improvement, $10,000; improving Occoquan Creek, $10,000; improving Acquia Creek, $10,000.

Improving harbor at Norfolk and its approaches, continuing improvement, $150,000, $50,000 of which shall be expended in improving the approach to the inner harbor and the United States Navy-Yard at Norfolk, by increasing anchorage between Lambert's Point and Fort Norfolk; improving harbor at Cape Charles City and approaches by Chenton Inlet, $25,000, for dredging only; improving harbor at Onancock, $6,000.

WEST VIRGINIA.

Improving Big Sandy River and Kentucky, to complete improvement, $31,000; improving Elk River, continuing improvement, $2,500; improving Buchannon River, continuing improvement, $1,000; improving Great Kanawha River continuing improvement, $300,000; improving Guyandotte River, to complete improvement, $2,000; improving Little Kanawha River, to complete projected lock and dam, $40,000, but no toll shall be collected by any person or corporation for this improved navigation, and such right, if any exist, shall be relinquished in a manner satisfactory to the Secretary of War before the expenditure of any of the money herein appropriated for this work; improving Gauley River, continuing improvement, $3,000; improving Cheat River, to complete improvement, $13,000.

KENTUCKY.

Improving Kentucky River, continuing improvement, $108,000; improving the Ohio River, continuing improvement, $300,000, of which sum $7,500 shall be expended in constructing an ice-pier pursuant to the present or prospective plan of the Chief of Engineers, at or near the mouth of Kerr's Run, in Ohio: *Provided*, That the Secretary of War is hereby authorized and directed to obtain, if he can do so without cost to the United States, a perpetual lease or conveyance of the riparian rights of the property owners at said locality, in the event said ice-pier shall be located where there is no landing place: *And provided further*, That at said locality, if it be an improved landing, he shall first obtain a relinquishment of wharfage right and dues in favor of water craft seeking protection from damage by ice; and no part of this appropriation shall be used for such purpose until the foregoing conditions are complied with; and a like sum for like purposes upon similar terms in all respects may be used in the discretion of the engineer in charge of the Ohio River at Ripley, O., and at Portsmouth, O.; and $20,000 of said Ohio River appropriation may be used for continuation of harbor improvement at Madison, Ind., according to the plans heretofore submitted by Lieutenant-Colonel Merrill; $13,250 may be expended in the completion of the construction of the embankment on the south side of the Great Miami River near its junction with the Ohio to confine the waters of said Miami River in great floods to the general course of its channel at or near the Ohio, to the end that the formation of the bar in the Ohio now obstructing navigation may be arrested; and $15,000 may be expended in completing the embankment at Shawneetown, already partly constructed for the preservation of the harbor at that place; the further sum of $20,000 may be expended for the removal of rock obstruction at the mouth of Licking River; improving the Falls of the Ohio River, continuing improvement, $60,000; improving Indiana Chute Fall, Ohio River, continuing improvement, $25,000; improving Licking River, from Farmer's to West Liberty, continuing improvement, $3,000; improving Rough River, $25,000, to be expended in procuring the necessary land, commencing the construction of a lock and dam, and removing obstructions in the river from its mouth to Hartford, Ky., on the least expensive-estimate recommended by Captain James C. Post, Corps of Engineers.

Improving Tug Fork of Big Sandy River and West Virginia, for snagging and the removal of other obstructions, $2,500: improving Levisa Fork of Big Sandy River, for snagging and the removal of other obstructions, $2,500.

NORTH CAROLINA.

Improving Cape Fear River, above Wilmington, continuing improvement, $15,000; improving Cape Fear River at and below Wilmington, $170,000; improving Contentnia Creek, continuing improvement, $7,000; improving inland water route from Norfolk Harbor, Virginia, to Albemarle Sound, through Currituck Sound, continuing improvement, $10,000; improving Neuse River, up to Smithfield, continuing improvement, $20,000: improving New River, continuing improvement, $5,000; improving Pamlico and Tar Rivers, including the Tar River from Tarboro to Little Falls, continuing improvement, $10,000: improving Trent River, continuing improvement, $5,000; improving Lumber River and South Carolina, continuing improvement, $5,000; improving Roanoke River, continuing improvement, from its mouth to Clarksville, $25,000; improving Yadkin River, up to Bailey's Ferry, continuing improvement, $5,000; improving Ocracoke Inlet, $90,000; improving Mackey's Creek, $15,000 to complete the project for nine feet depth of channel; improving North East (Cape Fear) River, so far as to clear out its natural obstructions from Wilmington up to Kornegay's Bridge, $5,000; improving water way between New River and Swansboro, $5,000; improving Lockwood's Folly River, $5,000; improving Fishing Creek, from its mouth to Bellamy's Mill, so far as to remove its natural obstructions, $10,000: *Provided*, That no part of this sum shall be expended until the bridges over that part of said river to be improved have been removed or suitable draws have been provided in the same, so as not to obstruct the navigation of said river. Improving Pasquotank River, $3,000.

Improving harbor at Beaufort, continuing improvement, $15,000; improving the inland water-way between Beaufort and New River, continuing improvement, $15,000.

LOUISIANA.

Improving Amite River and Bayou Manchac, completion of old project, $3,800: *Provided*, That this sum may be expended upon the Manchac or Amite in such proportions as the engineers may deem best; improving Boeuf River, continuing improvement, $5,000; improving Bayou Bartholomew, and Arkansas, continuing improvement, $5,000; improving Bayou Courtableau, completing improvement, $2,200; improving Bayou D'Arbonne, continuing improvement, $2,000; improving Tensas River and Bayou Macon, continuing improvement, $5,000; improving Tickfaw River, to complete $1,000; improving Bayous Rondeway and Vidal, re-opening old bayou, $1,000; improving Bayou Plaquemine, continuing improvement, $100,000; improving Bayou Lafourche, including immediate dredging to secure low water navigation, $50,000; improving Red River, Louisiana and Arkansas, from Fulton, Ark., to the Atchafalaya River, continuing improvement, $100,000, of which $15,000 shal be used in the work at Alexandria, $20,000 in deepening and widening that portion of the river known as Little River, from the Scoping Cut-off to Knox Point, and $5,000 in closing what is called the Sale and Murphy Outlet, or canal, on the west bank of the River above Shreveport; for completion of survey of Red River from Fulton, Ark., to the Atchafalaya River, $28,000; improving Bayou Teche from the mouth to St. Martinsville, $5,000; improving Bogue Chitto, $5,000; to be expended from its mouth to where the first bridge obstructing navigation is located; improving Tchefuncte and Bogue Phalia, for removal of snags, trees and obstructions, $1,000.

Improving mouth and passes of Calcasieu River, $75,000.

MICHIGAN.

Improving Saginaw River, continuing improvement, $75,000, $37,500 of which shall be expended above Bay City; improving Saint Mary's River at the Falls, continuing improvement on new locks and approaches, $900,000. *Provided*, That such contracts as may be desirable may be entered into by the Secretary of War for materials and labor for the entire structure and approaches, or any part of the same, to be paid for as appropriations may from time to time be made by law; improving Hay Lake Channel, continuing improvement, $4,000: *Provided*, That such contracts as may be desirable may be entered into by the Secretary of War for materials and labor for the entire work, or any part of the same, to be paid for as appropriations may from time to time be made by law; improving Saint Clair Flats Ship-Canal, continuing improvement, $80,000; improving Clinton River, continuing improvement, $10,000; improving Saint Joseph River, completing improvement, $1,000; improving mouth of Black River, continuing improvement, $10,000; improving Rouge River, at its junction with Detroit River, and up the river as far as the bridge of Saint Louis and Wabash Railroad, $10,000: improving Thunder Bay River, Alpena, for 16-foot channel from mouth to one mile above, $10,000; improving Black River, at Port Huron, to deepen channel, $25,000; improving Menomonee River, Michigan and Wisconsin, continuing improvement up the river from termination of old work, $54,000.

Improving harbor at Charlevoix and entrance to Pine Lake, continuing improvement, $9,000; improving harbor at Frankfort, continuing improvement, $10,000; improving harbor at Grand Haven, continuing improvement, $75,000; improving harbor of refuge at Grand Marais, continuing improvement, $50,000; improving harbor at Manistee, continuing improvement, $50,000, improving harbor at Black Lake, continuing improvement, $10,000; improving harbor at Monroe, continuing improvement, $5,000; improving harbor at Muskegon, continuing improvement, $50,000, $34,000 of which to close gap as recommended by engineer in charge; improving harbor at Ontonagon, continuing improvement, $10,000; improving harbor at Pentwater, continuing improvement, $8,000: improving harbor of refuge at Portage Lake, continuing improvement, $8,000; improving harbor of refuge at Sand Beach, for repairs, custody, and control of harbor and dredging the same, $30,000; improving harbor at Saint Joseph, continuing improvement, $20,000, $5,000 of which shall be expended on the water channel leading to Benton Harbor; improving harbor at South Haven, continuing improvement, $15,000; improving harbor at White River, continuing improvement, $17,000; improving harbor at Marquette, continuing improvement, $40,000; improving harbor at Thunder Bay, to restore 14-foot channel, $5,500; improving harbor at Petoskey, for breakwater and harbor of refuge, $15,000.

WISCONSIN.

Improving harbor at Ahnapee, continuing improvement, $6,000; improving harbor at Green Bay, continuing improvement, $10,000; improving harbor at Kenosha, continuing improvement, $17,500, $2,500 of the above appropriation to be expended in dredging the inner harbor; improving harbor at Kewaunee, continuing improvement, $20,000; improving harbor at Manitowoc, completing improvement, $8,000; and the engineer in charge, with the approval of the Secretary of War, may use such part of the above appropriation in the construction of an outer breakwater as he may deem proper; improving harbor of refuge at Milwaukee, continuing improvement, $80,000; improving harbor at Milwaukee, continuing improvement, $6,000: improving harbor at Port Washington, continuing improvement, $3,000; improving harbor at Racine, continuing improvement, $17,500; improving harbor at Superior Bay and Saint Louis Bay, continuing improvement, $65,000; improving harbor at Sheboygan, continuing improvement, $15,000; improving harbor at Ashland, continuing improvement, $60,000; improving harbor at Two Rivers, continuing improvement, $3,000; improving Sturgeon Bay Canal harbor of refuge, for maintenance of channel and piers, $3,000; improving Minnesota Point at Superior, for the preservation of said point and the protection of the harbor at Superior Bay by the construction of sand fences, $4,895.

Improving Chippewa River including Yellow Banks, continuing improvement, $10,000; improving Fox River, below Portage, except as herein provided, continuing improvement, $100,000, of this sum $5,000, or so much thereof as may be necessary, shall be used for deepening the south outlet of Lake Winnebago, at Neenah, so as to make navigation practicable during low-water season; the sum of $8,000, or so much thereof as may be necessary, shall be used for removing the sand bar at outlet of Fond du Lac River, according to recommendations in report of Major Charles E. L. B. Davis, Major of Engineers; improving Saint Croix River, Wisconsin and Minnesota, continuing improvement, $8,000.

INDIANA.

Improving outer harbor at Michigan City, continuing improvement, $50,000; improving inner harbor at Michigan City, continuing improvement, $7,500, of which $2,500 may be expended for a new dump scow.

INDIANA AND ILLINOIS.

Improving Wabash River, Indiana and Illinois, above Vincennes, continuing improvement, $5,500; improving Wabash River, Indiana and Illinois, below Vincennes, continuing the work on Lock and dam at Grand Rapids, near Mount Carmel, Ill., $60,000, including snagging, and $6,000 of said sum may be expended on said river at or near Grayville in the State of Illinois; improving White River, Indiana, the $5,000 heretofore appropriated is hereby directed to be expended, notwithstanding the conditions upon which such appropriation was made; improving Calumet River, Illinois and Indiana, continuing improvement, $50,000; that the city of Galena, Ill., be and hereby is, authorized to continue and complete the improvement and navigation of the channel of Galena River from a point 800 feet below the Custom House in said city to the main channel of the Mississippi River upon conditions hereinafter mentioned: *Provided*, That unless said city or her representatives shall commence the work within one year and secure a navigable channel within five years from the approval of this act, the provisions herein shall be null and void. In carrying out the provisions of this act, the city of Galena or her representatives shall be authorized to construct a dam above the point to be opened for navigation, rising not more than 12 feet above low water or a like dam may be constructed below the point to be opened to navigation with a lock not less than 280 feet long and 52 feet wide.

ILLINOIS.

Improving Illinois River, continuing improvement, $2,000; improving the Kaskaskia River, from the mouth to Baldwin Bridge, $6,000; for the construction of the Illinois and Mississippi Canal to connect the Illinois River at a point near the town of Hennepin with the Mississippi River, at the mouth of Rock River, together with a branch canal or feeder from said Rock River to the main line of said canal, $500,000; for continuing operations upon the reservoirs at the head waters of the Mississippi River, $80,000, to be expended in accordance with the recommendations of the Chief of Engineers in his annual report for the year 1889; improving the Mississippi River above St. Anthony's Falls, continuing improvement. $18,000; improving the Mississippi from the landing on the west bank below the Washington Avenue Bridge, Minneapolis, to the Des Moines Rapids, continuing improvement, $500,000, of which sum $30,000, or so much thereof as may be necessary, shall be expended by the engineers in charge in removing the sand bars and other obstructions to navigation in the East Channel of the Mississippi River opposite the prairie, on which the city of Prairie du Chien, in the State of Wisconsin, is located, the same being between Minneapolis and Des Moines Rapids; of which sum also $50,000 shall be expended between the Chicago, St. Paul, Minneapolis and Omaha Railroad bridge at St. Paul and the Washington Avenue bridge, Minneapolis, in dredging, removal of gravel, boulders and broken rock and the construction of dams and revetments; and in the discretion of the Secretary of War, the sum of $5,000, or so much thereof as may be necessary, shall be expended in removing the bar in the river at Port Bryon, in the State of Illinois; $5,000 at Burlington, Iowa, and $2,000 at Montrose, Iowa; improving the Mississippi River at Des Moines Rapids Canal, for completion of existing project, $22,000; improving Mississippi River, from Des Moines Rapids to the mouth of the Illinois River, $165,000, out of which $25,000 shall be expended in continuing the dredging in Quincy Bay, in the State of Illinois, and the Secretary of War is authorized and directed to cause an examination and report to be made by a competent engineer upon the advisability of reopening Willow Slough, or some other channel, from the Mississippi River to Quincy Bay; and also $15,000 of said sum shall be used in the rectification of the river at Clarksville, Mo., as suggested in the report of Captain Ruffner; and also $25,000 of said sum, or so much thereof as may be necessary, may be expended at the discretion of the Secretary of War to protect the banks of the river from erosion and prevent the destruction of the embankment of the Sny Island levee; improving the Mississippi River, from the mouth of the Illinois River to the mouth of the Ohio River, and, at the discretion of the Secretary of War, the protection of the Illinois shore opposite the mouth of the Missouri River, $400,000, $50,000 of which shall be expended in completing the work at Alton, and $50,000 in improving the river at St. Genevieve, in the State of Missouri.

Improving harbor at Calumet, continuing improvement, $20,000; improving harbor at Chicago, continuing improvement, $100,000; improving harbor at Waukegan, continuing improvement, $35,000.

ALABAMA.

Improving Alabama River, continuing improvement, $20,000; improving Black Warrior River, from Tuscaloosa to Daniel's Creek, continuing improvement, $150,000; improving Tallapoosa River, maintaining existing works, $4,000; improving Cahawba River, the existing provision restricting the expenditure of the balance now available for the improvement of said river is hereby repealed, and said balance shall be expended in continuing the improvement thereof; improving Tombigbee and Warrior Rivers, extending improvement, $100,000, of which $55,000 to be expended on the Tombigbee and $45,000 on the Warrior; so much of said sums as may be necessary is authorized to be expended in acquiring by purchase or condemnation under the laws of Alabama, the lands needed in making such improvements; improving Tombigbee River from Demopolis to Columbus, Miss., extending improvement, $15,000; improving Tombigbee River from Walker's Bridge to Fulton, continuing improvement, $4,000; improving Tombigbee River from Fulton to Vienna; continuing improvement, $6,000.

Improving harbor at Mobile, up to the mouth of Chickasabogue Creek, continuing improvement, $350,000.

SOUTH CAROLINA.

Improving Edisto River, continuing improvement, $5,000, which shall be expended in equal sums in the north and south forks of said river; improving Great Pee Dee River, continuing improvement, $12,500; improving Salkiehatchie River, to complete existing project, $5,000; improving Santee River, continuing improvement, $30,000, to be used in snagging and in making new cut between Estherville and Minim Creek, as recommended by the engineer in charge of the improvement of said river; improving Waccamaw River to Waccamaw Lake, North Carolina to South Carolina, continuing improvement, $12,500; improving Wapoo Cut, continuing improvement, $10,000; improving Wateree River, completing improvement, $12,500: *Provided*, That no part of said appropriation shall be expended until the Wilmington, Columbia and Augusta Railroad Company and the Camden branch of the South Carolina Railroad Company shall have built suitable draw-spans in their bridges over said river, to be approved by the Secretary of War. Improving Congaree River, continuing improvement, $5,000: *Provided*, That no part of said appropriation shall be expended until the South Carolina Railroad Company have built a suitable draw-span in its bridge over said river, to be approved by the Secretary of War. Improving Mingo Creek, continuing improvement, $5,000; improving Clark's River, continuing improvement, $2,500; improving Little Pee Dee River, continuing improvement, $5,000; improving Beaufort River, or that part of it known as Brickyard Creek, at the point called Brickyard, near Coosaw Mouth, $12,500.

Improving harbor at Charleston, including Sullivan's Island, continuing improvement, $370,000, of which $5,000 shall be expended on Mount Pleasant shore of inner harbor of Charleston; improving harbor at Georgetown, continuing improvement, $8,000; improving Winyaw Bay, continuing improvement, $100,000.

GEORGIA.

Improving Altamaha River, continuing improvement, $15,000; improving Chattahoochee River, Georgia and Alabama, continuing improvement, $20,000; improving the Coosa River in Georgia and Alabama, between Rome, in Georgia, and the East Tennessee, Virginia and Georgia Railroad Bridge, in Alabama, continuing improvement under approved existing project, $150,000; also for improving said river between Wetumpka, in Alabama, and said East Tennessee, Virginia and Georgia Railroad Bridge, work to be commenced at Wetumpka end, $150,000, of which so much as may be necessary is authorized to be expended in acquiring, by purchase or condemnation under the laws of Alabama, the lands needed in making such improvement, as the same become necessary; such improvement to be made in harmony with the existing approved project for the improvement of the Coosa River between Rome and said bridge; locks to be 40 feet wide and 210 feet between miter sills; improving Flint River, continuing improvement, $20,000; of which $5,000 are to be expended between Albany and Montezuma, and $15,000 below Albany; improving Ocmulgee River, continuing and extending improvement, $30,000, of which $15,000 are to be expended between Macon and Hawkinsville, and $15,000 between Hawkinsville and its mouth; improving Oconee River, continuing and extending improvement, $25,000, of which $5,000 are to be expended between Milledgeville and the Central Railroad Bridge; improving the Savannah River, between Augusta and Savannah, continuing improvement, $25,000; improving Jekyl Creek, continuing improvement, $7,500.

Improving harbor at Brunswick, continuing improvement, $35,000; improving Cumberland Sound, Georgia and Florida, continuing improvement, $112,500; improving harbor at Savannah, continuing improvement on extended project, $350,000; improving harbor at Darien, $25,000.

FLORIDA.

Improving harbor at Apalachicola Bay and the mouth of the river, continuing improvement, $20,000; improving harbor at Cedar Keys, continuing improvement, $2,500, a part of which may be expended at Derrick Island Gap on the inside channel from Suwanee River; improving harbor at Pensacola, continuing improvement, $25,000; improving harbor at Tampa Bay, continuing improvement, $25,000; improving entrance to harbor at Key West, $40,000; improving, dredging, and deepening the channel of Charlotte Harbor and Pease Creek, $35,000; improving harbor at Saint Augustine, to complete protection from erosion, $20,000; improving Apalachicola River, to maintain existing works, including Lee's Slough, $2,000; improving Choctawhatchie River, Florida and Alabama, continuing improvement under existing projects, and to secure low-water navigation between Geneva and Newton, $12,500: *Provided*, That no part of said sum shall be expended above Hollis' Bridge until a draw, approved by the Secretary of War, is put in said bridge; improving Escambia and Conecuh Rivers, Florida and Alabama, continuing improvement, $7,500; improving Manatee River, continuing improvement, $6,000; improving Saint John's River, from Jacksonville to the ocean including the channel over the bar at the mouth, continuing improvement, $170,000; improving Suwanee River, continuing improvement, $3,000; a part of which may be expended on the inside channel to Cedar Keys; improving Volusia Bar, for repairs, $500; improving Withlacoochee River, completing improvement, $5,400; improving Caloosahatchee River, to complete improvement, $3,600; improving La Grange Bayou, continuing improvement of Holmes River, $3,000; improving Ocklawaha River, to Leesburgh on Lake Griffin, $10,000; improving Sarasota Bay, from Tampa Bay to Sarasota, as recommended by W. M. Black, Captain of Engineers, $5,000.

TEXAS.

Improving Buffalo Bayou, continuing improvement, $25,000; improving Cedar Bayou, by removal of bar at the mouth of said bayou, where it empties into Galveston Bay, completing improvement, $18,150; improving Trinity River, continuing improvement, $10,000; the Secretary of War is hereby directed to cause a survey to be made of Cypress Bayou and the lakes between Jefferson, Tex., and Shreveport, La., in order to ascertain if the navigation of the said bayou and lakes can be materially and permanently improved by the construction of such dams, and locks and dams, as may be necessary, and if found practicable the probable cost thereof, and for this purpose the sum of $10,000, or so much thereof as may be necessary, is hereby appropriated.

Improving harbor at Sabine Pass, continuing improvement, $300,000, and of this amount the Secretary of War may, in his discretion, use $50,000, or so much of said $50,000 as may be necessary, for dredging; improving and maintaining ship-channel in Galveston Bay, from Bolivar Channel through Morgan's Cut and Morgan's Channel constructed through Morgan's Point to the San Jacinto River, $40,000; improving entrance to Galveston Harbor, continuing improvement, $500,000; *Provided*, That contracts may be entered into by the Secretary of War for such materials and work as may be necessary to carry out the plan contained in the report of the Chief of Engineers for 1886.

ARKANSAS.

Improving Arkansas River, Ark., Indian Territory, and Kansas, continuing improvement from Wichita, Kansas, to its mouth, $180,000; improving St. Francis River, continuing improvement, $4,000; improving Arkansas River, Ark., Indian Territory and Kansas, from Wichita, Kansas, to its mouth, for operating snag-boats and removing obstructions, $20,000; improving Red River above Fulton to complete, $2,000; improving Black River, Arkansas and Missouri, maintaining existing works, $5,000; improving White River, continuing improvement, $30,000; improving Fourche River, completing improvement, $7,500; improving Ouachita and Black Rivers, Arkansas and Louisiana, continuing improvement, $15,000.

TENNESSEE.

Improving Big Hatchie River, continuing improvement, $5,000; improving Caney Fork River, continuing improvement, in accordance with last survey, $2,500; improving Clinch River, continuing improvement, $4,000; improving Cumberland River, Tennessee and Kentucky, continuing improvement above Nashville, $250,000: *Provided*, That in the discretion of the Secretary of War $50,000 of this sum may be expended in commencing the improvement of said river at Smith's Shoals. Improving Cumberland River, Tennessee and Kentucky, below Nashville, continuing improvement, $40,000, $30,000 of which to be used in improving the mouth of the river; improving French Broad River, continuing improvement, $10,000; improving Hiawassee River, to complete improvement, $1,500; improving Forked Deer River, continuing improvement, $2,500; to be expended on the North Fork From Dyersburg to the main river, and thence on the main river to its mouth; improving Tennessee River above Chattanooga, continuing improvement, $30,000, of which $15,000, or so much thereof as may be necessary, shall be used in making a careful and comprehensive survey of said river from Chattanooga to the junction of the Holston and French Broad Rivers, with a view of ascertaining to what extent the navigation of the river is capable of improvement, and the cost of the same, and the preparation of suitable plans therefor; improving Tennessee River, below Chattanooga, including Colbert Shoals and Bee Tree Shoals, continuing improvement, $475,000, out of which $25,000 may be used at Livingston Point at the mouth of said river, in accordance with the recommendation of the engineer in charge of that portion of the river.

MISSISSIPPI.

Improving Big Sunflower River, continuing improvement, $5,000, of which $1,500 is to be used between Woodburn and Lehrton; improving Noxubee River, continuing improvement, $3,000: improving Pascagoula River, continuing improvement, $20,000; improving Pearl River, between Edinburgh and Carthage, to complete improvement, $5,000; improving Pearl River, between Carthage and Jackson, continuing improvement, $3,000; improving Pearl River, below Jackson, continuing improvement, $20,000, $5,000 of which shall be used for dredging at the mouth; improving Steele's Bayou, including Washington Bayou, continuing improvement, $2,500; improving Tallahatchie River, continuing improvement, $5,000; improving Tchula Lake, continuing improvement, $3,000; improving Yazoo River, continuing improvement, $25,000, of which $5,000, or so much as may be necessary, shall be used in making a survey of the Yazoo River from the bridge of the Louisville, New Orleans and Texas Railway to its mouth, for the purpose of determining in what manner the mouth of the river can be so improved as to freely permit the passage through the same, at all seasons of the year, of vessels engaged in the navigation of the river; and said survey shall also include an investigation into the feasibility and advantages of making a new mouth or outlet for said river, by way of Chickasaw Bayou, or otherwise, together with an estimate of the cost of the same; improving Bluff Creek, to complete improvement, $1,000; improving Chickasahay River, by the removal of logs, snags, and overhanging trees, from the mouth up to Railroad Bridge, near Shubuta, $5,000; improving Leaf River, from its mouth to the mouth of Bowie Creek, $5,000; improving Big Black River, the sum of $5,000, heretofore appropriated for the improvement of this river, may be expended in the improvement of said river, notwithstanding the proviso contained in the act of 1886 making said appropriation.

Improving harbor at Biloxi, continuing improvement, $9,000.

MINNESOTA.

Improving harbor at Duluth, continuing improvement, $100,000, of which sum $40,000 shall be expended on the harbor basin and new channel east of Rice's Point, and in the preservation and maintenance of the canal and piers at the harbor entrance, and $60,000 shall be expended on the channel west of Rice's Point and from thence along the northern shore of Saint Louis Bay to Grassy Point; improving harbor at Grand Marais, continuing improvement, $22,350; improving harbor at Agate Bay, continuing improvement, $25,000. Improving Red River of the North, continuing improvement, $25,000.

MISSOURI.

Improving harbor at St. Louis, $182,000; improving Mississippi River from the Head of the Passes to the mouth of the Ohio River, including salaries, clerical, office, traveling, and miscellaneous expenses of the Mississippi River Commission, continuing improvement, $3,200,000, which sum shall be expended under the direction of the Secretary of War in accordance with the plans, specifications and recommendations of the Mississippi River Commission, for the general improvement of the river, for the building of levees for surveys, including the survey from the head of the Passes to the head waters of the river, for the work at the harbors at Hickman, Ky., at New Madrid, Mo., at Helena, Ark., at Greenville, Vicksburg and Natchez, Miss., at New Orleans, La., at the head of the Atchafalaya and the mouth of the Red River, and at other localities, in such manner, to such extent, and in such proportion as in their opinion shall best promote the interests of commerce and navigation, provided, that the amount expended from such sum for work at the harbors aforesaid shall not exceed $600,000, and the amount expended at the head of the Atchafalaya and the mouth of Red River for the rectification thereof pursuant to the plan heretofore adopted, including keeping open a navigable channel through the mouth of Red or Old River into the Mississippi River shall not exceed $250,000; improving Gasconade River, continuing improvement, $4,000; improving Little River, from Hornersville to its junction with the Saint Francis River, completing improvement, $3,000; improving Saint Francis River, from Greenville to the Arkansas line, continuing improvement, $10,500; improving the Osage River, $55,000, of which sum $5,000 is to be used for snagging, and $50,000 is to be used in commencing the construction of a lock and dam at or near the mouth of said river; improving Black River, continuing improvement, $7,000; improving Missouri River from its mouth to Sioux City, Iowa, inclusive, embracing office, clerical, traveling and other expenses of the Missouri River Commission, surveys, permanent bench marks and gauges, $800,000, to be expended by the Secretary of War in the systematic improvement of the river from its mouth up according to the plans and specifications of the Missouri River Commission, to be approved by him in reaches to be designated by them, provided, that in the discretion of the Commission such portion of said sum and of all unexpended balances from former appropriations during the last four years for the improvement of the Missouri River below Sioux City, or any part thereof, not exceeding $200 and $3,000, as they may deem proper shall be expended in the protection of harbors and localities on any part of the river within said limits; improving Missouri River between the foot of the Great Falls of the said river in Montana and Sioux City, $300,000, to be expended in the discretion of the Secretary of War, and he is authorized to use so much thereof as may be necessary for the providing of two ice harbors, to be located by him.

CALIFORNIA.

Improving Sacramento and Feather Rivers, continuing improvement, $30,000; improving Napa River, completing improvement, $10,000; improving San Joaquin River, continuing improvement, $75,000, of which sum $23,750, or so much thereof as may be necessary, shall be expended in closing Laird's Slough and Paradise Cut, and $24,000, or so much thereof as may be necessary, shall be expended in dredging, and $27,250, or so much thereof as may be necessary, shall be expended for cutting off Head Reach; improving Petaluma Creek, continuing improvement, $4,000; improvement of Redwood Creek, to complete dredging, $8,000.

Improving harbor at Humboldt, continuing improvement, $80,000; improving harbor at Oakland, continuing improvement, $250,000, one-half of which may, in the discretion of the Secretary of War, be expended in dredging the entrance to the harbor; improving harbor at Wilmington, continuing improvement, $34,000; improving harbor at San Luis Obispo, continuing improvement, $40,000; improving harbor at San Diego, $60,500, of which sum $500 shall be expended for repairs, $8,000 for dredging, and the remainder to commence construction of jetty on Zuninga Shoals. That the Secretary of War is authorized and directed to appoint a board of three engineer officers of the United States Army, whose duty it shall be to examine the Pacific Coast between Points Duma and Capistrano with a view to determining the best location for a deep-water harbor. The said board shall report to the Secretary of War a project for said harbor, with the estimated cost of the same, who shall lay said report before Congress at its next session, with the views of the commission and of the Chief of Engineers of the United States Army thereon; and the sum of $5,000, or so much thereof as may be necessary, is hereby appropriated for the purpose.

OREGON.

Improving canal at the Cascades, continuing improvement, $435,000; improving Upper Columbia, including Snake River, Oregon and Washington, continuing improvement, $20,000; improving the mouth of Columbia River, continuing improvement, $475,000; improving lower Willamette and Columbia Rivers in front and below Portland, continuing improvement, $100,000; improving Willamette River above Portland, $11,000, of which sum $5,000, or so much thereof as may be necessary, may be used, in the discretion of the Secretary of War, for improvement of the river at Clackamas Rapids and Ross Island; improving Coquille River; continuing improvement, $30,000, not exceeding $3,000 of which may, with the approval of the Chief of Engineers, be used for snagging; improving Umpqua River, to complete, $9,000; improving the mouth of Siuslaw River, to commence construction of jetty, $50,000; improving Youngs and Klaskuine Rivers, to complete, $1,600.

Improving entrance to harbor at Coos Bay, continuing improvement, $125,000; improving harbor at Yaquina Bay, continuing improvement, $165,000; improving harbor at Tillamook Bay, completing improvement, $500; improving entrance to harbor at Nehalem Bay, $10,000 for commencement of jetty construction.

WASHINGTON.

Improving Columbia River from the head of Rock Island Rapids to the foot of Priest Rapids, $70,000, of which $10,000, or so much thereof as may be necessary, may be used in the survey of the Columbia River from the international boundary to Rock Island Rapids; improving Chehalis River, continuing improvement, $3,000; improving Cowlitz River, continuing improvement, $8,000; improving Shagit, Stielaquamish, Nootsack, Snohomish and Snowqualme Rivers, continuing improvement, $12,000; the Secretary of War is authorized and directed to appoint a board of three officers of the Corps of Engineers of the United States Army, whose duty it shall be to select and survey the most feasible location, and estimate the expense of construction of a ship canal to connect the waters of Lakes Union, Washington and Samamish with Puget Sound, and the sum of $10,000, or as much thereof as may be necessary, is hereby appropriated for its expenses.

CONTRACTING NEWS DEPARTMENT.

A WEEKLY RECORD

OF SPECIAL INTERREST TO CONTRACTORS, BUILDERS AND MANUFACTURERS OF ENGINEERING AND BUILDING SUPPLIES.

CONTRACTING INTELLIGENCE.

For works for which proposals are requested see also the "Proposal Columns, pages i-ii-288.

WATER.

For Additional Water Items see Proposal Columns.

KANSAS CITY, MO. — The Kansas City *Times*, of September 25, prints the following: "At the next meeting of the Common Council some action will be taken in reference to the water-works matter. The passage of the amendment, giving to the city the power to issue bonds, has placed the situation in a different light, and the Common Council may now treat with the water-works company. President Cannon, of the Upper House, yesterday expressed himself as being in favor of issuing bonds for the erection of new works. Other members of the Council, however, are not inclined to place themselves on record yet."

WATERTOWN, WIS. — The water-works project at his place has been killed by the people.

STROMSBURG, NEB.—The people of this place defeated the water-works proposed by refusing to appropriate $30,000, the amount necessary.

HUNTINGTON, L I.—The taxpayers of this place have united, and are making a determined effort to have a system of water-works.

GREELEY CENTER, NEB.—The proposed system of water-works for this place will probably be established at once.

MORRISTOWN, TENN.—Plans are now ready for a system of water-works for this place.

OENAVILLE, TEX.—A system of water-works is, it is reported, to be established here at once.

FORT WAYNE, IND. — Additional water mains will be laid here, at a cost of $20,000

LOWELL, MASS.—The sum of $60,000 has been voted for additional pumping machinery for the local water-works.

CONWAY, ARK.—This place has decided on establishing a system of water-works, and operations will commence soon.

TROY, N. Y.—Extensions are to be made to the water-works system at this place.

FLATONIA, TEX.—It is proposed to establish a system of water-works at this place, and the plans of the plant are now being prepared.

MASON, TEX.—A water-works system is to be established here by the proprietors of the projected ice factory.

STANLEY, VA.—The Stanley Land and Furnace Company can furnish particulars regarding a system of water-works projected for this place.

ELIZABETH, PA.—A movement towards establishing a system of water-works has developed at this place.

GREENVILLE, TEX.—Improvements are to be made to the plant of the Greenville Water and Electric Light Company of this place.

NORTHAMPTON, MASS.—Extensions to include 2,000 feet of pipe are to be made to the local water-works plant. Address the Water Commissioners, as above.

FRANKLIN, IND.—Improvements are shortly to be made to the plant of the Franklin Light and Power Company. Address the Secretary, as above.

TOLEDO, IOWA.—The following proposals for the construction of a system of water works at this place were opened September 23: W. G. Sherlock & Co., Kansas City, Mo., $16,734; National Tube Works, Chicago, Ill., hydrants, $2,883; Fairbanks, Morse & Co., St. Paul, Minn., $16,284; G. C. Morgan, Chicago, Ill., $16,548; F. Turner, Nevada, Iowa, $18,344. Plans by Geo. C. Morgan, to whom the contract was awarded.

HUNTINGTON, N. Y.—The question of making an appropriation for a water supply is to be brought before the people of this place October 6.

ELWOOD, IND.—It is proposed to expend the sum of $20,000 on a water-works system for this place.

HAMILTON, MASS.—This place is to have a system of water-works at an early date.

HENDERSON, MINN.—The system of water-works projected for this place will soon be established.

EDDY, TEX.—The people of this place have decided to establish a system of water-works.

SEQUATCHIE, TENN.—A system of water-works is to be established at this place by the Sequatchie Water Co.

HARDWICK, VT.—A complete system of water-works is to be established at this place as soon as the preliminary arrangements can be made.

JOLIET, ILL.—The city has decided to have a public fountain erected, to cost $5,000 or more. Address Charles C. Wilcox, City Clerk, for information. The Water-Works Company will take steps to procure two new boilers.

NASHUA, N. H.—The Pennechuck Water Company have consulted with M. M. Tidd, C. E., of Boston, in the matter of enlarging the water-works of this place by the addition of new pumping machinery, laying new mains, etc.

BRECKINRIDGE, TEX.—It is said that the people of this place favor establishing a system of water-works and that the Mayor can furnish particulars.

HAMILTON, MASS.—The Town Clerk at this place writes: "We have circulated paper for signers for water-works project."

ANTRIM, N. H.—Commissioner S. R. Robinson writes: "George C. Patten, C. E., East Deering, N. H., is making surveys for us but has not yet completed the same. He is drawing plans for bringing water from springs 1¼ miles west of village; reservoir 181 feet higher than Main Street. Cannot tell at present whether the works will be put in or not."

MILFORD, MASS.—Water-Works Superintendent A. A. Jenkins writes: "Voted to put up stand-pipe and a committee appointed for that purpose, to get specifications, etc. Also to put in more pumping capacity if needed when stand-pipe is built. Add to water supply also."

RITZVILLE, WASH.—Town Clerk S. S. Crons writes: "Nothing as yet has been done towards water-works. I do not think there will be anything done for some time yet—probably not this year."

PULLMAN, WASH.—Town Clerk Thomas Neill writes: "Election for $9,000 bonds, 15 years, at 6 per cent., will be held October 21, 1890. A prior election, which was found defective, was unanimous for bonding. The system is the reservoir and steam pump, so as to give either hydraulic or steam power."

ARKADELPHIA, ARK.—City Recorder A. S. B. Green writes: "We have appointed the Finance Committee relative to having water-works at this place, which is open for contractors."

EUSTIS, FLA.—It is probable that immediate steps will be taken towards the construction of a system of water-works at this place.

ISLIP, N Y.—At a recent meeting of the Islip Town Board the Great South Bay Water Company's plant was accepted, the only point of difference to be settled being as to when the town shall commence paying for the use of its fire hydrants.

BABYLON, N. Y.—The question of establishing a system of water-works at this place is to be decided at a special election to be held October 11.

TOLEDO, IOWA.—The following bid for constructing a complete system of water-works were received by Mayor A. M. Beal, September 23: George C. Morgan, Chicago, $16,538. Contract let as per above bid.

LOWELL, MASS.—Our correspondent writes: "The water-works are to have a $60,000 pumping engine, in addition to the two others."

TOPEKA, KAN.—A charter has been filled with the Secretary of State, for the Kansas Water Company, which proposes to build water-works in this city. The company is composed of J. B. Bartholomew, A. B. Quinton and others. The capital stock is $750,000. The ordinance provides that water is to be supplied from the Kansas River, and that the water-works are to be constructed of not less than 3,000,000 capacity, fire pressure, in 24 hours.

GREENVILLE, S. C.—The water-works system proposed for this place is now a certainty.

ADAIRSVILLE, GA.—Town Clerk G. B. Casny writes: "The water-works matter is under consideration, in fact a committee has been appointed to devise or say what style, etc."

CINCINNATI, O.—John W. Hill, Consulting Engineer, writes: "Plans for Eaton, O., water-works now under way, and when ready will be glad to give you a synopsis of the work."

PASADENA, CAL.—The Pasadena Land and Water Company intends to lay about a mile of 12-inch water pipe, maximum pressure about 7 feet. They may use salt-glazed vitrified clay pipe.

TACOMA, WASH.—The *Pacific Lumberman*, of San Francisco, prints the following: "The preliminary surveys for the new gravity supply from the Green River are nearly completed. The intention is to take water from the river at a point about 32 miles from the city, starting with an elevation sufficient to carry the water 500 feet above the tide in Tacoma. A new 25,000,000 gallon reservoir has been proposed for the middle service, and a 9x125-foot iron stand-pipe now under construction will supply the high service. The old reservoir will supply the low service. The estimated cost of the various improvements is $1,400,000. Charles P. Darrach, of Philadelphia, is engineer for the new works."

ALLEGHENY, PA.—The following proposals for a new pumping station, reservoir, filters and $8\frac{74}{100}$ miles of 60-inch water conduit, were opened by the Water Committee, October 1. Filtering system: National Pumping Co., $240,000; American Filtering Co., $260,000; Hyatt Filter Co., $369,429.60; Holly Manufacturing Co., $165,000; E. P. Alles & Co., for pumping station, $145,000, and for boilers, $30,000. The other bids were for $8\frac{74}{100}$ miles of 60-inch water main: T. P. Gillespie, $22.25 per foot, or $1,026,770.75 for the whole if steel, and $996,775.25 if iron; Fred Gwinner, for conduit, $1,010,000; for reservoir, $1,059,900; for buildings and engines, $724,000; whole plant, $2,825,000, excepting filters: Porter Manufacturing Co. for conduit, $845,000, and $2.50 per yard for all rock excavated; Oliver Iron and Steel Co., for conduit, $911,849; Butts & Kauffman, for pumping station, $565,000; Harold & McDonald, pumping station, excepting iron, steel and brickwork, $299,900; for battery of boilers of 1,500 horse-power, Carroll-Porter Boiler Co., $30,000; Abendroth & Root Company, $32,000; Sterling Co., $26,375 and $19,125; J. B. Sheriff Sons & Co., $32,784; Porter Boiler Manufacturing Co., $28,975; John Elgell, Jr., $25,500 and $24,700; Campbell & Zell Co., $31,570; for six stop-gate valves, Rensselaer Manufacturing Co., $1,950 each; Ludlow Valve Manufacturing Co., $1,845 each; Specialty Manufacturing Co., $960 each; T. F. Keating, $11,400 for all; R. D. Wood & Co., $1,300; Eddy Valve Co., $2,625 each; Coffin Valve Co., $18,000 for all. The Municipal Water Co. made two bids on the building and filter, one for $347,000, which called for a very imposing structure, and another for $280,000. A sub-committee has been appointed to tabulate each bid before the contract will be awarded.

CENTRALIA, WASH.—J. A. Miller, who is interested in the water-works franchise, reports that the engineers have almost completed surveys, and that work will be begun at an early day. The water will be brought from the Newaukum River and stored on Seminary Hill in a 5,000,000 gallon reservoir, 230 feet above the level of the Northern Pacific Railroad.

MANCHESTER, N. H.—An official of this place writes as follows: "We are making surveys for a high service and have not decided on anything yet, and of course are not sure that any will be built, on account of cost of same. It all will depend on surveys."

JACKSONVILLE, FLA.—Riverside, a suburb of this place, is to have a system of water-works, to be established by the Riverside Artesian Well Co. Address S. E. Foster, Secretary, as above.

COLDWATER, MICH.—The following proposals for the construction of water-works at this place were opened September 16, by J. D. Cook, Consulting Engineer:

Pipe and specials: Dennis Long, Louisville, Ky., $35,415.80; Detroit Pipe Foundry, Detroit, Mich., $35,353.15; Lake Shore Foundry, $34,688.76; Addyston Pipe and Steel Co., $35,593.30; Jackson & Woodin, $39,490.68.

Pipe laying: Walson & Moran, $13,111.50, $4.50 each for boxes; W. H. Longham & Co., $10,824.85; Snyder & Williams, $10,753.57; T. C. Crooks, $12,198.20; Dogiach Construction Co., $14,445.50; R. B. Caruthers, $12,859 50; J. W. McLane & Co., $13,226.87; A. H. Phillips, $12,093.80; Moffitt, Hodgkins & Co., $15,863.90.

Complete plant: Moffett, Hogdkins & Clark, Syracuse, N. Y., $82,065; Geo. C. Morgan, $68,047.

The remainder of the figures on the plant will be published next week.

WATER-WORKS.—See our Proposal Columns for information regarding water-works and water-works furnishings at the following places: Troy, N. Y.; Dallas City, Ore.; New York City; Ellsworth, Kan.; Vancouver, Wash.; St. Louis, Mo.; Austin, Tex.; Berryville, Va.; Toronto, Can.; Rushville, Ind.; Ashland, Ky.

SEWERAGE.

For Additional Sewerage Items see Proposal Columns

WILLIAMSPORT, PA.—The local officials have adopted plans for a system of sewers.

COLUMBUS, GA.—Immediate operations are expected on the proposed system of sewers for this place.

WHEELING, W. VA.—The local sewerage system is to be improved.

SCRANTON, PA.—It is proposed to make an expenditure of $75,000 on improving the sewerage system at this place.

STUTTGART, ARK.—The sewerage system, which has been spoken of for this place for several months, is about to be established by the Stuttgart Improvement Company.

HOBOKEN, N. J. — Plans have been completed for a system of sewers for this place, which is to cost $250,000.

ROCHESTER, N. Y.—Numerous sewer extensions are to be made at this place.

OMAHA, NEB.—Additional sewers are to be established at this place.

AKRON, O.—An exchange prints the following: "State Engineer John Myers and Samuel Bachtell, have been in Summit County looking over the ground in the vicinity of Wolf Creek lock in Norton Township, with a view to the drainage of the Pigeon Creek and Wolf Creek flats. The investigation of Messrs. Myers and Bachtell resulted in their determination to begin this fall the construction of an aqueduct for Wolf Creek under the canal, and to apply the $4,000 already appropriated for that purpose, on condition that $6,000 additional should be made up by parties immediately interested. This latter sum has already been pledged, and the work will go forward at once. The plan proposes dredging Tuscarawas River for a distance of seven miles below the junction of the canal with Wolf Creek."

DENNISON, O.—The City Council wants estimates for the sewerage and paving of certain streets.

PAWTUCKET, R. I.—Improvements are to be made to the sewerage system of this place. A R Sweet can furnish particulars.

CINCINNATI, O.—The Board of Public Improvements has ordered the construction of numerous sewer extensions.

East Portland, Ore.—Messrs. Hamand & Kelly, of this city, are preparing plans for a sewerage system for the city of Eugene, Ore.

Peoria, Ill.—King & Dickerson, sanitary engineers and contractors, of this place, have the contract for the construction of a sewerage system at Cedar Rapids, Iowa, and W. A. Dickerson has just left for the latter city to superintend the work.

Red Oak, Iowa.—The taxpayers of this place have decided to undertake the building of a sewerage system at once.

Jamestown, N. Y.—By vote September 26, the taxpayers of this city decided to issue bonds in the sum of $90,000 for a system of sewers.

Brooklyn, N. Y.—The estimated cost of the new sewers ordered October 1, by Commissioner Adams, to be constructed under the Eighth Ward Improvement Act, is placed at $60,000.

Columbus, Ga.—Mayor D. P. Dozier writes: "The city has had prepared plans, maps, etc., for a thorough system of sanitary sewerage, to cost about $100,000. This sewerage, no doubt, will be commenced during this fall or winter and finished as soon as it will be possible to do it. Bids will be advertised for later."

Victoria, B. C.—This place has, by a popular vote, decided to have sewers.

Sewers.—See our Proposal Columns for information regarding sewer work at the following places: Detroit, Mich ; Dubuque, Iowa; Toronto, Can.; Chicago, Ill.; Dayton, Ohio.; Westchester, N. Y.; Denver, Col.; Albuquerque, N. M.

BRIDGES AND IRON STRUCTURES.

For Additional Bridge Items see Proposal Columns

Midlothian, Tex.—It is proposed to erect a bridge over Soap Creek, near this place.

Round Timber, Tex.—An iron bridge is to be placed over Spring Creek, in Bayler County.

Hardeman County, Tex.—A bridge is to cross the Red River, connecting Hardeman and Greer Counties.

Norfolk, Va.—Reports say that a bridge to cost $35,000 is to be erected over Smith's Creek, at this place.

Zanesville, O.—The plans for a high bridge over the Muskingum River at Fifth Street, Zanesville, O., have been approved by the U. S. Engineers.

Chicago, Ill.—The city has let a contract for the superstructure of the Weed Street bridge, over the North Branch Canal, to the King Iron and Bridge Manufacturing Company, of Cleveland, for $15,500. The other bids were: Kimbell & Cobb Stone Company, of Chicago, $17,250; and Shailer & Schnighan, Chicago, $26,000.

Also the city has let a contract for the Ninety-fifth Street bridge superstructure over the Calumet River, to the Chicago Forge and Bolt Company, for $11,050. The other bids were: Milwaukee Bridge and Iron Company, $11,300; A Gottlieb & Co., of Chicago, $11,625; Bender & Seifert, of Chicago, $13,250; King Bridge and Iron Manufacturing Company, Cleveland, $15,300; Chicago Bridge and Iron Company, $16,500.

Also a contract for a viaduct for the Canal Street bridge to A Gottlieb, for $11,989. The other bids being: Bender & Seifert, Chicago, $13,000; Chicago Forge and Bolt Company, $13 380; King Iron and Bridge Manufacturing Company, $14,645; Chicago Bridge and Iron Company, $14,949; Milwaukee Bridge and Iron Company, $19,850.

Also a contract for a plate-girder viaduct at Washington Street (the superstructure to be the present Madison Street bridge, revamped), to the King Iron and Bridge Manufacturing Company, of Cleveland, for $16,685; the competitors being the Chicago Bridge and Iron Company, $18,400; A, Gottlieb & Co., $18,563; Kiter & Conley, Pittsburg, $18,760; and the Chicago Forge and Bolt Company, $20,685.

Bayonne, N. J.—The Central Railroad of New Jersey will ereet two new bridges.

Lockport, Ill.—The contract for the construction of the iron work of a bridge at this point will be awarded October 6. Contract for the masonry has just been awarded to R. C. Morrison for $6,000. The estimated cost of the entire structure is about $20,000. N. Whitley, civil engineer, of Joliet, Ill., has the plans.

Columbus, O.—It is reported that the City Engineer will prepare plans for a railway bridge at High Street.

Clifton Forge, Va.—A bridge will be built over Smith Creek, at this place.

Jefferson County, W. Va.—A new bridge is to be constructed over the Opepuan River, connecting Jefferson and Berkley Counties.

Dayton, Tenn.—Reports say that bids will soon be wanted for the construction of two iron bridges at this place.

Augusta, Ga.—Beaver Dam Creek, at this place, is to be bridged.

Baltimore, Md.—The plans and specifications for the Monroe Street bridge are being drawn, and as soon as they are completed proposals for the construction will be advertised for. Mayor Davidson can furnish particulars.

Charleston, W. Va.—Reports say that a bridge is to be erected over the Elk Two-Mile River, at this place.

Dayton, N. C.—Two new iron bridges are to be erected at this place. Address W. Engee, for particulars.

Atchison, Kan.—The following bids for the construction of two iron span bridges were received by W. S. Purcell, Chairman County Commissioners, September 16: King Iron Bridge Co., Weston, Mo., bridge No. 1, Engineer's estimate, $1,515; let for $1,220; Kansas City Bridge Co., Kansas City, Mo., bridge No. 2, $1,198; let for $922.

West Bay City, Mich.—The plans for a bridge across Saginaw River in the first ward are now being drawn, and the building of it is an assured fact. The estimated cost of the bridge is $41,000.

Lincoln, Neb.—Two new bridges are to be erected in this city.

Bridges.—See our Proposal Columns for information regarding bridge work at the following places: Lafayette, Ga.; Spring Valley, Ill.; Greenville, S. C.; Helena, Mont.; Dublin, Ga.; Houston, Tex.; Philadelphia, Pa.

GAS AND ELECTRIC LIGHTING.

Lykens, Pa.—The Williams Valley Light, Heat and Power Co. has been incorporated here, with a capital stock of $40,000. Directors: A. F. Engelbert, F. M. Williams, J. I. DeLancy, and others.

Weldon, N. C.—The people of this place are taking steps towards having an electric light plant.

Frackville, Pa.—The Frackville and Gilberton Light, Heat and Power Co. has been incorporated here, with a capital of $40,000.

Polk Rapids, Iowa.—The Northwestern Gas Light and Heating Co. has been incorporated, and will establish a plant at this place.

Stanley, Va.—An electric lighting plant is to be established at this place.

Reidsville, N. C.—This city is about to purchase the plant of the Danville Electric Light Co., and it is probable that after the transfer improvements will be made.

Fredonia, N. Y.—All the bids received for putting in an electric light plant at this place have been rejected, as excessive, and another set of plans and specifications will be prepared, after which new proposals will be wanted.

Montreal, Canada.—There is some talk of establishing a new gas company at this place.

Jamestown, N. Y.—The taxpayers of this place have voted the sum of $30,000 for the purpose of establishing an electric lighting plant.

Modesto, Cal.—The City Trustees have granted a franchise for an electric plant for Modesto to A. C. Swain, of Merced.

Electric Railways.—New electric railways will be constructed, and improvements will be made to those already established at the following places: Kinkora, N. J.; Washington, Pa.; Burlington, N. J.; Glens Falls, N. Y.; Madison, Wis.; Chicago, Ill.; Los Angeles, Cal.; South Manchester, Conn.; Allegheny, Pa.; Duluth, Minn.; Bridgeport, Conn.; Houston, Tex.; Salt Lake City, Utah; Fargo, Dak.

Seattle, Wash.—The City Clerk has been ordered to advertise for street lights, those of intensity of 16 candle-power, 30 candle-power, and arc lights of 2,000 candle-power.

STREET-WORK AND PAVING.

St. Paul, Minn.—Plans and specifications will soon be prepared by the City Engineer for the improvement of five miles of streets.

Marion, N. C.—The sum of $10,000 is to be expended in improving the public streets of this place.

Oakland, Cal.—Many of the streets of this city are to undergo extensive improvements.

Kansas City, Mo.—It is proposed to expend the sum of $100,000 on street improvements for this place.

BIDS OPENED.

St. Paul, Minn.—The court-house and city hall commission have awarded contracts for storm sash and doors for the new building to J. H. Donohue for $3.475. Other bids were: Corlies, Chapman & Drake, $6,400; Lenn, Fawcett & Johnson, $4.199.52; Bohn Manufacturing Company, $6.495; William Lettan, $5,577.

GOVERNMENT WORK.

Washington, D. C.—D. J. Curtis, of Springfield, Mass., has been awarded the contract for the construction of the Troy (N. Y.) public building, at his bid of $32,200.

Port Townsend, Wash.—The following proposals for iron columns, iron and wood floor and roof construction, terra cotta arches, etc., for the custom house, post office, etc., at this place, were opened September 30, by the Supervising Architect of the Treasury Department: Clark, Raffen & Co., Chicago, Ill.; $39,340; John Field, Omaha, Neb., $43,850, F. J. Myers Manufacturing Co., Covington Ky., $50,500.

Nashville, Tenn.—The following bids for the part construction and completion of Lock No. 1, Cumberland River, near this city, were opened by J. W. Barlow, Lieutenant-Colonel of Engineers, U. S. A., Sepsember 23: Henry F. Holmes, Nashville, Tenn., $35,490.50; L. M. Petitdidier, Cincinnati, O., $43,204.

Washington, D. C.—Bids were opened at the Navy Department, October 1, for building three armored battle ships of 9,000 tons displacement, and one protected cruiser of 7,500 tons displacement. The first bid was that of the Union Iron Works, of San Francisco, who offered to build one battle ship on the Department's plan for $3,420,000, or two for $3,200 000 each, making a total of $6,400,000. Cramp & Son, of Philadelphia, bid 2,990,000 for one battle ship on the Department plan, or $3,120,000 on their own plan, and for two on the Department plan at $2,890,000 each. They also bid $3,020,000 each for the ships on their own plans. The Bath Iron Company made one bid, that for the battle ship on the Department plan, for $3,149,000. The Risdon Iron Works, of San Francisco, also bid for the battle ship on the Department's plan, their proposal being $3,275,000. The next bid was for protected cruiser No. 12. The Union Iron Works bid $3,025,000, and Cramp & Son $2,725,000, both on the Department plans. The Bath and Risdon companies did not bid on the cruisers.

INDUSTRIAL.

Long Branch, N. J.—Percy Dobbins submitted the plans and profile of the proposed improvements to Ocean Avenue to the Long Branch Commissioners at their last meeting. Mr. Dobbin's project contemplates the erection of jetties from 50 to 100 feet seaward, 300 feet apart, and bulkheads of 4-inch planking driven slanting as deep as they can be forced The bulkheads and jetties will extend from Elberon to North Long Branch. The Commissioners gave their assent to the adoption of the plans, and he will proceed with the work as soon as the contracts can be completed and the specifications filed. The Commissioners propose to macadamize or asphalt the Ocean Avenue drive, and to put down flagging or other acceptable material on the 4-foot wide promenade on the bluff.

Duluth, Minn.—At a meeting of the City Council, held September 29, a resolution was adopted instructing the Board of Public Works to correspond with tunnel engineers with the aim of getting at the cost, length of time required and feasibility of placing a tunnel under the ship canal across Minnesota Point.

PROPOSALS.

(Continued from page ii.)

TO CONTRACTORS.

Department of Public Works,
Bureau of Surveys,
Philadelphia, September, 30, 1890.

PROPOSALS FOR CONSTRUCTING wrought-iron approaches to Walnut Street **BRIDGE**, and for bituminous concrete, will be received by LOUIS WAGNER, Director of the Department of Public Works, at this office, until 12 o'clock noon, MONDAY, October 27, 1890.

Proposals must be accompanied by a certificate that a bond for $500 has been filed in the Department of Law, Sixth and Locust Streets.

Blue prints copies of the plans on exhibition here may be obtained by those first applying upon payment of five dollars to the Receiver of Taxes.

J. MILTON TITLOW,
Principal Assistant Engineer.

Notice to Contractors.

SEALED BIDS FOR THE **GRADING, SEWERING, DRAINING, MACADAMIZING**, and otherwise improving the streets and avenues of PELHAM HEIGHTS, WESTCHESTER CO., N. Y., in accordance with the contract and specifications to be furnished by the Engineer in charge, No. 152 Prospect Avenue, Mt. Vernon, N. Y., until 12 o'clock M. of WEDNESDAY, October 15, 1890.

No bids will be received unless accompanied by a certified check for five hundred dollars as a guarantee of signing contract if bid is accepted.

All bids must be made upon the blank forms furnished by the engineer.

The owners reserve the right to reject any or all bids or parts of bids. Bids must be made for the whole work.

The sewers are to be pipe sewers. The property is situated at Pelhamville Station, N. Y., N. H. & H. R. R.

The following is a general summary of the estimates:

Grading	81,399	cubic yards.
Macadamizing	78,615	square yards.
Gutters	49,930	lineal feet.
Sidewalks	27,693	square yards.
Sodding	35,903	" "
Trees to be planted	1,645	
Sewerage	30,318	lin. ft. of pipe with accessories.
Drainage	13,000	" " "
Water pipe	30,986	" " "
Gas pipe	30,000	" " "

Plans can be seen, and specifications and other printed forms obtained upon application to the Engineer in charge.

BEN. L. FAIRCHILD,
GEORGE B. CRUMBIE, } Owners.

John F. Fairchild,
Engineer in Charge. 18

AQUEDUCT, New York City.—Proposals are wanted until October 8, for building 11 head-house superstructures, etc., for the shafts of the new Croton Aqueduct. Address John C. Sheehan, Secretary of the Aqueduct Commission, as above.

PUMPING ENGINES, Toronto, Can.—Proposals are wanted until October 20, for furnishing two duplex pumping engines, with a 10,000,000-gallon capacity, also the necessary boilers, etc., for the same. Address William J. Hill, Chairman Committee on Water-Works, as above.

DREDGING, New York City.—Proposals are wanted until October 13, for dredging for proposed bulkhead wall at East One Hundred and Second Street section on the Harlem River. Address the Department of Docks, Pier A, North River, as above.

STATE CANALS, Albany, N. Y.—Proposals are wanted until October 6, for doing certain work on the State canals. Address Edward Hannan, Superintendent of Public Works, as above.

WATER SERVICE SYSTEM, West Troy, N. Y.—Proposals are wanted until October 6, for furnishing material and labor complete for a water service system at the Watervliet Arsenal. Address Lieut.-Col. C. H. Parker, U. S. A., as above.

BRIDGE, Dublin, Ga.—Proposals are wanted until October 20, for the erection of an iron bridge across the Oconee River, at this place. Address John T. Duncan, Ordinary, as above.

SEWERS, Detroit, Mich.—Proposals are wanted until October 6, for the construction of numerous sewers in this city. Address the Board of Public Works, as above.

SEWERS, Denver, Col.—Proposals are wanted until October 17, for the construction of certain sewers in this city Address F. B. Crocker, President of the Board of Public Works, as above.

SEWERS, Toronto, Can.—Proposals are wanted until October 7, for the construction of sertain sewers at this place. Address John Shaw, Chairman Committee on Works, as above,

PAVING, New York City.—Proposals are wanted until October 7, for doing certain streets paving. Address the Department of Public Works, as above.

DREDGING, New York City.—Proposals are wanted until October 9, for dredging for a pier at the foot of East Twenty-second Street. Address the Department of Docks, Pier A, North River, as above.

ROADS, Tompkinsville, S. I.—Proposals are wanted until October 13, for the improvement of certain roads at this place. Address Charles M. Todd, Supervisors' Clerk, *pro tem*, as above.

SEWERS, Chicago, Ill.—Proposals are wanted until October 7, for constructing sewers on certain streets. Address W. H. Purdy, Commissioner of Public Works.

PROPOSALS.

WATER PIPE, Chicago, Ill.—Proposals are wanted until October 7, for laying water service pipes on 63d Street. Address W. H. Purdy, Commissioner of Public Works.

SCHOOL HOUSE, Joliet, Ill.—Proposals are wanted until October 13, for the construction of two new school houses. Address Charles C. Wilcox, City Clerk, or H. Boehme, architect.

SEWERS, New York City,—Proposals are wanted until October 15, for the construction of certain sewers. Address the Department of Public Works, as above.

TELEGRAPH LINE, Pineville, Ky.—Proposals are wanted, no date specified, for the erection of about 100 miles of telegraph line. Address Frank Mathews, Chief Engineer, K. I. C. & D. Co., as above.

PIERS, Americus, Ga.—Proposals are wanted until October 10, for the construction of four brick piers, with pile foundations, on the Savannah, Americus and Montgomery Railway. Address J. C. Wright, Engineer in Charge, as above.

RIP-RAP, Tompkinsville, S. I. — Proposals are wanted until October 11, for furnishing about 500 tons of rip-rap, at this place. Address D. P. Heap, Major of Engineers, U. S. A., as above.

REPAIRS TO BUILDINGS, Fort Trumbull, Conn.—Proposals are wanted until October 29, for making repairs to numerous public buildings at this Post. Address E. H. Catlin, First Lieutenant, Second Artillery, A. A. Q. M., as above.

SCHOOL, Providence, R. I.—Proposals are wanted until October 10, for building a brick school house. Address William W. Batchelder, Chairman Committee on City Property, as above.

BRIDGE, Spring Valley, Ill.—Proposals are wanted until October 10, for building a bridge across the Illinois River. Address Patrick J. O'Brien, Chairman of the bridge company, as above.

SEWERS, Dayton, O.—Proposals are wanted until October 13, for furnishing material and constructing about 12 miles of brick and pipe sewers. Address City Civil Engineer of Dayton, O.

BRIDGE, Greenville, S. C.—Proposals are wanted until October 15, for the construction of a bridge over the Saluda River at Holliday's Ford. Address L. K. Clyde, as above.

WATER-WORKS, Berryville, Va.—Proposals will be received until October 15, for the construction of water-works. Address T. S. Thompson, as above.

BRIDGE, La Fayette, Ga.—Proposals are wanted until October 7, for the building of an iron bridge across West Amichee Creek, in Walker County. Address R. N. Dickerson, as above.

LEVEES, New Orleans, La.—Proposals will be received until October 11, for levees to be constructed in First and Third Districts. Address State Board of Engineers, as above

WATER-WORKS, Vancouver, Wash.—Proposals are wanted until October 11, for building and completing a water-works plant. Address O. M. Hidden, as above.

BRIDGE, Helena, Mont.—Proposals are wanted until October 15, for the construction of a bridge across Ten Miles Creek, on the old Benton Road. Address J. S. Tooker, as above.

HOSPITAL, Waco City, Tex.—Proposals will be received until October 15, for the construction of a hospital for the city of Waco. Address W. W. Larmour, 318½ Austin Avenue, as above.

HOSPITAL, Atlaata, Ga.—Proposals are wanted until October 20, for labor and material required in constructing the buildings for the Grady Hospital. Address Jacob Elsas, Chairman Building Committee of Grady Hospital, as above.

SCHOOL, Socorro, New Mexico.—Proposals are wanted until October 13, for the construction of the basement of the laboratory of the New Mexico School of Mines at Socorro. Address E. W. Eaton, Secretary, as above.

SCHOOL, Canton, O.—Proposals are wanted until October 29, for the erection of a brick school building, including the heating apparatus, at this place. Address Guy Tilden, architect, Odd Fellows' Temple, as above.

TUNNEL, St. Louis, Mo.—Proposals will be received until October 14, for work on the inshore tunnel at Chain of Rocks. Address City Engineer, as above.

STREET WORK, Franklin County, O.—Proposals will be received until October 11, for the improvement of various streets. Address Frank J. Reinhard, County Auditor, as above.

MACADAM ROAD, Norwalk, Conn.—Proposals are wanted until October 8, for the construction of a Telford Macadam road of about 3,600 feet in length. Address E. N. Sloan, Chairman of Street Committee, as above.

WATER-WORKS, Rushville, Ind.—Proposals are wanted until November 3, for the construction of a system of water-works. Address Wilson T. Jackson, Mayor, as above.

BRIDGE, Houston, Tex.—Proposals are wanted until October 25, for the construction of Savin Street bridge at this place. Address Henry Scherffius, Mayor, as above.

PROPOSALS.

COURT HOUSE, Austin, Tex.—Proposals are wanted until October 15, for the erection of a brick or stone court house. Address Larmour & Watson, architects, as above.

DREDGING, Savannah, Ga.—Proposals are wanted until October 15, for dredging in Savannah River, Ga. Address O. M. Carter, First Lieutenant Corps of Engineers, U. S. A., as above.

WANTED.

TOO LATE FOR CLASSIFICATION.

WANTED.—A YOUNG ENGINEER WISHES a situation as leveler or rodman with a surveying or engineering party on railroad work. Will make himself useful for a moderate salary. Address F. M. AXTELL, care of County Surveyor, Joliet, Ill.

Building Intelligence.

We solicit from each and every one of our readers information relating to projected buildings in their locality, and should be glad to receive newspaper clippings and other items of interest.

ABBREVIATIONS.—*b s*, brown stone; *br*, brick; *br st*, brick store; *b s dwell*, brown-stone dwelling; *apart house*, apartment-house; *ten*, tenement; *e*, each; *o*, owner; *a*, architect; *b*, builder; *fr*, frame.

NEW YORK.

424–26 W 39th st, 2 br, s and terra cotta flats; cost, $26,000 each; o, H J Beaudet, a, R R Davis.

418 W 17th st, br flat; cost, $12,000; o, T V & A E Bannan; a, G A Bagga.

121 E 82d st, br and s flat; cost, $22,000: o, W Picken; a, E Wenz.

77th st, n s, 100 w West End av, 11 br and s dwells; cost, $12,000 each: o, F M Jencks; a, Van C Taylor; m, McDowell & Heney.

98th st, s s, 350 e Amsterdam ae, 2 s front flats; cost, $20,000 each; o, A Cameron; a, H Davidson.

Central Park West (8th av), s w cor 95th st, br and s flat; cost, $35,000; o and b, D Christie; a, M V B Ferdon.

29 W 128th st, 2 s dwells; cost about, $7,000 each; o, A E Fountain; a F Stanley.

Briggs av, n s, 208 e Southern blvd, fr dwell; cost, $7,000; o, W J Usher; a, a Zucker.

3–6 Pelham st, br factory, cost, $18,000; o, M Levy & Alex Huff; a, F Wandeldt.

N s 88th st, 125 w 10th av, 4 br flats; cost, $160,000 all; o, J M Niece; a, G H Griebel.

S s 90th st, 90 w West End av, 6 br dwells; cost, $75,000 all; o, T A Squire; a, C Luce.

S s 118th st, 75 e 1st av, br stable; cost, $12,000; o, J N Gallagher; a, A Spence.

W s 1st av, 75 n 108th st, br shop; cost, $12,000; o, P Hogan; a, same as above.

E s Tainton av, nr Cedar pl, 3 fr dwells; cost, $7,500 all; o, F Schwait; a, C F Lohse.

S s 92d st, 100 e 5th av, 8 br dwells; cost, $136,000 all; o and a, T Graham.

510 W 53d st, br factory, cost, $8,000; o, E L Striker; a, not given.

S s 134th st, 136 w 3d av, br shop; cost, $24,000; o, The J L Mott Iron Works; a, A S Thomson.

387–9 Greenwich st, br warehouse, cost, $70,000; o, W L Livingston; b, not given.

ALTERATIONS—NEW YORK.

1st av, n w cor 29th st, building made fireprooff and windows changed; cost, $40,000; o, Koehler & Co; m, J & L Weber.

29th st, n s, 100 w 1st av, roof raised, building made fire-proof and windows changed; cost, $20,000; o and m, same as above.

BROOKLYN.

S e cor Broadway and Myrtle av, br store; cost, $31,000; o, J Block; a, F Holmburg.

312 North 2d st, br store; cost, $7,800; o, A Roseman; a, H Vollweiller.

N s Jefferson av, 80 e Broadway, br dwell; o, C H Mallen; a, F Holmburg.

S s 14th st, 100 w 5th av, br dwell; cost, $12,000 all; o, J Bolton; a, Thos Corrigan.

S w cor Wallen st and Throop av, fr dwell; cost, $9,000; o, F Seifert; a, H J Smith.

MISCELLANEOUS.

ALLEGHENY, PA.—Lake st, 4 2-story br tenement houses; cost, $8,000; o, W H Ritchie; a, Alston & Heckert.

BUILDING INTELLIGENCE.

BALTIMORE, MD.—Caroline and Preston, 3-story stone and brick church: o, Grace Baptist Church.

BOSTON, MASS.—Simmons st, br addn and alt; cost, $6,000; o, A J Tower; a, F N Footman.

18-24 McLean st, br addn and altn; cost, $5,500; o, Boston Lying in Hosp; a, Andrews, Jacques & Rantoul; b, L D Willcutt.

Mt Vernon st (Dor), br boiler house; cost, $8,000; o, Bay State Gas Co; a, W R Addick; b, James Smith.

Vale st (Rox), fr storage and br altn; cost, $7,500; o, Dennison Mfg Co; b, Edw M Cox.

Chestnut av, 3 fr dwells; cost, $9,000; o, a and b, John W Priesing.

119 Commonwealth av, br dwell; cost, $55,000; o, I Arthur Beebe; a, James T Kelley; b, McNeil Bros.

Blaine av, 3 fr dwells; cost, $8,000; o, Samuel Hano; a, H F W Cate; b, J Young.

Elmore st, 2 fr dwells; cost, $7,500; o, John Foley and others; a, J S Eastman; b, John C Frame.

Tremont and Elmwood sts, altn and 2 br addns; cost, $14,000; o, Boston Belting Co; a, A W Folsom; b, Connery & Wentworth.

Essex st and Brighton av, br engine house; cost, $20,000; o, B & A R R; a, Waller Shepard; b, I G Wheeler.

Asylum st cor Washington st, br altn; cost, $6,500; o, Lyman Gibbs; a, A H Vinal; b, R R Mayers & Co.

BRAINTREE, MASS.—Elm cor Railroad, br basement, wood above basement, the whole forming a block; o and b, R M Long.

CAMBRIDGE, O.—The Episcopal Congregation of this place will build a new church, Hoyle & Scott, of Cambridge, O, have the contract.

CHICAGO, ILL.—4500–04 Greenwood, br dwell; cost, $10,000; o, F Thacker; a, R Rae, Jr; b, B G Robinson.

8 Pennsylvania av, br factory; cost, $22,000; a, Jno T Barney.

144–48 W Monroe, br barn; cost, $28,000; o, Adams Express Co.

726–28 W Adams, br flat; cost, $16,000; o, T H Gault; a, W L Carroll.

Cor Butterfield and 39th, s and terra cotta chapel; cost, $35,000; o, First Presbyterian Church; a, Chas S Frost.

Lake av, s and br dwell; cost, $10,000; o, M Fisher; a, as above.

Campbell park, br and s church; cost, $18,000; o, Campbell Park Presbyterian Church; a, Bell & Swift.

Englewood (67th st), remodeling br church; o, First Congregational Church of Englewood; a, as above.

Cottage Grove av and 56th, br store and flats; cost, $16,000; o, Mr Weil; a, H D Dean.

3740–42 Wabash av, s and br dwell; cost, $20,000; o, B F Ferguson; a, J W Ackerwave.

235 Rebey, br dwell; cost, $16,000; o, Peter Smith; a, as above.

Chicago av, nr Wellington, 4-story store and flats; cost, $33,000; o, Wm Thompson; a, as above.

739 Goodwin, br dwell; cost, $8,000; o, A P Jones; a, Freips & Bortell.

5631–33 Wentworth av, br store and flats; cost, $14,000; o, L A Brucks; a, L H Heinze; b, Gutrich Bros.

5300 Butterfield, packing house; cost, $17,000; o, Ellsworth & Bartlett; a, Wm R Berger.

528–36 58th, br dwell; cost, $12,000; o, N O Budd.

376 N Clark, br store and flats; cost, $14,000; o, Mrs S H Thompson; a, Edbrooke & Burnham; b, C & A Price.

415 W Madison, br store and flats; cost, $16,000; o, James F Stephens; a, C S Corwin; b, Chas Moses.

1409 Harvard, br dwell; cost, $12,000; o, Chapman Bros.

169–71 Sacramento, br flats; cost, $8,000; o and a, Horatio F Post; b, E A Slack.

BUILDING INTELLIGENCE.

CHICAGO, ILL.—173–75 Sacramento, br flats; cost, $8,000; o and a, H F Parks; b, E Slack.

2968 Michigan av, br dwell; cost, $17,000; o, H B Peabody; a, H P Harned; b, Angus & Gindele.

1271 Washington blvd, br dwell and barn; cost, $17,000; o, Hy I Evans; a, J H Moore; b, C A Moses.

3403 Calumet av, br dwell; cost, $12,000; o, W H Fleming; a, W H Drake.

2–8 Penn st, br factory; cost, $22,000; o, Jno F Barney; a, J L Holberg; b, Barney & Rodatz.

5–12 N Hoyne av, br flats; cost, $9,000; o, Louis Ehrim; a, W Bhrim; b, Joe Polouski.

144–48 W Monroe st, br barn; cost, $28,000; o, Adams Express Co; a, S V Shipman; b, Angus & Givdele.

141–43 Ontario st, br factory; cost, $28,000; o, W C Newberry; a, R T Newberry; b, W L Hoffman.

84–92 Illinois st, br factory, etc; cost, $22,000; o, Saml O Dauchy; a, Jno H Wagner; b, J C Robinson.

1027–29 W Van Buren st, br store and flats; cost, $18,000; o and b, W H Thomas & Son; a, F L Fry.

366–68 Elm st, br school and dwell; cost, $60,000; o and b, Geo F Fuller & Co; a, C S Frost.

843 W Division st, br store and flats; cost, $11,000; o, Chas Gord; a, Furst & Rudolph.

137 W 12th st, br store and flats; cost, $9,000; o, H Stein; a, W T Lasher; b, J C Voght.

1040–48 Jackson st, br dwell; cost, $17,000; o and b, Chapman Bros; a, F B Townsend.

516 29th st; br store, flats and barn; cost, $3,000; o, Jno Simneth; a, B T Rosler; b, J Waska & Son.

5730 Hibbard st, br dwell; cost, $8,000; o, T G McCullough; a, Cole & Dahlgren; b, F Gustafson.

187 buildings costing less than $7,000.

COLUMBUS, O.—12 dwells; cost, $25,000.

DETROIT, MICH.—Jefferson av, bet St Aubin av and Dubois st, 2-story br and s res; cost, $13,000; o, M Marts; a, Gordon W Lloyd; b, individual contracts.

4th st, bet Plum and Cherry sts, 2-story br double res; cost, $8,000; o and b, Robt Bed; a, Harry J Rill.

Ferry av, bet Chene st and Grandy av, 6 2-story fr res; cost, $9,000; o, R White; b, individual contracts.

Kirby and Grandy avs and Chene st, 6 2-story fr res; cost, $9,000; o, R M Bahan; b, as above.

GALVESTON, TEX.—Ave H and 20th st, electric light station for Galveston Electric Street Car Railway; cost, $20,000; o, William H Sinclair; a, N J Clayton & Co.

HARVEY, ILL.—Church and school; cost, $13,000; a, Flanders Zimmermann.

Hotel; cost, $16,000; o, C G French; a, Sprague & Newell.

LEWISTON, ME.—Chestnut st, 4-story fr block; o, Geo A Wiseman; a, Coburn & Sons.

LOWELL, MASS.—Westford st, fr store and ten bldg; cost, $15,000; o, C I Hood; b, not let.

The Massachusetts Corporation is to build an addition to one of its mills.

Plans have been submitted for a new depot at the Middlesex st station by the Boston and Maine R R Co.

READERS of **THE ENGINEERING AND BUILDING RECORD** interested in the Contracting News Department of that paper are respectfully requested to examine those columns every week, and advise the Editor of any item which they may find that, in their judgment, is of no value to any one other than the person mentioned.

BUILDING INTELLIGENCE.

MANAYUNK, PA.—Cor Main and Robinson, 5-story br store bldg; cost, $16,000; o, A & P Roberts; a, L S Jacoby; b, not yet contracted for.

MERIDEN, CONN.—Liberty st, 4 2-story tenement houses; cost, $18,000; o, C N Cahill; a, D Bloomfield; b, not let.

Main st, residence; cost, $10,000; o, I Lewis; a, H M Jones; b, not let.

MILWAUKEE, WIS. — Cor Martin and Marshall, residence, cost, $20,000; o, Ed R Bacon; a, Ferry & Close; b, Val Maudt.

Grove nr Walker st, store; cost, $15,000; o, J Katz; a, H P Schmetzky; b, W Zeimann.

NORTH WALES, PA.—A college building is to be erected here, to cost $50,000.

NEWARK, N. J.—Architects Schweitzer & Deimer have made plans for a 3-story brick building, to be erected at 54 15th av, to cost about $12,000; Jeremiah O'Rourke has made plans for a row of brick dwellings; the same architect has made plans for a 3-story brick store and dwelling.

ORANGEBURG, S. C.—The Knights of Honor and Edisto Rifles are soon to erect a lodge room and armory, at a cost of $10,000. For further particulars, address L H Wannamaker, as above.

PHILADELPHIA, PA.—S s Paschal st, nr 48th st, 8 dwells; o, W S P Shields.

E s 15th st, n Dauphin st, storehouse; o, C C Haines.

Kip and Kambria sts, 8 dwells; o, Thos McFarland.

N w cor 18th st and Penn av, factory; o, J M Charest.

S s Washington av, w 20th st, factory; o, Phospher Bronze Smelting Co.

E s Woodland av, n 73d st, dwell; o, J Welsh.

52d st, w of Media st, machine shop; o, Chambers Bros.

S w cor 11th st and Colon av, depot; o, S Hart & Son.

E s 12th st, w of Cambria st, hotel; o, W W Binder & Son.

S e cor 25th st and Sederlby av, office; o, W C Merritt.

N s Manheim st, e Wissahicokon av, club house; o, Brennfuger & Ploucher.

9th and Somerset sts, 22 dwells; o, J M Sharp.

PORT DOVER, ONT.—4-story br hotel; cost, $50,000; o, Syndicate, (Thos Hyland, Detroit, Agent); a, W P Clarke, Detroit; b, not let.

READING, PA.—11th and Windsor, stone church; cost, $12,000; o, Reformed Congregation; a, Mr Fry; b, J Angstadt.

Benjamin and 4th, br church with stone trimmings; cost, $10,000; o, Reformed Congregation, Rev McCauley, Pastor; a, Mr. Mull.

Greenwich and 5th, Queen Anne cottage; cost, $7,500; o, J Mishler; a, Smith Bros; b, J Koch.

ROCHESTER, N. Y.—Harper st, 4 fr and cut stone bldg; cost, $4,500 each; o, Wheeler & Wilson; a, H B Gleason.

Harber st, fr bldg; cost, $3,500; o, I Miller: a, same as above.

Edgewood Park, fr and cut stone bldg; cost, $3,000; o, T Chamberlain; a, same as above.

Thayer st, fr bldg; cost, $3,000; o, Wm Oviatt; a, same as above.

SNOW HILL, MD.—A hotel, to cost $20,000, is to be erected at this place.

SALT LAKE CITY, UTAH.—Main st cor 3d st, S, 3-story br store, cost, $60,000; o, Walker Bros; a, Carroll & Kern.

ST. PAUL, MINN.—7th nr Robert, iron, brick and glass arcade; cost, $50,000; o, W P Murray.

The St. Paul Building and Improvement Company have filed plans for a 3-story brick block on Arkwright and Case sts. The structure will cost $50,000.

BUILDING INTELLIGENCE.

ST. LOUIS, MO.—10th and Victor sts, br stable; cost, $9,000, o, St Louis Brewing Co; b, C Weking.

Cote Brilliante and Grand avs, br dwell; cost, $8,000; o, Mrs C Laumann, b, Goesse & Remmers.

Lucas and Grand avs, br dwell; cost, $13,200; o, R H Stockton; b, J H Bowler.

N e cor Kings Highway and Pac R R, br planing mill; cost, $10,000; o, Lohse Pat Door Co; b, sub let.

Manchester Rd and Papin av, br warehouse; cost, $10,000; o, H Bischoff; b, sub let.

TAMPA, FLA.—A court-house, to cost $75,000, is to be erected at this place.

WALTHAM, MASS.—River st, fr box factory; cost, $8,000; o, Boston Manufacturing Company.

Cor Prospect and Russell sts, 2-½story double fr dwell; cost, $10,000; o, Elijah Anderson; b, L W Martin.

WYANDOTTE, MICH.— 3-story br 'bus and lodge bldg; cost, $7,000; o, A O of U W; a, Malcomson & Higginbotham, Detroit; b, not let.

YORK, PA.—Cor Geo and Market sts, s br and iron hotel, 7 stories high; cost, $90,000; o, York Hotel Co; a, J A Dempwolf; b, Menough & Slagle.

THE CONTRACTING NEWS DEPARTMENT of **THE ENGINEERING AND BUILDING RECORD** is edited with a view of giving space to no item that does not indicate where professional services or supplies may be needed in the near future, the prices bid for work or supplies, and the correction of false or misleading reports in some papers, that may subject readers to needless trouble and expense in going after something that does not exist.

DENVER, COL.—S 15th, bet 14th av and Colfax, br dwell; cost, $9,000; o, P V Carlin; a, Gwdovant Bros.

California, Cor 22d st, br terrace; cost, $27,000; o, Lenoard & Motgomery; a, Barresen Bros.

Broadway, bet 17th and 18th avs, interior hotel finish; cost, $125,000; o, Bush & Morse; a, L M Wood.

Corona, bet 19th av and Colfax, 2 br dwells; cost, $8,000; o, G W Huntington.

Curtis st, bet 12th and 13th sts, br store; cost, $7,000; o, J H Montgomery; a, M Merideth.

Market st, bet 38th and 40th st, br hotel; cost, $20,000; o, B M Williams; a, W T Nelson.

28th st, bet Calif and Stout sts, double br dwell; cost, $8,000; o, W R Carr; a, Alex Cuzin.

MINNEAPOLIS, MINN.—7th av, s e 2d st, br machine shop and foundry; cost, $45,000; o, Herzog Mfg Co; a, F J Llwelyn.

324–28 N 1st, br warehouse; cost, $35,000; o, Wood & Moses: a, W C Whitney; a, Haglin & Morse.

4113–17 18th av, S, fr ten; cost, $9,500; o, S Ahlman.

3d av, N, bet 2d st and Washington av, add to Power House; cost, $10,000; o, Minneapolis Street Ry Co; a, C Wise; b, I M Libbey.

BUILDINGS.—There is nothing over $7,000 in value to report at the following places: Pottstown, Pa.; Pottsville, Pa.; Harrisburg, Pa.; Montclair, N. J.; Geneva, N. Y.; Zanesville, O.; Charleston, S. C.; Chester, Pa.; Worcester, Mass.; Minneapolis, Minn.; Poughkeepsie, N. Y.; Pasadena, Cal.; Fitchburg, Mass.; Wheeling, W. Va.; San Antonia, Tex.; Wilkes Barre, Pa.; Dennison, O.; Clinton, Iowa; Springfield, O.; Canton, O.; Dayton, O.· Topeka, Kan.; Findlay, O.

BUILDERS' AND CONTRACTORS' ENGINEERING AND PLANT.

NOW APPEARING IN THE ENGINEERING AND BUILDING RECORD.

I.—Introduction. Issue of November 27, 1886.

II., III., IV.—Erection of the Towers of St. Patrick's Cathedral in New York City. Seven Illustrations. Issues of December 4, 11, and 18, 1886.

V —Improvements in Dredging Machinery. Thirteen Illustrations. Issue of December 25, 1886.

VI.—Dumping-Scows. Thirteen Illustrations. Issue of January 1, 1887.

VII., VIII., IX., X., XI.—The Equitable Building in New York City. Thirteen Illustrations. Issues of January 8, 22, 29, February 5 and 12, 1887.

XII.—Carson's Trench Machine. Four Illustrations. Issue of February 19, 1887.

XIII.—Raising the Old Court-House in Boston. Three Illustrations. Issue of March 5, 1887.

XIV.—Cram's Steam Pile-Hammer. Five Illustrations. Issue of March 12, 1887.

XV.—The Equitable Building, New York City. Three Illustrations. Special Hoisting Engine and Derrick. Issue of March 26, 1887.

XVI.—The Equitable Building, New York City. One Illustration. Shoring of Column. Issue of April 9, 1887.

XVII.—Bridge-Erecting and Hoisting-Engine used on the Suburban Elevated Railway, New York City. Three Illustrations. Issue of April 30, 1887.

XVIII.—Traveler for Erecting Columns and Transverse Girders, Kings County Elevated Railway, Brooklyn, N. Y. Four Illustrations. Issue of June 4, 1887.

XIX.—Excavating Apparatus used on the Tancarville Canal and Sewer, Havre, France. Three Illustrations. Issue of July 2, 1887.

XX.—Tipple Cars on the New Croton Aqueduct. Six Illustrations. Issue of August 13, 1887.

XXI.—Derrick, Foot Block and Sheaves at Shaft 14 on the New Croton Aqueduct. Two Illustrations. Issue of September, 17, 1887.

XXII.—The Potomac Flats Dredging Plant. Nine Illustrations. Issue of October 8, 1887.

XXIII.—The Tube-Riveting Machines at the Forth Bridge. Two Illustrations. Issue of October 22, 1887.

XXIV.—The Lockwood Dredge. Cape Cod Ship Canal. Eight Illustrations. Issue of November 5, 1887.

XXV.—Location of Plant at Shafts on the New Croton Aqueduct. Two Illustrations. Issue of November 12, 1887.

XXVI.—Material Lock used in the Pneumatic Caissons at the Forth Bridge. Illustrated. Issue of December 3, 1887.

XXVII.—Six-Ton Universal Traveling Crane for Elevated Railroad Erection. Illustrated. Issue of December 17, 1887.

XXVIII.—Head-House on the New Croton Aqueduct at Shaft 22. Illustrated. Issue of December 24, 1887.

XXIX.—The New Harlem River Bridge. Illustrated. Issue of January 21, 1888.

XXX.—Erection of Poughkeepsie Bridge, No. I. Illustrated. Issue of March 3, 1888.

XXXI.—Oil Rivet Furnace at the Forth Bridge Works. Illustrated. Issue of April 21, 1888.

XXXII.—Erection of Poughkeepsie Bridge. No. 2. Masonry. Illustrated. Issue of May 5, 1888.

XXXIII.—Erection of Poughkeepsie Bridge. No. 3. False Work. Illustrated. Issue of May 12, 1888.

XXXIV.—Erection of Poughkeepsie Bridge. No. 4. Travelers. Illustrated. Issue of May 19, 1888.

XXXV.—Erection of Poughkeepsie Bridge. No. 5. Riveting Traveler, Derrick, and General Plant. Illustrated. Issue of May 26, 1888.

XXXVI.—Erecting Traveler on Kettle Creek Trestle. Illustrated. Issue of June 2, 1888.

XXXVII.—Erection of Central Viaduct, Draw Span, Cleveland, O. Illustrated. Issue of June 9, 1888.

XXXVIII.—The 70-foot Caissons at the Forth Bridge. Illustrated. Issue of June 9, 1888.

XXXIX.—Raising an Engine at Poughkeepsie Bridge erection. Illustrated. Issue of June 16, 1888.

XL.—The Hydraulic Spade at the Forth Bridge Works. Illustrated. Issue of June 30, 1888

XLI.-XLVI.—Harlem River Bridge Erection. No. 2. Masonry. Illustrated. Issue of July 7, 1888.—No. 3. Cement and Concrete. Illustrated. Issue of July 14, 1888.—No. 4. Hoisting Apparatus; Revolving Derrick. Illustrated. Issue of July 21, 1888.—No. 5. Hoisting Apparatus; Floor Travelers. Illustrated. Issue of July 28, 1888.—No. 6. Derrick Details and Shipping. Illustrated. Issue of August 11, 1888.—No. 7. Support of Segments, Field Riveting, etc. Illustrated. Issue of September 1, 1888.

XLVII.—Head-House on New Croton Aqueduct at Shafts Nos. 1. 2. Illustrated. Issue of September 8, 1888.

XLVIII.—Lever Truck for Handling Bridge Material. Illustrated. Issue of September 15, 1888.

XLIX.—Bismarck Bridge. Erecting Traveler. Illustrated. Issue of November 3, 1888.

L.—Details of Head House, New Croton Aqueduct. Illustrated. Issue of November 17, 1888.

LI —Suspended Tipple for Dumping Cars on the New Croton Aqueduct, N. Y. Illustrated. Issue of December 15, 1888.

LII.—A Viaduct Erecting Traveler. Illustrated. Issue of December 22, 1888.

LIII.—Ropes and Tackle. Illustrated. Issue of December 29, 1888.

LIV.—Power used for Operating Plant on the New Croton Aqueduct. Issue of January 19, 1889.

LV.—Special Methods of Handling Material on the New Croton Aqueduct. Issue of February 16, 1889.

LVI. Railway Bridge Erection in Peru. Part I. The Erection of a 200-foot Span. Illustrated. Issue of February 23, 1889.

LVII.—Railroad Bridge Erection in Peru. Illustrated Issue of March 2, 1889.

LVIII.—Erection of Omaha Bridge. Part I. General Description and Erecting Travelers. Issue of March 9, 1889.

LIX.—Erection of Omaha Bridge. No. II False Work in Channel Span. Illustrated. Issue of March 16, 1889.

LX.—Building the Centre Pier of Railway Drawbridge. Illustrated. Issue of March 23, 1889.

LXI.—The Sugar River Bridge Erection. False Work. Illustrated. Issue of March 30, 1889.

LXII.—Erection of Canadian Pacific Railway Depot, Montreal, P. Q. Illustrated. Issue of April 20, 1889.

LXIII.—Erection of a Plate Girder Bridge. Illustrated Issue of May 18, 1889.

LXIV.-LXV.—The Boylston Street Bridge, Boston, Mass. Illustrated. Issue of June 8 and 22, 1889.

LXVI.—Erection of Harvard Bridge, Boston, Mass. Illustrated. Issue of June 29, 1889.

LXVII.—False Work of St. Peter's Bridge over the Dadore. Illustrated. Issue of August 10, 1889.

LXVIII.—Methods of Timbering Shafts on the New Croton Aqueduct. Illustrated. Issue of August 17, 1889.

LXIX.—The Erection of Machinery Hall at Paris Exposition. Illustrated. Issue of August 24, 1889

LXX.—Hoisting Cages on the New Croton Aqueduct Illustrated. Issue of August 31, 1889.

LXXI.-LXXIII.—Erection of Machinery Hall, Paris. Issue of September 7, 21 and 28, 1889.

LXXIV.—Standard Cars used on New Croton Aqueduct. Illustrated. Issue of October 12, 1889.

LXXV.—Erection Adjustment of the Kanawha River Bridge. Illustrated. Issue of October 26, 1889.

LXXVI.—An Adjustable Pile Driver and Derrick. Illustrated. Issue of November 9, 1889.

LXXVII.—Construction of Inverts and Side Walls on New Croton Aqueduct. Illustrated. Issue of November 16, 1889.

LXXVIII.—Erection of Buffalo Truss Viaduct. Illustrated. Issue of December 14, 1889.

LXXIX.—Construction of Arches on the New Croton Aqueduct. Illustrated. Issue of December 14, 1889.

LXXX.—Erection of St. Paul High Bridge. Part I. General Diagram and Viaduct Erecting Traveler. Illustrated. Issue of December 21, 1889.

LXXXI.—New Croton Aqueduct Compressed Air Plant. Illustrated. Issue of December 28, 1889.

LXXXII.—Erection of St. Paul High Bridge. Part II. False Work and Traveler for River Spans. Illustrated. Issue of December 28, 1889.

LXXXIII.—Lighting the Croton Aqueduct. Issue of January 11, 1890.

LXXXIV.—Erection National Gallery, Berlin. Illustrated. Issue of January 11, 1890.

LXXXV.—The Van Buren Bridge Piers. Part I. General Description of Location, Structure, Methods, Progress and Materials. Illustrated. Issue of January 11, 1890.

LXXXVI.—Ventilating Croton Aqueduct. Illustrated. Issue of January 25, 1890.

LXXXVII.—Van Buren Bridge Piers. Part II. Illustrated. Issue of February 8, 1890.

LXXXVIII.—Croton Aqueduct Pumps. Experiments relating to Hydraulics of Fire Streams. Issue of February 22, 1890.

LXXXIX.—European Bridge Erection. Illustrated. Issue of March 1, 1890.

XC.—Erection of Court Street Bridge at Binghamton, N. Y. Illustrated. Issue of March 8, 1890.

XCI.—Sidewalk Protection during Building Construction. Illustrated. Issue of March 15, 1890.

XCII.—House Builder's Derrick. Illustrated. Issue of April 5, 1890.

XCIII.—Drilling, Blasting and Timbering the Croton Aqueduct. Illustrated. Issue of May 17, 1890.

XCIV.—Raising a Block of Brick Houses. Illustrated Issue of May 31, 1890.

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THE PRESENTATION OF PAPERS BEFORE ENGINEERING SOCIETIES.

A NOTEWORTHY circumstance, connected with the New York meeting last week, of the American Institute of Mining Engineers and of the British Iron and Steel Institute, was the distribution, immediately before each session, of printed copies of some of the papers which had been prepared. So far as we are aware this was the first time in the history of the Institute of Mining Engineers, at least, that anything of this kind had been attempted, and it must be regarded as a decided step in advance of the customary and still partially retained practice of this and nearly all other engineering societies, of reading the papers in full at the sessions, and of being content with the necessarily limited and imperfect discussion of points which may suggest themselves to the attending members during the reading.

There seems, fortunately, to be a gradually growing appreciation of the fact that intelligent and comprehensive discussion of a professional paper cannot be conducted on the spur of the moment, but requires careful study of the subject, and that this can be made possible only by making the papers available previous to the time during which they are to be presented. The distribution of printed copies, as in this instance, secures not only this object, but further, makes it unnecessary to needlessly take up time at a meeting by allowing a paper to be read from beginning to end by its author. A brief abstract, setting forth the salient features, is all that is necessary.

In connection with this we cannot too strongly commend to the attention of all engineering societies the plan adopted several years ago by the American Society of Mechanical Engineers, and which has been found to give excellent results. All papers to be presented before that society must be submitted to a publication committee several weeks before the meeting for which they are intended. Upon acceptance, printed copies are prepared and distributed among those members desiring them, several days in advance of the meeting. A good opportunity is thus given for a careful study of the subject, and for preparing written discussions if desired. At the meeting, the author of each paper is permitted to present only an abstract of it, to take up not more than ten minutes, and in the resulting discussion each speaker is limited to five minutes. For written discussions ten minutes are allowed, and for the closing remarks the author is granted an additional period of five minutes. The advantages of this system have been demonstrated in the most striking manner. Every one who has attended one of the meetings of the American Society of Mechanical Engineers cannot have failed to be impressed with the thoroughly business-like character of the sessions, and the large amount of work which is crowded into a comparatively short period of time in virtue of this arrangement. The discussions, based upon mature consideration of the subject, are animated and to the point, and there is no flagging of interest brought about by long drawn out readings of papers which, however valuable they may be, cannot usually be intelligently followed if presented in the customary manner, and, therefore, of necessity must become somewhat wearisome.

The attempt at reform made last week by the American Institute of Mining Engineers has, undoubtedly, been prompted by the success of the Mechanical Engineers' methods and ought to meet with hearty encouragement. Other engineering societies, having a comparatively large number of papers to dispose of at their meetings, would also find it advantageous to follow the same plan. It enables the ready handling of a great volume of business in a short time, adds to the interest and value of the proceedings, and impresses upon the members the conviction of having spent the available time in the most economical and profitable manner.

THE RELATIONS OF CONSUMPTION TO WIDTH OF STREETS.

THE word "consumption" in the above title does not refer to expenditure of money, or to the rapidity of wearing out of pavements or of vehicles; but to the popular term for the disease known to physicians as "phthisis," or more specifically as "pulmonary tuberculosis." It destroys more lives in the United States in the course of a year than does any other disease, and in our large cities it causes about 14 per cent., or over one-eighth, of all the deaths. It is well known that the mortality from this cause is greater in some parts of cities than it is in others, and the reasons for this are of much practical interest.

Dr. H. S. Anders, in a paper recently published in the *University Medical Magazine*, calls attention to the fact that the width of streets seems to have some connection with local death-rates from consumption, basing his conclusions on a study of the deaths from this disease which have occurred in the Fifteenth Ward of Philadelphia during the fifteen years from 1874 to 1888. This ward includes an area of about one square mile, lying north of Vine and west of Broad Streets, and bounded on the west by Fairmount Park and the Schuylkill River. Most of it is well elevated and fairly drained. It presents great variety in the width of its streets, and the number of deaths reported as due to phthisis is comparatively large. Taking a map of this region, Dr. Anders marked upon it the precise location of 1,665 cases of death from consumption, and then, comparing the frequency of these with the width of the streets upon which they occurred, obtained the following results: "The number of deaths from phthisis on a very wide street is proportionately small as compared with those occurring upon almost any narrow street, and the same is true with reference to the aggregates of several wide and narrow streets. The mortality was low in streets of medium width, but very high in certain groups of small streets, and especially so in narrow streets closed at one end. Even narrow streets, only a block in length, show a remarkably large death-rate from phthisis." He refers to similar investigations, leading to similar conclusions, made some years ago by Dr. Arthur Ransome, in Manchester, England, and concludes that it is the defective change in the air in narrow streets which is the chief cause of the increased mortality, and that, therefore, street ventilation should be given special consideration by municipal engineers.

We have no doubt that the death rates are generally lower on wide streets and in houses facing open spaces than they are on narrow streets, alleys, and nearly inclosed courts, or *cul* *de sacs.* The English statistics on the healthfulness of large cities in England long ago demonstrated that the mortality was greatest where the houses are most closely packed, and Dr. Farr expressed this mathematically, by saying that the mortality in different localities is in proportion to the sixth root of their densities of population. We now know that this relation between death rates and densities of population is by no means a necessary and inevitable one within the ordinary limits, and that defective amount of open air space acts prejudicially in several ways besides merely preventing rapid change of air.

Phthisis is caused by the development and growth in the air passages of a minute vegetable organism, which forms rods, each about one ten-thousandth of an inch long, and is called *bacillus tuberculosis.* It can be cultivated on various substances if kept very warm, but so far as we know it does not grow naturally except in the living bodies of warm-blooded animals, including man. In many men and animals it does not grow at all under ordinary circumstances. It is transmitted to men and animals chiefly by its spores contained in matter spit up by men, or animals, affected with the disease. It may be transmitted by the flesh or milk of tuberculous animals, but so far as pulmonary tuberculosis is concerned, it is due in almost every case to the inhalation of dust carrying with it dried and pulverized sputa which contained the bacillus when it was expectorated. One of the things which strongly affects this bacillus is light. In the dark it can maintain its vitality for a long time, months at least, even when quite dry; but a few hours' exposure to full sunlight kills it, and so does a few days' exposure to full daylight. The illumination of living rooms, therefore, has an important influence on their healthfulness so far as phthisis is concerned, and this is one reason why narrow streets and alleys and back-to-back houses show high death rates from this cause.

Another reason is that in such narrow streets and alleys live the poorer classes, who shun ventilation of their living rooms in order to save fuel, and in whose families, crowded together in a few rooms, a single person affected with the disease is a specially dangerous source of infection. But if we cannot assign the precise share which impure air, insufficient light, uncleanly habits, etc., have in favoring the development of tuberculosis, it is at least fortunate that abundance of fresh air and light usually go together, and that in securing the one we usually obtain the other. Many poor families in cities cannot, unfortunately, have as much of these two great needs in their living rooms as they ought to have, but they can at least avoid the special danger which arises from allowing the sputa of a consumptive member of the family to dry upon the floor and to be scattered in dust through the apartment.

AN ELECTRIC CENSUS.

THE following electrical statistics are given in a recent issue of London *Iron*:

In 1837 the first practical telegraph was worked in England, after a crude attempt made in 1835 on a line of 13 miles between Paddington and Drayton. In 1884 a telegraph line was opened between Washington and Baltimore. In 1850 a copper wire insulated in gutta-percha was submerged between Dover and Calais, and the first submarine telegraph was laid by the late Mr. T. R. Crampton. There are now 942 submarine cables, exclusive of the seven Atlantic cables, with an aggregate of 112,740 nautical miles. The overland telegraph is already a world-wide institution, in which there is a total of 1,680,900 miles of wire, enough of the attenuated metal to go around the equatorial belt of the globe just thirty times. The number of words transmitted, the miles traveled, and the cash changing hands would tax the enumeration table. The United States have 776,500 miles of wire, and in 1889 no less than 56,000,000 messages were sent through the country. France has 220,890 miles of wire, on which in 1889 were transmitted 30,050,000 dispatches. Great Britain has 180,000 miles of metal line, and in 1889 sent 50,000,000 messages. Russia has spun out 170,500 miles, and in 1889 gave the operators 10,280,780 messages to dispatch. Australia has strung no fewer than 105,360 miles of wire across its surface, and transmitted in one year 12,000,000 messages. Italy has 19,500 miles, and has made an annual record of about 7,000,000 electric messages. Canada has 58,500 miles of wire, and did a business in 1889 of 4,027,581 dispatches. Egypt has 5,500 miles, and is in connection with India and England by submarine cables on which last year 1,600,205 communications were carried from one end of the world to the other. China has 5,500 miles of wire across Mongolia, and Japan owns no less than 16,500 miles, over which 5,000,000 messages were sent in one year. New Zealand has strung itself with 11,375 miles of metal cord, and dispatched 1,835,394 messages. Tasmania has 2,500 miles of telegraph wires. Persia claims, in partnership with European wires, about 6,124 miles. South Africa has a credit of 4,310 miles, and even St. Helena, the island prison of the great Corsican, has 13 miles of the universal wire cobwebbing its rocks. The telegraph systems of the world have unrolled the wire reel without stint, and if we add to the 1,688,900 miles used for telegraph purposes the wholesale appropriation by the telephone system, the sum total would be enormous.

AN HYDRAULIC CALCULATING RULE.

AN hydraulic calculating rule, invented by an English engineer, Arthur Honeysett, and made by W. F. Stanley, Holborn, W. C., England, is described in the London *Building News*.

The rule is made of boxwood, graduated with great nicety, and is about 16 inches long and 2 inches broad. It appears to be a very useful instrument, as it will greatly facilitate the labors of the engineer in calculating the velocities and discharge of sewers and pipes. Eight scales are marked on the rule, A, B, C, D, E, F, G, and H, the four last ones being made to correspond to four classes of co-efficients, according to the nature of the channel, the first class being for cement or smooth pipes, the second class for brick or ashlar, the third for rubble masonry, and the fourth for earth, river courses. By a sliding index the figure (marked 100) is brought opposite the value of the hydraulic mean depth on one of the lower scales corresponding to the nature of channel, then on another scale (marked D) will be found the velocities in feet per second due to the inclinations given on the slide, which comprise falls from 1 in 6 to 1 in 2,000, though inclinations flatter than the last can be obtained. To aid in adjusting the sliding index over the lower scales, a piece of talc, marked with a line, slides over the rule. By another adjustment of the slide the quantity discharged can be found. Scale A gives the square root of the fifth powers of values, by means of which the diameter of a pipe to discharge a given quantity can be found. Other tables at the back of the rule enable the engineer to find the area and hydraulic mean depth of segments of circular and oval conduits.

NOTES.

THE construction of the Niagara tunnel was commenced, with appropriate ceremonies, on Saturday last, October 4, C. B. Gaskill, President of the Niagara Power Company, turning the first sod.

SEVERAL disastrous explosions occurred at the Dupont Powder Works, near Wilmington, Del., on the 7th inst. A number of buildings were wrecked, and several lives lost.

THE work of the Mississippi River Commission, which has been sitting at New York, was completed on the 4th inst. Over $3,000,000 has been apportioned for the improvement of the lower Mississippi and its tributaries. The work of improvement will be begun as soon as the Secretary of War has approved the apportionment.

CHIEF ENGINEER FTELEY has reported to the New York Aqueduct Commissioners that a structure of less magnitude than the Quaker Bridge Reservoir, but large enough to furnish ample storage capacity for the next twenty years, can be built at smaller cost. The site he suggests is about a mile below the Croton Dam, and he recommends that such a dam as is proposed be built there immediately. The Aqueduct Commissioners will give a public hearing in the matter on October 27.

MEETINGS OF ENGINEERING SOCIETIES.

The AMERICAN SOCIETY OF CIVIL ENGINEERS holds its regular meetings on the first and third Wednesday in each month, at the House of the Society, 127 East Twenty-third Street, New York.

The BOSTON SOCIETY OF CIVIL ENGINEERS holds its regular meetings at the American House, Boston, at 7.30 P. M., on the third Wednesday in each month.

The WESTERN SOCIETY OF ENGINEERS holds its regular meetings at its hall, No. 67 Washington Street, Chicago, at 7.30 P. M., on the first Wednesday in each month.

The ENGINEERS' CLUB OF ST. LOUIS holds regular meetings in the club's room, Laclede Building, corner Fourth and Olive Streets, St. Louis, on the first and third Wednesdays in each month.

The ENGINEERS' CLUB OF PHILADELPHIA holds regular meetings at the House of the Club, 1122 Girard Street, Philadelphia.

The ENGINEERS' SOCIETY OF WESTERN PENNSYLVANIA holds regular meetings on the third Tuesday in each month, at 7.30 P. M., at its rooms in the Penn Building, Pittsburg, Pa.

The ENGINEERS' CLUB OF CINCINNATI holds its regular meetings at 8 P. M. on the third Thursday of each month at the Club rooms, No. 24 West Fourth Street, Cincinnati.

The CIVIL ENGINEERS' CLUB OF CLEVELAND holds regular meetings on the second Tuesday of each month, at 8 P. M., in the Case Library Building, Cleveland. Semi-monthly meetings are held on the fourth Tuesday of the month.

The ENGINEERS' CLUB OF KANSAS CITY meets in Room 200, Baird Building, Kansas City, Mo., on the second Monday in each month.

The ENGINEERING ASSOCIATION OF THE SOUTHWEST holds regular meetings on the second Thursday evening of each month at 8 o'clock, at the Association headquarters, Nos. 63 and 64 Baxter Court, Nashville, Tenn.

The CIVIL ENGINEERS' SOCIETY OF ST. PAUL meets at St. Paul, Minn., on the first Monday in each month.

The MONTANA SOCIETY OF CIVIL ENGINEERS meets at Helena, Mont., at 7.30 P. M., on the third Saturday in each month.

The CIVIL ENGINEERS' ASSOCIATION OF KANSAS holds regular meetings on the first Wednesday in each month at Wichita, Kan.

The NEW ENGLAND WATER-WORKS ASSOCIATION holds quarterly meetings in Boston at Young's Hotel.

THE CANADIAN SOCIETY OF CIVIL ENGINEERS holds its regular meetings on each alternate Thursday, commencing with the 9th of October, at the House of the Society, 112 Mansfield Street, Montreal.

The convention of the American Institute of Architects will be held in Washington, D. C., beginning on October 22, and continuing until the business has been completed.

A QUANTITY of mining machinery, comprising air compressors, rock drills, etc., was shipped to the Jehu Mines in China, last week, by the Ingersoll-Sergeant Rock Drill Co., of New York. Jonas Crabtree, an experienced mechanical engineer, was engaged by the company, and is now on his way to China to erect and operate the machinery.

A GOVERNMENT appropriation has been made for exhaustive trials of the Ericsson submarine torpedo gun.

OBITUARY

MARTIN ALLEN, Superintendent of Section 3 of the Erie Canal, died on the 8th inst., of pneumonia, aged 51 years.

THOMAS THOMPSON, one of the oldest architects in Elizabeth, N. J., died on Sunday, October 5. He was 71 years old, and had designed many fine houses in Elizabeth and its vicinity.

ANDREW PERRIN, died on October 7, at Rochester, N. Y. He was born in Conesus, Livingston County. He lived many years in Oil City and Titusville, Pa., where he served as Mayor two terms, and was favorably known throughout the oil country. He was 41 years old. Mr. Perrin owned large business interests in the oil country, and was manager of the Seaboard Pipe Line Company.

PERSONAL.

D. C. DUNLAP was recently appointed City Engineer, of Rockford, Ill.

SETH GREGORY, architect, of Aurora, Ill., will spend the winter in Tacoma and other cities in Washington.

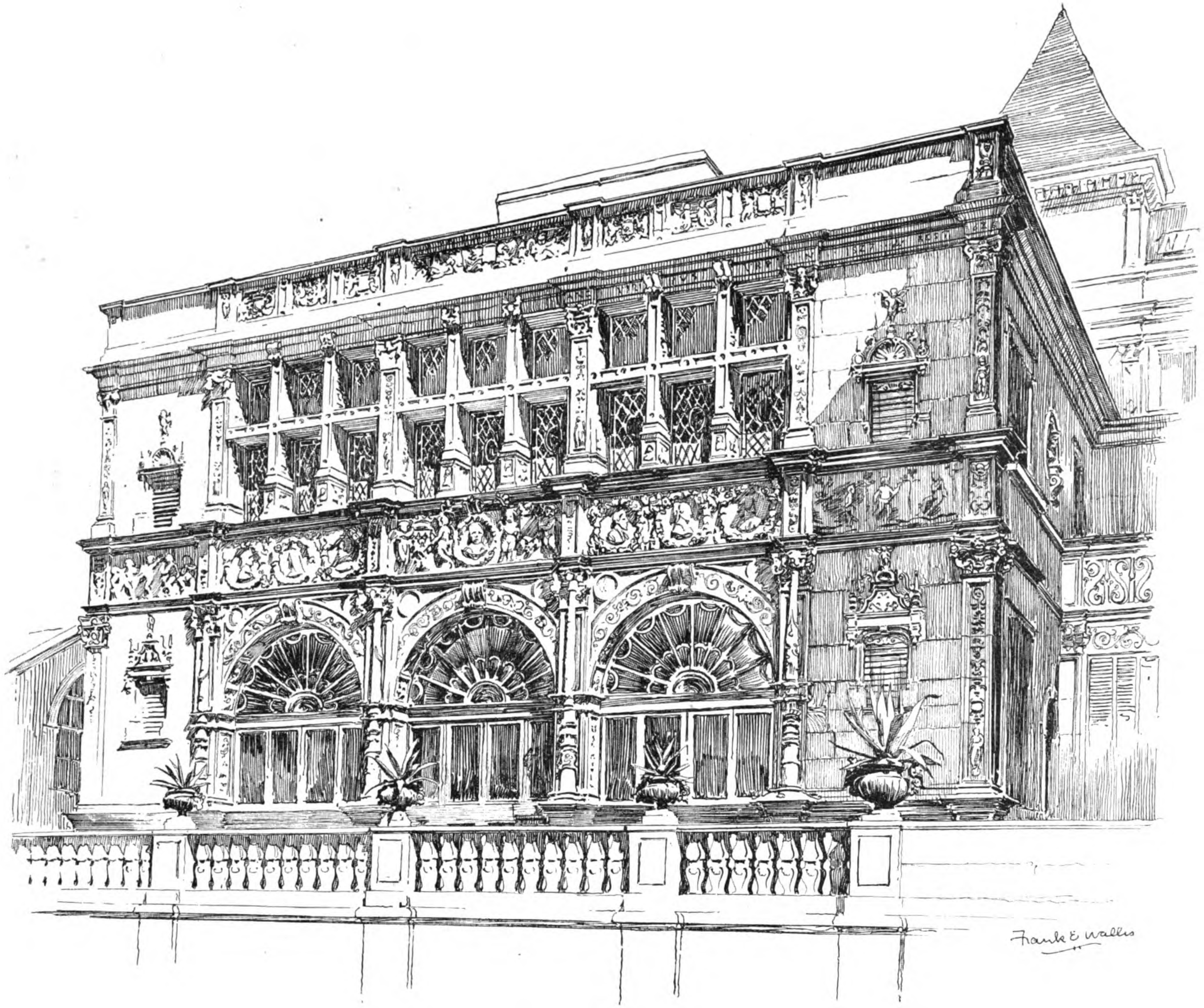
HENRY C. ALLEN has been appointed to temporarily fill the office of City Engineer of Syracuse, N. Y., during the absence of H. W. Clarke, necessitated by ill health.

OUR ARCHITECTURAL ILLUSTRATIONS.

SHOOTING LODGE OF FRANCIS I., PARIS.

COTTAGE OF E. H. PENDLETON, BAR HARBOR, ME.
ROTCH & TILDEN, ARCHITECTS, BOSTON, MASS.

THROUGH an oversight, the supplement showing "West Front, Church Echillais, Charrente, France," was inclosed in part of last week's issue in place of the one showing "The Shooting Lodge of Francis I." Those having duplicates of either can effect an exchange on application.



THE ENGINEERING AND BUILDING RECORD ILLUSTRATED SERIES.

SHOOTING LODGE OF FRANCIS I.

TAKEN FROM FONTAINBLEU AND SET UP IN PARIS.

NEW YORK, VOLUME XXII.

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THE IRON AND STEEL MEETING.

As ALREADY stated in our last issue, the American Institute of Mining Engineers, with its British and German guests, left New York for Philadelphia on Saturday, October 4, Philadelphia being the first stopping place on the extended trip West, North and South, for which arrangements have been made.

Saturday was spent in visiting the Disston Saw Works, at Tacony, near Philadelphia, and in a trip by boat to Chester, Pa., and Wilmington, Del.

The special feature of Monday, October 6, was the excursion to the works of the Phœnix Iron Company, at Phœnixville, Pa. A train, furnished through the courtesy of the Reading Railroad Company, left Philadelphia in the morning, and a special train had also been arranged to leave New York, to convey a number of New York representatives of the iron trade and of the engineering and architectural professions to the works.

Those who did not go to Phœnixville visited a number of other establishments in and near Philadelphia, among them the Camden Iron Works, at Camden, N. J., the Baldwin Locomotive Works, at Philadelphia, the Edgemoor Iron Company's Works at Wilmington, Del., and the Southwark Foundry and Machine Company's Works, at Philadelphia.

Early on Tuesday, October 7, the engineers left Philadelphia for Lebanon and Harrisburg, visiting the various large iron and steel works at these places,

Wednesday was devoted to the industries of Altoona and Johnstown, prominent among them the Pennsylvania Railroad Company's shops at the former, and the Cambria Iron Works at the latter town. Pittsburg was reached in the evening.

On Thursday and Friday mornings, sessions were held at Pittsburg, for the reading and discussing of professional papers.

THE Inca's Bridge in the Andes, as described by Theodore Child in *Harper's Magazine*, is simply an arch of stratified shingle, cemented together by deposits and petrifications from the hot springs which bubble up all over the neighboring bluff, the river Cuovas having eaten its way through the shingle and falling in a cascade below. The bridge is 66 feet high, 120 wide, and varies from 20 to 30 feet in thickness, and seen from below the bridge it is found to be covered with yellowish stalactites, more curious than beautiful.

BOOK NOTICES.

THE THAMES RIVER BRIDGE AND APPROACHES AT NEW LONDON, CONN. By Alfred P. Boller, Chief Engineer. Size, 10½x14 inches; 60 pages.

We are indebted to Mr. Alfred P. Boller, Chief Engineer of the Thames River Bridge, at New London, Conn., for a copy of the above volume, which has just been issued, and which, virtually, is his report upon the construction of the bridge and its approaches to the General Manager of the New York, Providence and Boston Railroad, for which it was built.

Concerning the bridge itself we need say nothing here, as comprehensive extracts from the book are given elsewhere in this issue. The work opens with an historical account of the enterprise from its inception; this is followed by a general illustrated description of the bridge and of the methods of construction followed, while eight appendixes and 13 folding plates of illustrations make up the concluding portion. To the engineer the appendixes are of more than general interest, being, with a few exceptions, devoted to copies of the specifications covering the construction of the superstructure and of the foundations and the masonry, and to a mass of highly interesting and valuable figures, in tabulated form, giving the weights of metal in the different truss spans, and the results of tests of the structural material used.

The tables represent a prodigious amount of testing work, and their importance can scarcely be overrated, placing, as they do, within reach, in condensed form, a large quantity of data on the physical and chemical properties of the metals employed. Thus, Appendix No. 7 contains the results of 33 tests of full-sized ¾ inch. open hearth steel eye-bars, giving all the particulars obtained which are likely to be of any possible practical value; and Appendix No. 8 is devoted to tests of finished material, embracing open hearth and Bessemer steel bars, plates, L's, channels, and I-beams, and to tests of the iron used. The peculiar value of these tables to the engineer who is interested in structural iron and steel work scarcely needs pointing out.

The folding plates, already mentioned, illustrate various details of the bridge, both superstructure and foundation work, profiles of soundings across the Thames River, and of part of the line from New London.

The importance and value of the report make it all the more to be regretted that the binding is not of a more substantial and protective character, being practically ordinary trade catalogue binding. This defect, however, can be easily remedied at slight expense by the purchaser.

THE RAIYAN CANAL.

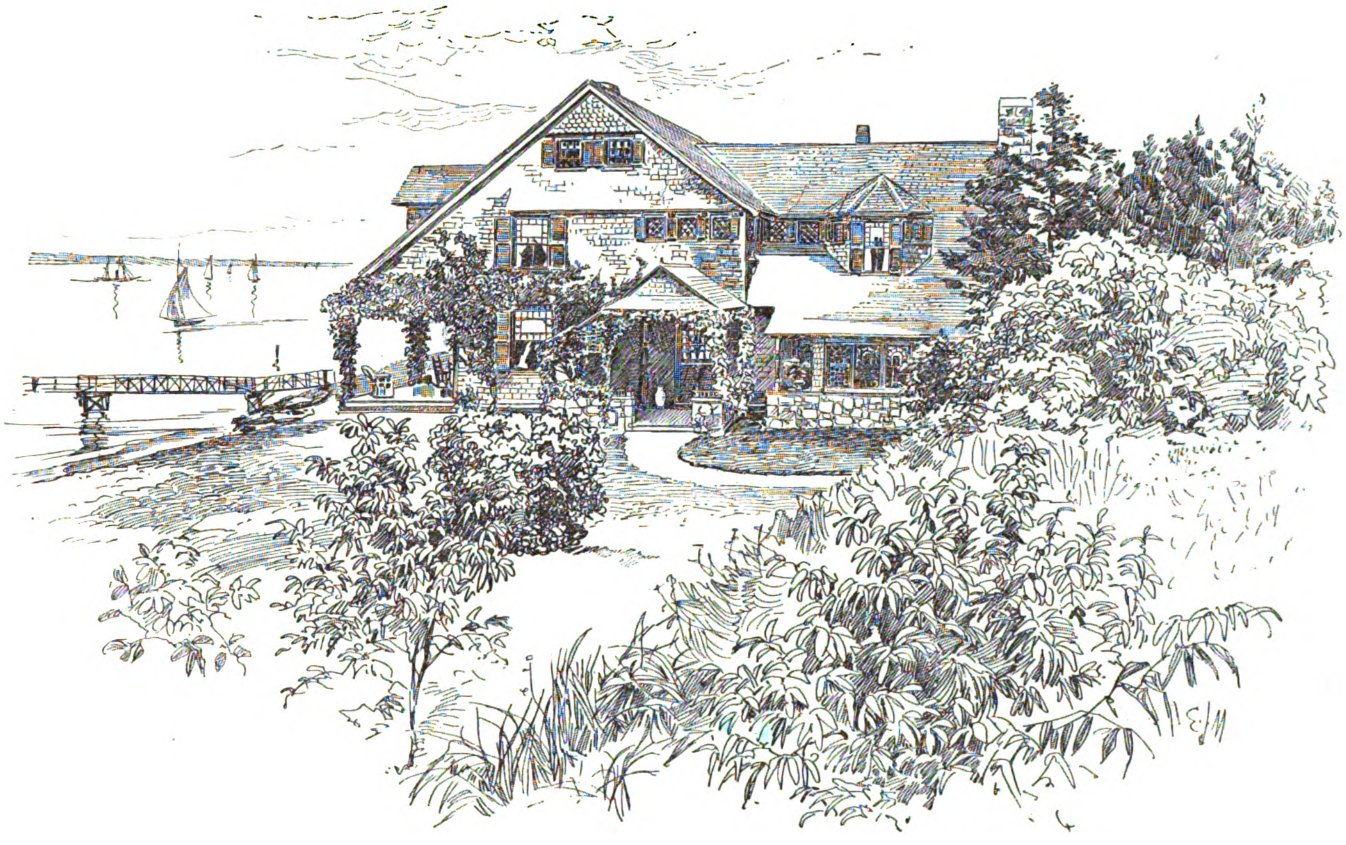
A PAPER on the Raiyān Canal was contributed to the British Association for the Advancement of Science, at its last meeting, by Mr. Cope Whitehouse.

The general character of this canal, which it is intended to construct between the Valley of the Nile and the Raiyān depression, at a point about 80 miles south of Cairo, was explained at a previous meeting. The proposed works have now been elaborated in detail, (1) the size of the basin; (2) the section of the canal: (3) the water-surface levels of the Nile; (4) the minimum level of the Nile in flood; (5) the works to the west of the Nile Valley—excavations, earthworks, pitching, and masonry; (6) the works in the Nile Valley for the passage of existing canals, drains and railways under and over the Raiyān flood-canal; (7) the time required to fill the reservoir; (8) the quality of the water stored, tables, maps, sections, photographs exhibited, and estimates given. With an 80-meter wide canal the flood could be lowered at 50 centimeters per 24 hours, and the reservoir, 250 square miles in area, and 220 feet in maximum depth, filled to the level of + 27 meters above sea in three years.

The total cost is estimated at less than £1,589,000. The duty of the reservoir would be to raise the minimum flow of low-Nile from about 9,000 feet per second to 30,000, and fix a maximum for high-Nile. The results anticipated would be practically to double the present cultivated area and agricultural output, with large extension of internal navigation in the Delta.

AT the meeting of the Executive Committee of the Grant Monument Association on the 6th inst., at New York, the special Committee on Site reported in favor of a plot on Riverside Drive at One Hundred and Twenty-third Street. It is only a short distance above the place where the General's body now rests.

THE scant water supply of Waterbury, Conn., is said to occasion some anxiety. The present reservoirs were built 20 years ago, and were calculated to supply all demands for 10 years. The city is claimed to be more than three times as large as it was then, and still there has been no increase in the water supply.



COTTAGE OF E. H. PENDLETON, BAR HARBOR, ME.—ROTCH & TILDEN, ARCHITECTS, BOSTON, MASS.

THE A. L. HOLLEY MEMORIAL.

ONE of the features of last week's meeting at New York of the American Institute of Mining Engineers and the British Iron and Steel Institute was the unveiling, on Thursday afternoon, of the bust of Alexander Lyman Holley, at Washington Square.

In a brief speech, as the chairman of a committee representing the American Institute of Mining Engineers, the American Society of Mechanical Engineers and the American Society of Civil Engineers, ex-President Bayles of the Health Board, formally presented the memorial to the city of New York. After Mr. Bayles had spoken, and while the Seventh Regiment band played "America," Alexander Holley Olmstead, the six-year-old grandson of Mr. Holley, pulled the cord and the American flag fell to the ground, revealing the clear-cut features and fine proportions of the bust. Then Mr. Gallup, the President of the Park Boark, in behalf of the city, accepted the gift in a brief speech.

Previous to the ceremony an address on Alexander L. Holley was delivered at Chickering Hall by Mr. James Dredge, one of the editors of *Engineering*, of London. Mr. Dredge prefaced his address with the reading of letters in praise of Alexander L. Holley from James Forrest, the Secretary of the British Institution of Civil Engineers, and Sir Henry Bessemer. From the address we extract the following:

> In 1857 I was the first person to shake hands with Holley on his arrival in England. Twenty-five years later I was the last Englishman to shake him by the hand in London, when we said our final farewell. You cannot imagine the effect which the sudden apparition of the two young Americans, Holley and Colburn, in the gloomy London office, had upon me. They appeared to me like beings from a superior world, so unlike were they to any persons I had ever met before. Even with my untutored and crude power of perception, I could feel that they were surrounded with an atmosphere of energy and intelligence; that they were overflowing with vitality. The one seemed to me a spirit of darkness, the other a spirit of light; and both so immeasurably my superiors that I could do little more than gaze on them in wonder.
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> When their brief visit came to an end, and they returned to New York, most of the light went out of my life, though their influence remained behind, especially that of Holley, whose bright individuality rested with me as an ideal, which I might, perchance, with time and constant effort, feebly imitate. The following year Zerah Colburn returned to London alone. He became the editor of *The Engineer*, and I, having sought him out, had the privilege of being closely and intimately associated with him until the curtain fell upon his tragic end. As no doubt you know, after he returned to England in 1858, he made his permanent home there, with the exception of a few months in 1860, which he passed in Philadelphia. You are also aware that it was he who founded *The London Engineering* in 1866. Into the management of this journal he threw, for the first three years, the whole force of his great erratic powers. After their first visit to London, and their joint publication of the volume on European railways, Holley and Colburn, without becoming actually estranged, had but little in common. The dark and fiery genius of the one was, in fact, so opposed to the trained talents and noble soul of the other, that it was impossible for any real and lasting sympathy to exist between them.
>
> With Holley's return to America in 1858, or shortly afterward, began the journalistic epoch of his career. For some years he was a valuable and industrious contributor to the New York *Times*, and certainly never before or since has any daily newspaper been so fortunate in the services of an engineering contributor. In 1859, and again in 1860, he visited England, chiefly to write upon a subject which was then attracting the attention of the civilized world—the "Great Eastern." This business brought him into intimate contact with the engineers of that vessel, Brunel and Scott Russell; with the last named the acquaintance ripened into a warm personal friendship which always remained. The New York *Times*, *The Railway Review*, inventions connected with the steam-engine and permanent way, and miscellaneous literary employment kept Holley closely occupied, and brought him plenty of reputation, though but little money, until the War of Secession. It is needless to say that Holley, like a good patriot, offered his able services to the Government, and it is interesting to add that his offers were uniformly declined. It was during this great national crisis that Holley, while still holding on to his main support—a brilliant and facile pen—had the opportunity of taking up work more congenial to him. He was employed by Mr. Stevens in 1862 to visit Europe in order to obtain information that might be useful in the construction of the Stevens battery, on which so much time and money, as well as skill, were wasted. Mr. Scott Russell, who at that time had considerable interest in naval and military circles, rendered Holley good service in obtaining for him introduction and information, while his own presence of mind and coolness often stood him in good stead in obtaining access to places the official doors of which were closed against him. It was this new connection that turned his mind to the production of that important hand-book on "Ordnance and Armor," which, when completed, was destined to remain for so many years the standard book of reference on the subject. Like every piece of work to which Holley set his hand, this treatise bears on every page evidence of his capacity for taking infinite pains. The objection has been made by friendly critics in this country, that "Ordnance and Armor" was scarcely worthy of its author. I do not agree with this criticism, and in this I am sustained by one of the ablest practical designers of artillery in the world, M. G. Canet.
>
> When this book was published, the art of heavy gun construction was far more tentative and experimental than it is now, and the classified collection of all information available up to the date of its publication served as a great aid in advancing a science then in its infancy. The strictly literary period of Holley's career was now drawing to a close, and though he could never, as long as he lived, abandon his innate love for writing, he was no longer compelled to rely on his pen as a means to live. In May, 1863, he finally decided upon turning his talent and energies into another channel, one that was destined to lead him to fame, and moderate prosperity.
>
> The practical value of the Bessemer process for manufacturing steel had by this time become widely recognized, and it followed almost as a matter of course that Holley, who was always on the lookout for some new and good thing, felt intuitively that the time for which he had so long waited had at last arrived. The story of the Bessemer process was at that time no new one. Seven years before, at the Cheltenham meeting of the British Association for the Advancement of Science, Mr. Bessemer had made the first public announcement of his invention. The title of the paper excited derision; its reading, wild enthusiasm. Mr. James Nasmyth said of the samples shown to the astonished audience, "Here are true British nuggets." A wave of excitement passed over the country; one result of this paper was that almost immediately a sum of $250,000 was offered for the English patents; another, that within a month £28,000 had been paid for licenses to work the process in Great Britain alone. Then swiftly followed a fierce reaction, consequent on failures due to hasty experiments and crude trials. Abuse of the inventor was as hearty as the praise had been fulsome a few weeks before.
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> The Sheffield Bessemer Works in 1864 were on a very small scale; they comprised only two three-ton converters and a corresponding plant. Holley came from America upon this business as the representative of Messrs. Corning, Winslow & Co., a firm that was afterward changed to Winslow, Griswold & Holley. His mission was to purchase the Bessemer patents for the United States; to learn the process; and afterward to inaugurate the new industry at home. As he said, that journey was no pleasure trip; but he came back successful on all points, and the following year the works at Troy were built.
>
> As is the case with so many great inventions, a number of active minds were turned toward the manufacture of steel, stimulated thereto by Bessemer's success and his reputed failures. Prominent among these in the United States was W. Kelley, of Eddyville, Kentucky, and your talented countryman, W. F. Durfee, addressed himself to the practical development of this invention; it was he who constructed the experimental steel works at Wyandotte, Mich. This was in 1862, the year of the great international exhibition in London, where Holley had ample opportunity of studying the products of the Bessemer converter. We may be certain that what he saw there convinced him of the importance of the process for the United States. His judgment was confirmed by that of Zerah Colburn, who, with his usual foresight, had some time before become a strong advocate of the process. Writing in *The London Engineer* in 1862, Zerah Colburn said: "The fact that as a substitute for wrought-iron, at least where facility of welding is not of a special consequence, the Bessemer metal is now known to be of established, trustworthy character, is of itself a most important one, and as those who fully know the process are aware that ingots can be turned out by it at £6 a ton, and finished rails at less than £10, we have only to await the time when through competition this metal has been cheapened to an extent which will insure its general application for the many purposes to which it is so admirably fitted."
>
> After the return of Holley to America in 1864 the Troy works were started, and the first charge of Bessemer metal was made on February 16, 1865. Let me refer you to R. W. Hunt's interesting paper on the original Bessemer steel plant at Troy, read before your Society of Mechanical Engineers in 1884. You will see from it that Troy was only a small works with two 2-ton converters, but such capital steel was produced that enterprise and capital were convinced. During the month of May, 1865, less than twelve weeks after the works were started, eighty charges were made, giving 118 tons of steel with 16.7 per cent of loss; immediately after this the works were extended by the installation of a plant that included two 5-ton converters; Mr. Z. S. Durfee assumed the charge of the establishment, and Holley proceeded to construct steel works in other parts of the country, commencing with those of the Pennsylvania Steel Company at Harrisburg.
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> The thorough efficiency of the Bessemer process having been thus demonstrated, there was no limit to the supply of capital required for the erection of steel works, and Holley rapidly found himself almost unable to satisfy the demands made upon him for designing and starting new establishments. He, however, never knew what it was to have too much occupation, and the finest steel works in your country bear evidence of his skill and industry, those of North Chicago and Joliet; the Edgar Thomson Works at Pittsburg; the Vulcan Works at St. Louis; the Cambria, the Bethlehem, the Scranton and other works, were built under his instruction and from his plans. But more than this, Holley completely modified the details of the Bessemer process as he had learned it in England; he adapted it to the special requirements of the American manufacturer, who was enabled, through the modifications he designed, to produce those stupendous outputs of steel the records of which were so long received in England with incredulity.
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> So the busy years passed, bringing with them a rich, if tardy, harvest of fame to Holley. He continued to be recognized as the one great authority in America on Bessemer steel; in Europe his reputation stood nearly, if not quite, as high. We all remember the prominent part he took in the Centennial Exhibition of 1876; his admirable reports on the iron and steel exhibits of that year, and which were followed by a long and masterly series of articles on the steel works of the United States—a series which unfortunately remained unfinished. Some of us have had the privilege of studying his annual and confidential reports on the steel manufacture of the world. The reports are marvels of technical skill and labor; they attest also the unlimited confidence which he commanded both at home and abroad; in the steel works of Europe as well as those of the United States. They were the result of periodical visits to England and the Continent, and were, during the last years of his life, prepared solely for the use of the Bessemer Association, with which he had entered into confidential relations. The gates of every steel works in Europe were open to him, and from him no manufacturers' secrets were withheld. It was quite a unique position which he then occupied, one for which his long training, high intelligence and perfect integrity absolutely fitted him. Manufacturers knew well that their secrets were safe in his hands; that if they gave him much, he brought still more to them; that his visits were always useful and suggestive, and that the exchange of American experiences for their own never left Holley their debtor. There was also another aspect to these annual visits. Time, hard work, and the cares of a busy life, had never withered the great charm of Holley's character, but, on the contrary, his personal influence and indefinable power of attraction had increased with years. He was loved as much as he was admired; he was as popular in France, in Germany and in Belgium, as he was in England or the United States.
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> The professional honors that were so fully his due fell thickly enough on him during the later years. He was elected president of your Institute of Mining Engineers in 1875; he was vice-president of your Society of Civil Engineers in 1876; he founded your Society of Mechanical Engineers, of which society you did me the high honor to elect me an honorary member; in 1877 he became a member of the Institution of Civil Engineers, a body which we in England are proud to regard as the parent of all the Anglo-Saxon engineering societies.
>
> Holley was proposed as a member of the Institution of Civil Engineers by the late Sir William Siemens, and was seconded by a long list of well known and famous men in the profession; they were F. J. Bramwell, E. A. Cowper, T. R. Crampton, James Ramsden, J. T. Smith, Alexander Brogden, B. Baker, John Hawkshaw, W. H. Barlow, Charles Hutton Gregory, Douglass Galton, I. Lowthian Bell.
>
> Holley was also a member of the Iron and Steel Institute of London In 1875 he was appointed a member of the United States Board for testing structural materials; in 1879 he became a lecturer on the metallurgy of iron and steel at Columbia College, and in 1878 he was given the degree of Doctor of Laws.
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> It was early in the summer of 1880 when Holley received the first warning that his career was drawing to a close. Twenty-five years of life at high pressure had told on his constitution, though his energy and magnificent mental powers remained unaffected.
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> It was my privilege to pass many hours by Holley's bedside during this long period of trial, and if my presence and his knowledge of the constant solicitude of his very numerous friends in London afforded him some consolation; his fortitude, his patience and his calm endurance not only called forth our constant admiration, but taught a lesson I can never forget; an example few of us can hope to follow. It was very long before the faintest ray of hope threw a gleam upon that sick bed; not until after he had been absolutely condemned by the highest medical opinion. I believe that nothing but his indomitable determination, which never flagged, saved his life. He had from the first a fixed resolution to live, and I think he never once lost confidence. Some of you at a later time saw a similar scene enacted, but then, alas! he was able only to keep death at arm's length for a few hours instead of repelling it altogether. It was during this period that I learned the inner aspect of Holley's character. It was no seamy side that was thus exposed to me; but, on the contrary, great and gentle virtues, combined with an absolute trust that all was well, which showed the noble gentleman and the true Christian. The closer death approached, the more resigned he grew. "So far as I am concerned," he would say, "it matters nothing; I have done my best with the powers that I possessed, not for money or ambition, but because I just had to do my best. And it is impossible for me to die for another 18 months; those I leave behind me must be provided for, and I can do that easily in a year and a half."

THE TRANS-ANDINE RAILROAD.

THE year 1892 will probably be signalized in South America by a most interesting event in civil engineering and in international overland commerce. This will be the completion and opening of the Trans-Andine Railroad, the first across the continent of South America. It is 19 years since this work was begun, and it is now confidently expected that it will be finished by the beginning of 1892. The road is to run from Buenos Ayres to Valparaiso, a distance of 871 miles. There are now 640 miles of it finished at the Buenos Ayres end and 82 at the Valparaiso end. Of the remaining 149 miles about one-third is practically complete and the rails laid. The passage of the Andes is accomplished at the Cumbre Pass, which is 13,045 feet above the sea level. The railroad, however, does not reach the summit of the pass, but pierces the mountains by means of a tunnel more than three miles long, at an elevation of 10,450 feet above the sea. The grades are, of course, very steep; for a considerable distance the rise is more than 422 feet to the mile, or one foot in every 12½. On this portion of the line a rack rail is employed similar to those on the Hartz and other mountain roads. One unfortunate feature of the road is the diversity of gauges adopted. The different sections of the road have been built by different companies, and each company has its own gauge.

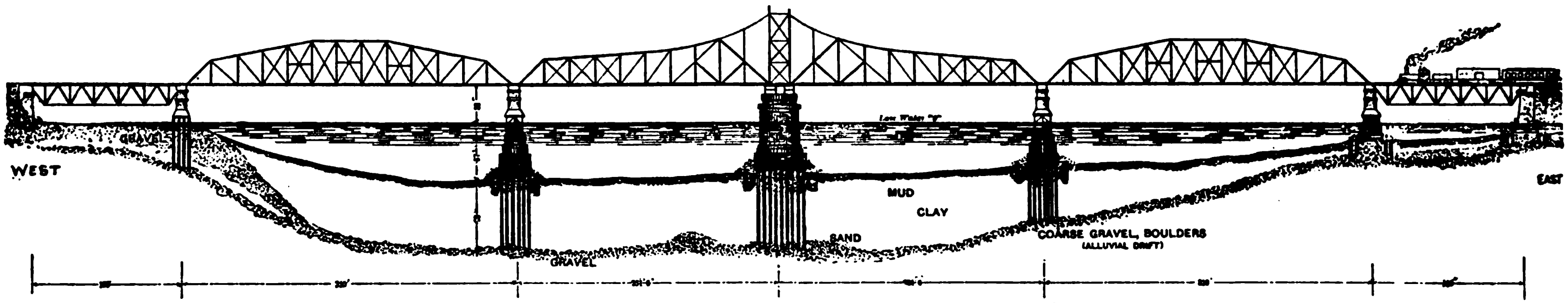
Architecture and Building, of October 4, 1890, is a special issue, devoted, in a great part, to the subject of modern school-house design. Besides a large amount of descriptive matter on the subject, there are 13 plates of illustrations showing various proposed and executed designs.

THE THAMES RIVER BRIDGE.

FROM the just-issued report of Alfred P. Boller, Chief Engineer of the Thames River Bridge, at New London, Conn., to J. W. Miller, General Manager of the New York, Providence and Boston Railroad, on the construction of the bridge and its approaches, we take the following particulars:

Ever since the establishment of the "Shore Line route" between New York and Boston, about 1860, the desire to replace the ferry over the Thames River, at New London, with a bridge has been ever present with the interested corporations forming the line. Thirty years ago, the then engineer of the "Stonington Road," Mr. A. M. Matthews, was engaged in making surveys for the purpose, and did locate a line of approach from the Stonington road to the most probable location of the bridge crossing, dictated by local and topographical considerations. The soundings made through the ice by Mr. Matthews, during the winter of 1859, disclosed such a depth of water and of mud before hard bottom was reached as to force the abandonment of the project, it being one beyond the engineering and financial resources of the day. Nothing further was done in the matter until the winter of 1882, when the great development of the Shore Line traffic impelled the group of roads forming the line to make another effort to attain the long desired bridge, which the marvelous development of modern engineering and the command of large financial resources made now a possible enterprise. Application was made, accordingly, to the General Assembly of the State of Connecticut, for authority to bridge the Thames River, and, on April 6, 1882, a bill was finally approved, "Authorizing the New York, Providence and Boston Railroad Company* to bridge the Thames River and extend its lines."

THAMES RIVER BRIDGE,
N. Y., PROV & BOSTON R. R. NEW LONDON, CONN.



The whole work, including right of way,* was estimated to cost one and a quarter million dollars, the plan of the bridge being for single track, and the approaches double track. All technical and legal questions being settled, the financial one alone remained for solution, and negotiations were commenced between the several interests involved for an apportionment of cost of building the bridge, and other matters incidental to a joint ownership of such a structure. Finally, through the exertion of Mr. George M. Miller, Vice-President of the New York, Providence and Boston Railroad Company, that corporation determined to shoulder the whole financial burden of building the bridge, and in February, 1888, notified Mr. Boller to at once prepare for the commencement of the work, and to make comparative estimates for both single and double track structures, as it was exceedingly desirable to avoid a break in the double track line. As the original estimate for a single track structure had been made on a most liberal basis, on higher market prices than now ruling, and as the substructure work and masonry only required a slight expansion to meet double track requirements, to say nothing of the advance in the art of bridge building and the use of steel, even in the short interval of four years, it was computed that a double track bridge could be covered very nearly, if not quite, by the original estimate. The plans and specifications were modified accordingly, and invitations to tender for the whole work on a unit basis were issued to a selected few of the bridge building firms of the country. After a careful canvas of the bids submitted, the work was awarded to the Union Bridge Company, of New York, under a contract dated April 6, 1888.

During the succeeding summer, a relocation of the approaches was made, purchases of right of way vigorously prosecuted, and the whole work put under contract in the early fall, the company reserving to themselves the ballast-ing and track laying.

GENERAL DESCRIPTION.

The Thames River is properly an arm of Long Island Sound, extending some fourteen miles inland up to the city of Norwich, at which point empty into it the Shetucket and Yantic Rivers, draining steep and precipitous water-sheds, as does the Thames River itself, on either side, to within a short distance of its mouth. The Thames is a broad stream, with irregular shore lines for about one-third of its length from its mouth, whence it rapidly contracts to its head at Norwich. Winthrop's Point juts out into the river about three miles from the Sound, contracting the stream to a width of about 1,500 feet, and affording an upper and lower harbor, in either one of which the deepest draught vessels can anchor. The current is purely a tidal one, save when increased at the surface during spring freshets, or seasons of heavy rainfall, when the tributary streams are running abnormally full.

The rise and fall of the tide between mean high and low-water mark is $3\frac{1}{10}$ feet, with an extreme of about 6 feet at spring and neap tides. The bottom of the river is that characteristic of a tidal estuary, commencing with mud, stiffening through various degrees of consistency into clays, clay and fine sand mixed, clay, sand and shelly fragments, into pure sand, thence into gravel, increasing in coarseness until the boulders of the alluvial drift are reached, or ledges of the underlying rock, hard bottom in consequence being very irregular.

These borings and soundings were performed by Messrs. Spielman & Brush, civil engineers, of Hoboken, N. J., and were made on the driven well principle of forcing a jet of water down a small pipe within a pipe of larger bore, the jet returning upward in the annular space between the pipes, carrying with it the material penetrated, which may be caught in vessels for examination and record. The pipes used were of ¾ and 2 inches bore for the inner and outer pipes respectively. This method, while a dangerous one to draw deductions from under many circumstances, where fine material may be washed up with no suggestion of a coarser one through which the tube might be passing, and by the washed-up samples being of an entirely different consistency from the material in *place*, still, in cases of this kind, the method serves an admirable purpose, since the geological character of the crossing could be determined from the surrounding country and from the well-known laws that govern deposits in streams. The extent of the deposits could be accurately determined, while their consistency could be judged in the light of the geological facts, and driving of test piles. The method is a rapid one, the deepest borings not requiring over a day, while from two to five borings were made where shallower. When the work was actually commenced, the upper mud proved to have much greater consistency than the borings indicated. It is of a peculiarly tenacious character, and stood readily on a slope of one to one, when dredged out for settling the cribs.

Teredo and Limnoria.—The operations of these destructive creatures are most entirely confined to the lower harbor, and even there they are only moderately active. In the waters in and around New York, creosote has proved a perfect barrier against them. But it is essential that the creosoting should be properly done, and preferably a product of coal tar, there being a considerable difference of opinion about the efficacy of that obtained from wood distillation. The creosoted material used in the Thames River Bridge is impregnated with fourteen pounds of the oil to the cubic foot, under a pressure of 150 pounds per square inch, after the timber had been heated up to 250° Fahr. in a vacuum of 26 inches.

Location of Piers.—Less than three deep-water piers were unavoidable, involving at best long spans which would be in harmony also with probable government requirements. The arrangement of piers adopted provides for a Draw span 503 feet long, flanked on either side by a span of 310 feet and 150 feet, respectively, center measurements.

Foundations.—The financial limits, within which the enterprise would be a feasible one, made the study of the piers and their founding of the leading importance, involving questions of the gravest consideration. The stability and permanence of foundations in water are of the first importance, involving the placing of materials at great disadvantage as compared with work on land, and in them a close economy cannot prevail. The west abutment foundation and that for Pier I. are simple in their character, requiring no special comment. In building the foundation for Pier V. and the east abutment the soft material was dredged to hard bottom (boulders and gravel), solid double walled square timber curbs were sunk surrounding the foundation area, which was filled in with concrete, lowered in wedged-shaped buckets of a cubic yard capacity, placed and leveled by means of a diver. The submarine concreting was carried up to the level of the original river botton, and surfaced off for the reception of the masonry platform. This concrete was made extra rich, two and one-half barrels of Portland cement to the yard of gravel being used, instead of two barrels, as provided for in open air concreting. The borings had only reached rock or boulders, under Piers II. and IV., and then at depths of 130 feet, and 100 to 120 feet respectfully, below datum (mean low water), with deposits of from 60 to 75 feet overlying the rock. At Pier III., the borings were carried to gravel and boulders, without reaching any suggestion of ledge rock, and the different borings taken were of very irregular depth. To reach the hard bottom, as the borings disclosed, by any of the pneumatic methods (excepting possibly at Pier IV.), was out of the question. Human labor could not be carried on under the enormous pressures involved, to say nothing of the prodigious cost if practicable. To reach hard bottom through an open caisson either of metal or timber, sunk by means of internal dredging and weighting, and filling up the voids created with concrete deposited through the water was prohibited through the cost, if indeed there were not grave questions as to the integrity of the concrete so deposited, and the great difficulty, if not impossibility, of dredging to a satisfactory bottom, particularly at Pier III., where the boulders were very irregular. To have stopped short of the gravel, boulders or rock, would involve a foundation on clay, which was not considered prudent. The use of isolated cylinders was considered and abandoned, if for no other reason than the great unbraced depth there would be from low water, to where they would be firmly held in the river bottom, some 70 to 80 feet. The only remaining method of founding which could be considered, and which was adopted, was that of a pile foundation, on which the masonry should be sunk in open caissons, which, owing to the unprecedented depth of water and material, involved novel methods of procedure. The piles must be driven from 100 to 130 feet below water—they must be driven true and straight; and cut off horizontally from 45 to 60 feet below water. They must be grouped in such a mass as to act as unit, and well collared at their upper ends, through the upper stratum of the mud, too soft for lateral support. They must be protected against the possibility of attack by marine worms. It was deemed judicious to adopt ten tons as the extreme loading on the piles, and to drive them with 4,000-pound hammer, with a short fall and rapid blows. The plan contemplated the sinking of a massive square-timbered, double wall curb, some 18 to 20 feet below the bed of the river, and surrounding the piled area, the mud within the curb being dredged out, and replaced with sand filling after the piles were driven. Such a filling thrown in loosely from above, would run in and fill every crevice and void among the piles, and embraced by the crib. The compacting of the bottom by closely driven piles, and the frictional support the piles afford to the narrow columns of sand, will, it is believed, prevent any substantial subsidence of the sand through the stiff mud and clay on which it rests. It was the original intention, when this plan was first thought out and adopted, to handle the work from a subsidiary staging, surrounding the foundation area on three sides, and by means of overhead trusses, to control the various operations of dredging, sinking the curbs, etc. But as that was a great expense, it was concluded, upon the revival of the enterprise, to abandon such temporary aids and save the cost towards the double track structure now desired, and boldly perform the work in the open river, with such aids as the permanent guard fenders would afford. In settling the curbs, it was first thought practicable to weight them down into place by dredging the material from within, but after testing the question on the curb for the east abutment, that method of procedure was abandoned, as the mud proved more tenacious, and had greater supporting power than the original borings indicated—and to have carried out the above plan would have involved extensive ballast pockets being built up on top of the curbs.

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*The Boston and Providence Railroad was completed to Providence in 1852. The Stonington Line to New London in 1858. The Shore Line, from New Haven to New London, was opened in 1852.

The dredging was therefore performed as an independent preliminary operation, with a clam-shell dredge, and carried down 18 to 23 feet below the river bottom, the material standing on a slope of one to one—being below datum (mean low water), 77 feet at Pier II., 68 feet at Pier III., and 58 feet at Pier IV.

The curbs are framed from 12x12 hemlock timber, thoroughly drift-bolted together, and consist of a double-walled rectangular frame work surrounding an open area to contain the piling. These walls are 8 feet apart, and form, with a uniting bottom, a ballast chamber for sinking. This bottom flares downward from the inner to the outer wall, the voids between the timbers being well packed in with gravel and stone chips to solidify the mass and gain sinking weight. The outer walls are 23 feet deep, while the inner walls finish off on top, 4 feet less. The curbs are strengthened and stayed by transverse partition walls, forming interior cells, in which the piling is driven. The curb for Pier III. is 71 feet square, with 16 interior cells 12 feet square, while the curbs for Piers II. and IV. are 50x80 exterior dimensions, with 8 cells 15 feet square.

As these curbs would finish at or below the river bottom, for the convenience of their handling and control, as a guide for the piling operations and regulation of the masonry caissons, a stout and well-braced temporary framework was carried up from the partition points of the inner and outer walls, to finish about one foot above high water, when the curbs were settled in place. One side of this framework was kept down sufficiently low to take the draught of the masonry caissons. Some little anxiety was had regarding the control of these curbs during sinking, as to place and level, since the leeway or clearance for the succeeding work was not over 3 feet in any direction, and a comparatively small difference of level at the bottom would have a very marked effect upon the verticality of such a great depth of framework at the surface of the water. This sinking was performed, however, with great success, with the aid of the pile-driving machines and falls attached to the fenders, occupying but a few hours for either curb. So soon as the curbs were settled in place, the pockets were filled with ballast sufficiently to hold them against any possible displacement, and so distributed as to correct irregularities of level as much as possible.

Piling.—The piles used were Michigan white pine and Southern yellow pine, as straight as it was possible to get them, and from 85 to 95 feet long. They held their size remarkably well, few measuring less than 9 inches at the point, and were 15 to 20 inches when cut off. The pile-driving scow used was 23 feet by 48 feet, with 70 feet leaders, and a 4,000-pound hammer run by a double drum Mundy 30 horse-power engine, with 10x16 cylinders. The first curb ready to receive the piling was that for Pier III. (center pier), in which piling was commenced August 27. This curb was to contain 640 piles, or 40 piles to a cell. Long as the piles were, when driven they would be from 30 to 40 feet below water, which involved the use of some kind of follower arrangement.

After several trials with ordinary socket connections between follower and pile, it was found impossible to keep from smashing the sockets, and before resorting to a more complicated system of following, a trial was made with a simple ringed oak follower, 10 inches square, with a 2-inch dowel in the end. This method proved so successful that it was adopted and carried out through the rest of the work. It was found that by carefully steadying the machine, holding the follower firm in the leaders and keeping it plumb, the descent of the pile was conveniently controlled under the *short*, quick blows of the hammer. The method adopted for the above foundation was to plant all the piles (excepting in one cell, left for introducing the saw), and then drive them to bearing. There was just hold enough in the bottom to support the piles, leaving their heads above, or even with, the water. The planting and driving of these piles occupied about 20 days, barring one cell of 40 piles, which had to await the cutting off of the piles driven, after which this vacant cell was filled and cut.

As no sawing was ever performed in such deep water (from 47 to 51 feet according to stage of tide), the commencement of that operation was awaited with no little anxiety, not only as to the operation itself, but also maintaining a reasonable level plane of cut off, under the swells produced by tide and wind, at times quite heavy. The vertical saw shaft of 3-inch steel, was solidly backed by two 14x14 yellow pine timbers, well bolted together, to within 8 feet of the saw. This back-bearing timber was slung in the leaders of the pile-driver and hoisted up and down, according to the stage of the tide. The saws were 50 inches in diameter, three-eighths of an inch thick, with the usual teeth.

The driving pulley attached to upper end of shaft was 15 inches in diameter, and was driven direct from a 48-inch pulley on the engine shaft through a 10-inch belt. The shaft was run at a speed of about 400 revolutions. It was soon demonstrated that there would be no difficulty cutting off the piles, but it was also demonstrated that hunting up the piles to cut, with no visible guide to locate them, was quite a different matter. The saw would get started into two or more at a time, and the shaft would jam against the upper part of the pile. Backing out was not always an easy thing to do among piles so thickly driven, and the breaking of saws was becoming a serious annoyance. Resort was had to divers, two being constantly at work in alternate shifts. Their mission was to go down and locate the piles in reference to position of saw, attach a line to each pile that was to be sawed, come up and report direction in which to move the machine. After a little experience, piles began to come up with a reasonable speed, as high as 34 being cut off in one day (which was the exception), some days none, when the saw would get jammed, with resulting trouble and delay. Keeping the cut-off level was an exceedingly troublesome matter—there was no way of sighting from shore, the distance was too great, besides the shifting of the machine in every direction would be continually cutting off the view of the shaft. A level board was therefore attached to one side of the temporary framework that had been carried up from the curbs, with a mate on the opposite side, across which the ring on the shaft was sighted. By this method the piles were eventually cut off. As many of the yellow pine pile tops sank when cut, it was difficult to tell whether any had been missed, and the machine was passed back and forth in two directions, at right angles, shifting two feet each time.

The experience gained in the piling for foundation of Pier III. suggested certain modifications of procedure for Piers II. and IV., the building of their curbs, and their placing, being carried on during the piling operations at Pier III. Each of these piers were to have 368 piles, those for Pier II. being cut off 60 feet below high tide, and those for Pier IV. 43 feet below. This last pier followed the center pier, and instead of filling all the cells before cutting, the piles were planted and driven in rows lengthwise with the curb, commencing at one side, each row being cut off as soon as driven before another row was started. To each pile was attached a line, which was fastened to a guide timber stretching from end to end of the curb and resting on the framework. This timber was shifted as each successive row was completed. It was found that by starting the saw at one end of the row and following the line as indicated by the attached cords, the work could be rapidly and continuously performed without the aid of divers, and none were again employed throughout the remainder of the piling. The leveling was sighted from carefully placed sight-boards fastened to the fenders outside the curb at either end, having a long slit one-eighth of an inch in width. The observer, standing on the fenders, could comfortably and with great accuracy keep the elevation ring on the saw shaft always in exact line, as was proved by the perfect level to which the masonry platforms settled for these two piers. The sawing off the piles at 60 feet was as readily performed as at 43 feet.

Sand Filling.—As the foundation piles for each pier were finished, the whole interior of the curbs and ballast chambers were filled with bank sand in which more or less gravel was intermixed. This filling was at first spouted in through 9-inch tubes reaching nearly to river bottom, but they were soon abandoned for the more expeditious method of shoveling the sand overboard, the current being too sluggish to carry it off from where it belonged, care being exercised to unload at either end, as the tide ebbed or flowed. After the above interior filling, the space between the dredged excavation and the sides of the curb were likewise filled, partly with sand and partly with material dumped from scows brought down from the upper river, where the channel was being deepened by the Government. After the piers were built, this sand filling was carried five to ten feet up the sides of the masonry platforms, covering the outer walls of the curbs, and which the current is too feeble to scour or displace.

The Caissons.—During the progress of the foundation work the caissons were being prepared. The caissons for Pier III. were 50 feet square and 50 feet deep, while for Piers II. and IV. they were 30x60 feet square, and 59 feet and 45 feet deep, respectively. The depth of the platforms or bottoms of the boxes were regulated by the maximum it was deemed desirable to load the piles—viz., ten tons each, and by the practicable height of sides over which to hoist the heavy ashlar stones, many of four and five tons weight, which was fixed at 35 feet. Even with this height of sides it was found convenient to have a door in the upper portion of one of the sides for about one-third of its descent. It would be a great convenience to build the sides of such deep caissons in two stories, erecting the second after the first had been sunk to within five or more feet of the top. These platforms were composed of 12-inch square hemlock timbers, laid in transverse courses. They were started on launching ways, until four courses were put together, when they were launched and finished afloat. The courses were securely drift-bolted together with ⅞ square by 20-inch bolts, particularly around the sides, for four courses in, where every timber was bolted to each alternate under timber. The final course of the platform, on which the masonry was to be started, consisted of a 6-inch calking deck of creosoted Carolina pine, very thoroughly spiked with 12x⅝-inch spikes, special care being given to the portion extending beyond the masonry. This deck was laid in Portland cement mortar, spread over the preceding course, which, in turn, was well calked with cotton yarn, which swells when wet. The finishing deck was calked with oakum. The squared-up ends and sides of the platform were cased in with two courses of 2 inch creosoted plank, breaking joint with each other, and secured in place with 6x⅜-inch ship metal spikes.

The caisson sides were very stoutly built, as they might be subject to very rough handling during process of sinking. All these caissons proved exceedingly tight, only a little leakage taking place through an occasional sun crack in the siding or a loose knot.

The class of masonry adopted is quarry faced Ashlar in 2-feet courses for all face work, the hearting being concrete well rammed in place, except for the abutments, where rough backing was used, with concrete rammed in all voids. The concrete was made from coarse beach pebbles, beach sand, with Burram Portland cement below water, and improved Union cement above. Two barrels of cement and six barrels of sand being used for each yard of gravel, with an additional half barrel of cement for concrete deposited under water. Mixtures were made in 2-yard batches, gauged by a frame on deck of the concrete scow, all mixing being performed by hand. The moisture was regulated with careful supervision, and applied by sprinkling pots so that the mortar should be thoroughly damp without being wet. The pebbles were all wetted before applying the sand and cement previously mixed dry. The weight of the concrete so made was 135 pounds per cubic foot, and the solid piers averaged below water 150 pounds per cubic foot, deduced from the flotation of the caissons.

SUPERSTRUCTURE.

The superstructure, built for double tracks, is of the American type pin connection work, intended to cover the best results of modern practice, built wholly of steel, excepting lateral rods and a few minor parts, which are of wrought iron. It consists of two deck spans of 150 feet, and two fixed spans of 310 feet, symmetrically disposed on either side of the great swing draw span of 503 feet in length, forming the central feature of the work. The deck spans of three trusses, 20 feet deep and 9 feet centers (so spaced that the tracks on 12 feet centers will bring an equal load on each truss), are designed on the triangular system. The through fixed spans consist of two trusses on the Whipple system, 28 feet 4 inches centers. The swing span, with the same depth of truss at the ends as the adjacent fixed spans, slopes upwards towards the center where it attains a height of 71 feet, two-fifths the slope on either side of center being in a parabolic curve, the balance being a straight incline. The loads for which all the spans were proportioned, in addition to their own weight, consisted for each track of two consolidated engines with tenders covering a space of 103 feet, and weighing 171 tons, followed by train assumed to weigh 3,000 pounds per foot.

The steam power of the draw span consists of a pair of oscillating cylinders, 10 inches in diameter, with 7-inch stroke, setting at an angle of 120 degrees and working upon one crank shaft, running at a maximum velocity of 200 revolutions (averaging about 170), applying the power through two Frisbie friction clutches, the one driving the unlocking shaft, the other the turning shaft. The turning shaft, of $4\frac{7}{16}$ inches diameter, runs at a speed of nine turns per minute, gearing direct through a pair of beveled gears into the vertical drum shafts. The unlocking and rail lifting shaft is three inches in diameter, speeding 60 revolutions per minute, and gears by transverse shafting at the bridge ends into the pedestal feet, screwing up and down in the hub of a beveled gear wheel, forming a fixed nut. The minimum time of operating the draw is fifteen seconds for lifting rails and raising end screws, and two and a half minutes to open, which is varied at will of operator, more time being consumed in starting and slowing up in high winds.

The signaling mechanism of the bridge, devised by the Union Switch and Signal Company, is governed from a cabin erected in the bridge tower, and is an interlocking system, with electric safeguards which prevent the movement of the switches or signals after a train has entered the section protected.

The steel used is low grade or soft steel, that is, a metal not running over 65,000 to 68,000 pounds per square inch breaking strength. In the draw span the Bessemer was confined to the vertical and inclined posts at center and center section of bottom chord. Open hearth steel was preferred on account of the process insuring a uniform product and the control of its composition.

Protection fenders are built around Piers II., III. and IV., with flaring wings and pointed ends. Those for the rest piers are 180 feet long, while that for the draw pier is 570 feet long. They consist of a system of piling and framework of yellow pine timber, sheeted vertically with 4 and 6 inch plank, corners being protected with boiler-plate armatures.

The disbursements made in execution of this work, up to subgrade and laying of track, when the work was handed over to the regular organization of the company, amounted to $1,293,939.90.

On the completion of the bridge, the following test was made under the direction of Mr. E. P. Dawley, Chief Engineer of the N. Y. P. & B. R. R., which, although below the basis of the design, employed all the available engines that could be spared for the purpose. Two trains were made up on the east side of the river and driven over the structure side by side. That on the west-bound track was composed of three engines in a space of 150 feet, and weighing 235 tons, followed by 155 feet of loaded passenger cars, weighing 59½ tons, or a total of 294½ tons in 305 feet. That on the east-bound track was composed of three engines, weighing 221 tons in 160 feet, followed by 330 feet of passenger cars, weighing 139 tons, or a total of 360 tons in 490 feet—of the passenger car load 150 feet weighed 59½ tons, or same as on west-bound track. For both tracks, the total load with 150 feet of cars, was therefore 575 tons, in a space covering a 310-feet span—the engines on the two tracks being *vis-à-vis* with each other, as near as practicable. The greatest deflections recorded were as follows:

	N. Truss.	S. Truss.	
Easterly 310′ span.....	2⅜"	2¼"	Recovery perfect.
East arm draw, 240′ ..	1⅝"	2¼"	" "
West arm draw, 240′...	1¼"	1⅜"	Recovery perfect. less ⅛" for S. Truss.
Westerly 310′ span....	2⅜"	2¼"	Recovery perfect, less ⅛" for N. Truss.

The easterly 148-foot deck span deflected $\frac{11}{16}$ inch and the westerly deck span 1 inch.

The maximum raise of unloaded draw arm was 2½ inches—the opposite arm being loaded with six engines, with about 90 feet of cars. The 160-feet two truss through span on the west approach over the New London northern tracks—deflected 1⅛ inches for north truss, and 1 inch for south truss, with complete recovery, lacking $\frac{1}{16}$ inch for north truss.

The bridge was open to travel, with imposing ceremonies, on October 10, 1889, 16 months after the commencement of the work.

TESTS OF WATER AND OTHER PIPES.

IN discussing a paper by Mr. T. W. Yardley, on "Specifications for Cast Iron, Coated Water Pipe," read several months ago, before the American Institute of Mining Engineers, and presented also at the Chicago meeting, last May, of the American Water-Works Association,* Mr. James C. Bayles said:

"I should in every case demand that the pipe be tested before it is coated. This is especially true of cast iron. Any form of coating suitable for a pipe which is to be shipped and handled will conceal a multitude of small defects in casting, such as blow holes, sand holes, and even small shrinkage cracks. In 1887 the Commissioners of the Health Department of New York City found it necessary, in the discharge of their responsibilities relative to the plumbing of new buildings, to amend the plumbing code by the insertion of a clause forbidding the use of dipped, varnished or painted pipes. The reason for this action was the discovery that even a thin coating, of very little value as a protection for the iron, could be made to conceal so many foundry defects, and permitted so much carelessness on the part of makers, that sound pipes were the exception rather than the rule. The value of such a coating in enabling pipes to pass a test is shown in much of the light riveted pipe in the market. I have seen a pipe put together with small, cold rivets, headed by pressure, which, after coating with coal tar and asphalt, has shown in the testing machine a capacity to carry without leaks a test pressure much higher than Mr. Yardley prescribes for the strongest and heaviest cast-iron pipes he mentions † Before coating, the seam would have shown a continuous leak from end to end. The fact that a coated pipe will hold water under a considerable pressure in the testing machine seems to me to speak more for the coating than for the pipe. A cork inserted in the end of a gun barrel will usually be found in place when the explosion of the charge has burst the barrel. Experiments show that a plug of mud, or even of snow, will do the same. As a manufacturer of pipes, I should be very much pleased to have consumers specify that none should be tested until they had been coated. We should have very few wasted. For cast-iron pipes the test pressures prescribed by Mr. Yardley seem to me much higher than is necessary. The calked joint is not adapted for high pressures, and cast-iron pipe is seldom employed under pressure greater than a lead calking will stand. It is not unusual in water-works practice for the lead to blow out of pipe joints at pressures much below those which the pipe will carry safely and comfortably. This is especially true if opportunity is offered for such changes of temperature as will produce a measurable contraction and expansion with the changes of the seasons. The strength of the pipe cannot be greater than the strength of its joints, and with the hub and spigot connection the usefulness of cast-iron pipes as a pressure conduit has well defined limitations. In buying it for any purpose for which that kind of pipe is adapted, I should be content with half the test pressures prescribed by Mr. Yardley, but should insist on having the test made before the pipe was dipped — and, for that matter, I should require a very much better coating, after testing, than a coal pitch varnish applied at 300° Fahr."

Replying to the above, Mr. Yardley said:

"Cast-iron pipes for water-works were first used by the New River Water-Works Company, of London, England, in the year 1810. In 1822 the greatly increased demand for water made it necessary for the company to enlarge the mains. In taking up some of the pipe laid in 1810, many were found rusted so much that they were unfit for future use. This fact coming to the notice of Dr. Angus Smith, he commenced a series of experiments in the preparation of a coating of varnish to be applied to the inner and outer surfaces of pipe to be used for carrying water. His experiments demonstrated the fact that his varnish would not stop the rust when it had once commenced, notwithstanding the rust was covered by the varnish. It was then he adopted the system of coating pipe as soon after cleaning as was practicable, and requiring the pipe to be heated to 300° Fahr. before immersing it in the bath.

"In 1858, some of the pipe being taken from the trenches in which they had been underground for 30 years, the varnish was found hard and bright, and the pipes that were broken gave no sign of rust. So satisfactory was this result that the English Government gave a patent therefor to Angus Smith, and his process has since been used by all makers of cast-iron pipe for water-works. In making my specifications I have followed what I believe to be the recognized practice of the best hydraulic engineers of this country, and I know I have the indorsement of many. I was not aware until Mr. Bayles made the statement that tar coating possessed so much strength. If he is correct, would it not be more economical for water-works companies to have the iron shell of the pipe much thinner than now used and give the pipe greater thickness of tar? In regard to the hydraulic test, I have the best authority for the pressure required for all pipe above 16 inches diameter. The increased pressure is specified for the smaller diameters, because the water test is the only one used. It would be very inconvenient, as well as quite expensive, for the makers if they were required to take test bars for so great a number of pipes as the foundry could turn out daily of the smaller size."

THE WATER SUPPLY OF PALERMO, SICILY.

THE sources of the water supply of Palermo, Sicily, and the methods of water distribution are described in a report of the British Consul at that city.

It appears that the deficiency of the supply, especially in summer, has long been one of the great grievances of the Palermo householders. The supply at present is meted out in *penne*—that is, "quills"—of water, a *penna* being a continuous supply of as much water as will run through a pipe of the size of a goose quill. There are houses of three stories in Palermo, inhabited by three or four families, which have no more than a supply of one *penna* of water per day, and even this at times is intermittent, for the men who have the care of the water pipes contrive, when water is required irrigating orange and lemon trees and melons to divert, for a consideration, the water from its proper destination.

The water with which Palermo is mainly supplied comes from the hills near Montreale. The distributing system is very curious and is said to come down from the days of the Arabs. Visitors making excursions in the environs are often puzzled by the appearance along the roads of strange structures in the form of lofty, truncated obelisks. These are called water towers, and some of them are very ancient, built of stone and overgrown with ivy. There is usually an iron ladder reaching half way down, by which the watermen, who carry ladders to be joined to them, can get to the tops. On the top of each tower is a small reservoir into which the water rises, due to its head. From the reservoir the water is distributed in pipes to the neighborhood.

In view of the scarcity of the supply the formation of an Anglo-Palermian company to bring water from a copious source at Scillato, about 20 miles off, has been greeted with much satisfaction.

IRRIGATING DUTY OF WATER.

FROM a paper read before the Denver Society of Engineers, by Mr. G. C. Anderson, it would appear that the irrigating duty of water varies considerably. In Spain the duty is 35 acres per cubic foot per second in Valentia, for rice cultivation, or 101 acres per cubic foot per second for general crops. In Granada it was 286 acres per cubic foot per second. In Elche and Lorca the duties reach as much as 1,072 and 2,200 acres per cubic foot per second. In India a duty of 240 acres was obtained on the Ganges Canal, whilst one of 250 acres has been reached on the Eastern Jumna Canal. In the older canals of California a duty of 555 acres has been reached, but this has now been increased to at least 1,000 acres.

THE new Pennsylvania Railroad passenger station at Jersey City, N. J., will have an iron arched roof like the Grand Central station at New York, but larger. It will be 256 feet wide along the water front, and 600 feet long. This is exclusive of the waiting-room and ferry accommodations.

A 300-FOOT span suspension bridge at San Bernandino, Cal., gave way about two weeks ago, on the application of a test load. The bridge had been pronounced unsafe by several engineers.

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[*] See THE ENGINEERING AND BUILDING RECORD, July 19, 1890.

[†] Mr. Yardley prescribed from 450 pounds hydrostatic pressure per square inch for 6 and 8-inch pipe, to 250 pounds pressure for 36-inch pipe, and upwards.

THE NEW LONDON, CONN., WATER-WORKS HIGH SERVICE.

THE original water supply of New London, Conn., was by a gravity system. Recently a portion of the water from these low pressure mains has been diverted to a high service system, in which the water is elevated to a tank, and thence supplied to the distribution mains at a pressure about 15 pounds greater than that of the gravity mains.

The delivery of water through the gravity main is made to operate a motor, driving a pump that fills the high service tank. In case of insufficient supply from the high service system, water is admitted through a 12-inch check-valve from the low pressure system.

Figure 1 is a perspective of the motor and pump; Fig. 2 is a plan of the same; Fig. 3 is a vertical elevation corresponding to Fig. 2, and Fig. 4 is a horizontal section through the motor.

The motor A is situated on the line of the 20 inch supply main and about 500 feet from the tower. It consists of a cast-iron cylinder C, 36 inches in diameter and 8 feet long, set at right angles to the line of the main, containing a hollow, air-tight, steel plunger, 24 inches in diameter and 54 inches long, which makes a 36-inch stroke.

On each side of the cylinder are two 24-inch butterfly valves E E, etc., which are connected by means of reducing Y's and 20-inch bends with upright 20-inch Y branches set in the supply main. The pump F is situated at the end of the main cylinder, the pump plunger being on the same rod as the motor plunger D. The stems H H, etc., of the butterfly valves run up through the casing and are connected by means of arms I I, etc., and rods J J, etc., with a wrist plate K on the center of the motor cylinder.

On top of the main cylinder is an auxiliary cylinder L, 6 inches in diameter, taking water through a cylindrical slide valve. On the piston rod M of the auxiliary cylinder is a piston working in an air cylinder N, 10 inches in diameter, which acts as a cushion for the valves. This piston rod is connected with the wrist plate above mentioned. The auxiliary cylinder is actuated by water passing from the low-service main and exhausting into the air, or may, when the tank is full, take water from the high-service pipe and exhaust into the low-service mains. In the first instance the amount of water wasted is 1⅛ gallons per stroke; in the latter case no water is wasted.

The supply main runs under the motor making a by-pass. In the by-pass is a 20-inch check valve which closes by means of a lever, which is weighted so as to offer a resistance of about five pounds per square inch.

The pump is the usual horizontal plunger pattern, with rubber disk valves and air chamber. The pump plunger makes the same stroke as the motor plunger, and is 8 inches in diameter.

The action of the motor is as follows: The water passing to the low-service district is deflected by means of the check valve into the motor, passing through one of the butterfly valves, one on each side being open. The water drives the motor plunger over, which, when near the end of the stroke, moves a tappet, which latter reverses the valve on the auxiliary cylinder. The action of the auxiliary piston reverses the butterfly valves, opening two and shutting two, by this means deflecting the water to the other side of the motor plunger, which reverses the above operation; the water, after driving over the plunger, passing on to be used in the low-service district.

The wearing surfaces of the butterfly valves and the connecting rods are of phosphor bronze, and all parts of the machine are made of the strongest and most durable material. Provision is made for substituting larger motor or pump plungers, if desirable, at small cost, without other changes in the machine, and two-geared 20-inch gates are set to shut the motor out of the system. The present pump delivers 7¾ gallons per stroke, against a pressure of 15 to 20 pounds per square inch, with a loss of from two to three pounds per square inch on the low-service, depending on the velocity.

The motor was built by W. H. Lang, Goodhue & Co., of Burlington, Vt., from designs by W. H. Lang, of that city.

The motor is covered by a brick building 24x38 feet inside. The wall from the floor to the level of the ground, a distance of 5 feet, is 20 inches thick, of heavy stone masonry. This wall is capped by a granite water table on which rests the brick walls, 14 inches thick, including a 2-inch air space. The brick walls terminate 11 feet above

New London Water Works High Service

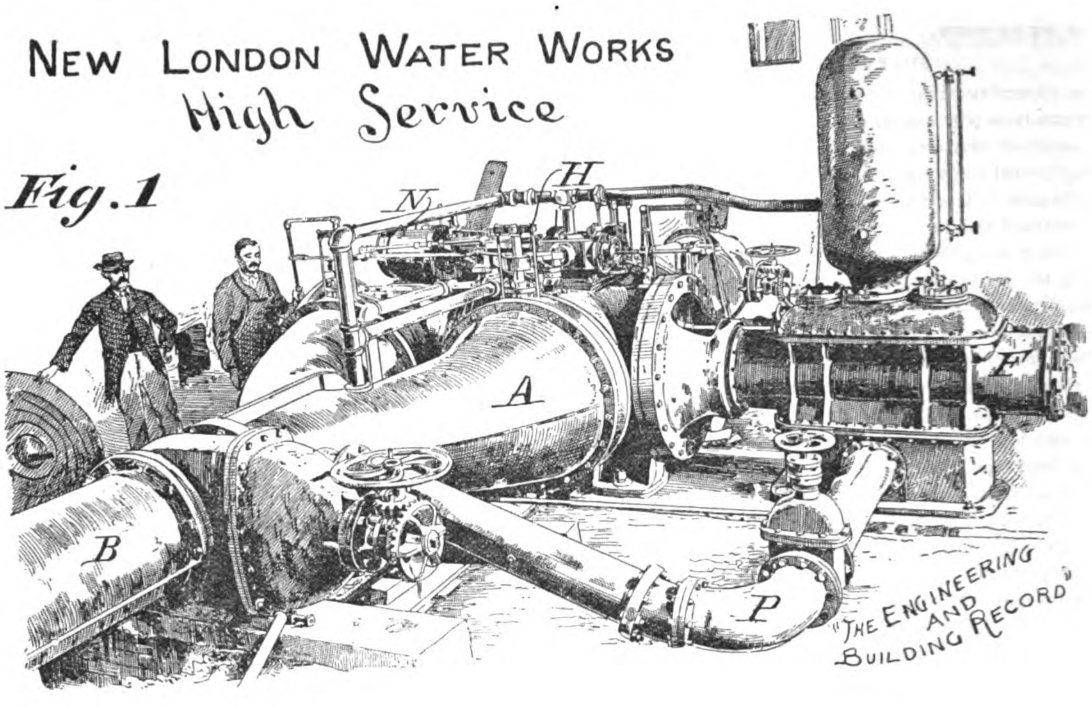


Fig. 1

N
H
A
F
B
P
"The Engineering and Building Record"

The New London Water Works High Service.

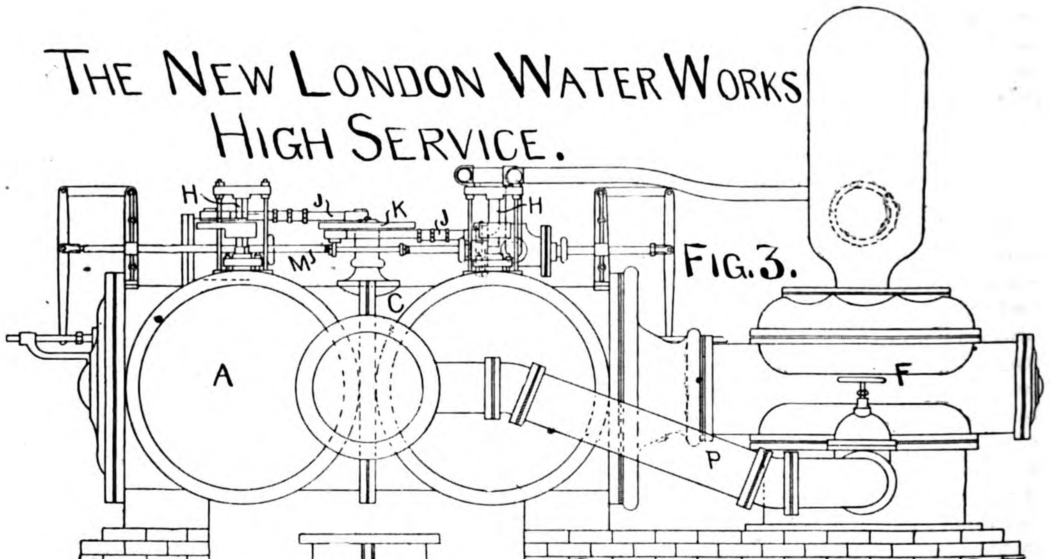


Fig. 3.

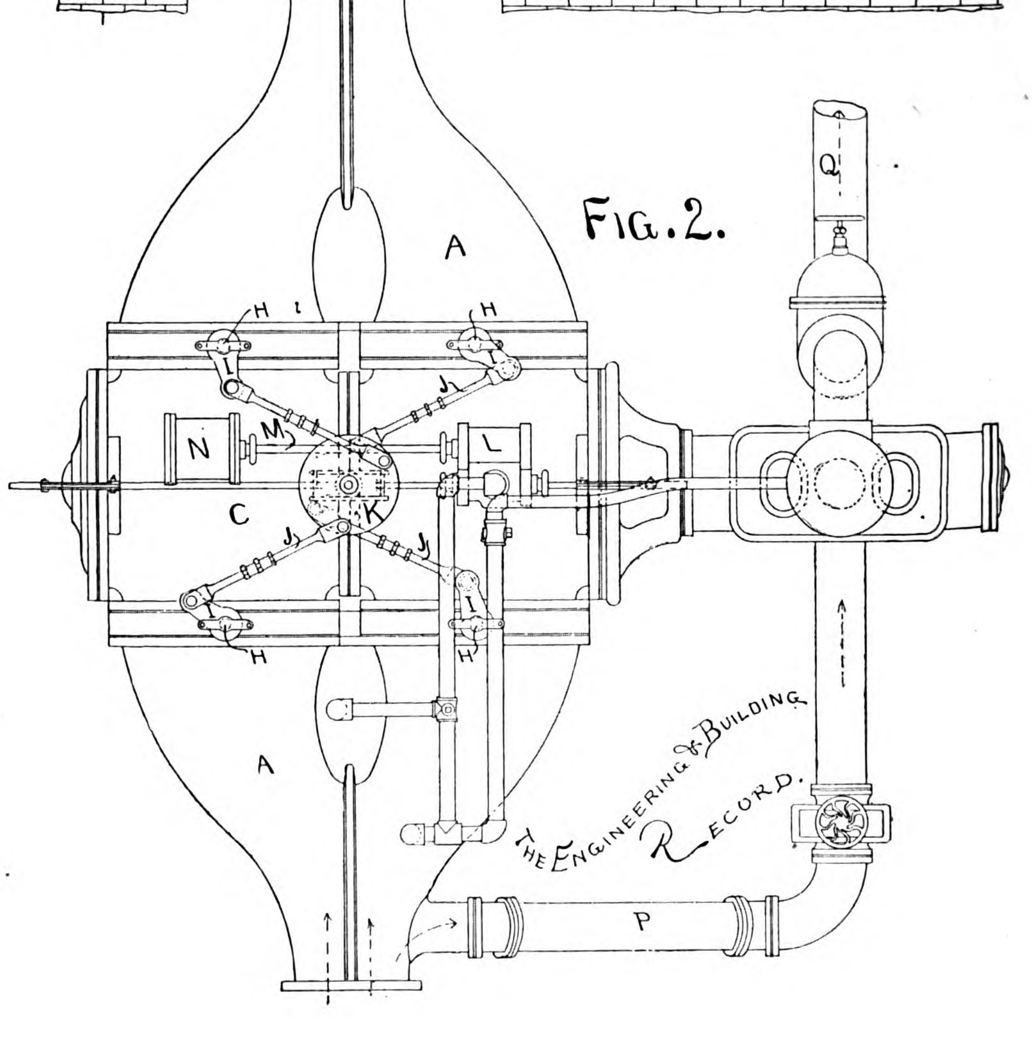


Fig. 2.

the ground, and are surmounted with a trussed roof, covered with slate. The windows are furnished with double sashes, and the doors are of 2-inch cypress. The whole is especially designed to exclude the cold and prevent freezing.

The foundation for the motor house, and also for the tower was built by George Prest; the brickwork by C. P Smith & Co., and the woodwork by A. O. Goddard, of New London. The grading, pipe connections, and concrete floor was done by day work by regular employees of the water works department.

The tower, which is situated on a hill about 120 feet above mean high tide, rests upon four heavy granite masonry piers laid up in cement mortar. These piers are surmounted by pillar blocks of cut stone, 10 inches thick. The piers rest on a clayey hard-pan formation. Two 1½-inch bolts run from the bottom to the top stone, and the iron bed plates are secured to the pillar blocks by four 1-inch bolts running through this stone, the whole structure being thus fastened together.

The tower (Fig. 5) consists of four wrought-iron lattice posts, resting on wrought-iron bed plates which support nine plate girders, four feet in depth. The tower is surmounted by a wrought-iron tank weighing 38,000 pounds, and built up of plates of the following thicknesses: Bottom, ½-inch; first plate, ⅜-inch; second plate, 5/16-inch, and third, fourth and fifth plates, ¼-inch. The vertical seams are double riveted, and the bottom and horizontal single riveted, with ¾-inch and ⅝-inch rivets. A 4x4-inch angle iron is riveted at the bottom, and a 4x3-inch T-iron near the top. Oak plank hewed to fit the laps are placed between the tank and the girders. All the iron used in the structure is of 45,000 pounds tensile strength. A suitable iron ladder runs from the ground to the top of the tank, and the tank is provided with a manhole near the bottom. The supply pipes are of spiral welded steel; these pipes extend up through the bottom of the tank, the supply pipe to within 4 feet, and the overflow to within 1½ feet of the top of the tank. Where these pipes are fastened to the tank, corrugated copper expansion joints are inserted. The water enters the tank near the top and, by means of a check valve, is drawn from near the bottom. All the ironwork is thoroughly painted. The capacity of the tank is 90,100 gallons.

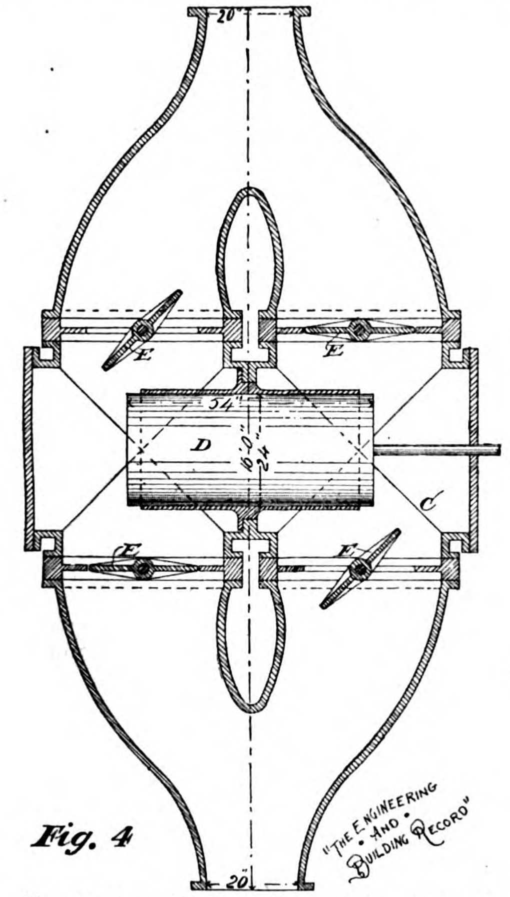


Fig. 4

New London Water Works High Service

The tower and tank were built by the Berlin Iron Bridge Company, of East Berlin, Conn. Chief Engineer W. H Richards acknowledges valuable suggestions regarding the construction of the motor and tank from W. B. Sherman, C. E., Providence, R. I., and commends the efficient work of his principal assistant engineers—G. K. Crandall, in charge of original surveys; G. E. Manning, in charge of pipe inspection and high service, and G. H. Chase, in charge of pipe laying.

AN IMPORTANT NATURAL GAS DECISION.

Judge Lemmon, in the Common-Pleas Court, at Toledo, O., on September 29, rendered a natural gas decision of importance.

The Northwestern Natural Gas Company, which is controlled by the Standard Oil Company, obtained a franchise to lay pipes to furnish natural gas to citizens in the fall of 1886 by ordinance of the City Council, in which certain rates were fixed, to be binding until July 1 last; and it was provided that future rates should be fixed by agreement between the city and the gas company. In March, 1887, the Ohio Legislature passed an act empowering City Councils to fix the price of natural gas to consumers. On August 4, 1890, the City Council by ordinance fixed the price at a rate the gas company refused to accept. The city solicitor then obtained a temporary injunction, restraining the company from furnishing gas at any higher rates than the ordinance permitted, and applied for mandatory injunction to compel them to furnish gas at ordinance rates.

The case was argued at length, and Judge Lemmon decided against the city on the ground that the original ordinance of 1886 and its acceptance by the company was of the nature of a contract, and the subsequent law could not impair the obligation of that contract under the federal constitution, and that if the rates are deemed too high a court must pass upon the question, and not the City Council.

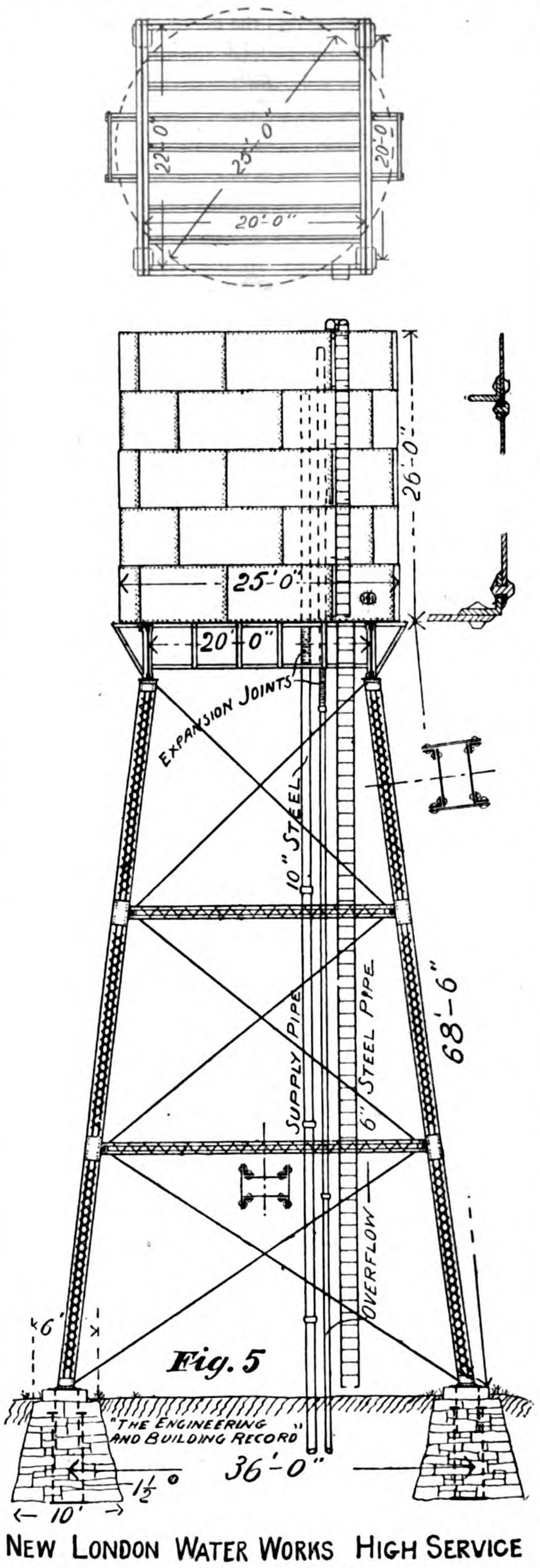


Fig. 5

New London Water Works High Service

Correspondence.

Communications giving information or opinions on matters of general interest to the engineer, the architect, the contractor, or the municipal officer, will be welcomed in this column. Fairness will suggest that when communications are sent simultaneously to this and other journals we should be informed of it at the time. Anonymous letters will not be noticed.

LIME *VS.* CEMENT MORTAR.

Chicago, September 29, 1890.

To the Editor of The Engineering and Building Record:

Sir: Your extracts from Prof. Ira O. Baker's paper on "Lime *vs.* Cement Mortar," in your issue of September 27, are interesting and valuable in strengthening opinion as to the quality of mortar which it is advisable to use in heavy buildings. Portland cement enters each day to a greater degree into the construction of tall buildings in this city, and its use will undoubtedly continue to increase. I desire, however, to enter a protest against the arbitrary, and I believe, incorrect change in the nomenclature of cements which Professor Baker suggests, or rather, asserts.

By long custom the name Portland cement has come to mean any artificial cement, and is firmly fixed in this meaning in literature and in the minds of engineers. In distinction from this the cements made from rocks, into which enter proportions of lime and clay, producing, in varying degrees, hydraulicity, are called "Natural," "American," "Domestic," and "Roman," as Professor Baker tells us. Professor Baker further tells us that these names are inappropriate, and that they should all be classed as "Rosendale Cement." To my mind, the most appropriate name for a class of cements, the material for which is found in nature ready for manufacture, is "Natural Cements." Further, it would be entirely inappropriate and very confusing to apply to a class of cements, varying through a wide range of hydraulicity and activity, the name of one individual of this class which is, at present, on the market. Such action would lead to endless differences in the interpretation of specifications or would require explicit and lengthy explanation.

This confusion or want of meaning is evident further on in Professor Baker's paper, when he states: "If great ultimate strength is required, then Portland cement must be employed; but if a quick-setting mortar is desired then Rosendale cement must be employed." There is absolutely no such distinction between Portland and natural cements. Greater strength, more even quality and resistance to heat are the distinguishing characteristics of Portland cement mortars. Quickness of setting or activity in any degree is not peculiar to Portland cement, for while in general Portland cement is considered slow-setting, yet the variation is great, depending in part on the freshness of the cement, and it is possible to obtain Portland cement of any desired degree of activity. Nor is activity a distinguishing mark of natural cements, varying in these as it does with freshness or the qualities of the rock. When Professor Baker says, "Rosendale must be employed," does he mean the North River cements, which vary somewhat in activity, or Akron, which must be quicky used, or Utica, which may lie for hours in the box without suffering in ultimate strength? In the light of his first quoted statement he means natural cement mortar; yet see how this varies.

If it were at all desirable to give this class of cements a proper name, "Roman" or "Boulogne" cement would be preferable to "Rosendale," as these names, so far as I know, are no longer used as brands for any cement in the market; but I think that all engineers will agree with me that the term "Natural Cement" conveys the idea clearly as to what cement is desired, and in conjunction with the local name or brand, fixes the quality it is deemed preferable to use.

Wm. S. Mac Harg.

ECONOMICAL FREIGHT TRANSPORTATION.

In his book on famines in India, the late Mr. Thomas, according to London *Engineering*, says: "Perhaps the most economical application of power in the conveyance of goods in the world is that which is to be seen in the canals of Malabar. There a tree, 60 feet long and 2½ feet in diameter, is hollowed into a canoe; the opening above is not wider than a plank would cover. This canoe will carry with ease five tons of grain. It floats on the water like a duck, requires little depth and little width. A boy sits at the helm steering and a man propels it by walking along the plank with a punting pole against his chest. This man and boy take this boat, containing 12 ordinary cart loads of grain, 30 miles in the 24 hours, thus for six annas—9*d.*—doing three days' work of 12 carts with their pairs of bullocks and of their drivers."

At Gothenburg, in Sweden, a number of experimental borings have been undertaken with a view to increase the water supply of the town. The result has, as a rule, been favorable; the water-carrying strata has been met with at a depth of about 100 feet. They consist of sand and gravel, and have in some places reached a depth of some 230 feet, but as a rule rock is met with at a depth of from 125 feet to 150 feet. The water rises in a pipe to about 20 feet, and the temperature is 9° Celsius (48.2° Fahr.)

Questions and Answers.

All questions relating to building construction, paving, sewerage, water supply, or kindred subjects, will be welcomed in this column provided they relate to matters of general interest and are not such as should properly be referred to a consulting engineer. Answers will be carefully prepared and a proof of both question and answer mailed to the inquirer as early as proper consideration will permit. They will be published for the benefit of other readers as soon as convenient. The full name and address should be given, not necessarily for publication, but as a guarantee of good faith, and to facilitate further correspondence in case the question is not sufficiently explicit.

Inquiries of the Editor, in order to secure prompt attention, should *not be written on the same piece of paper as a communication* to the *Publishing Department*. Letters renewing subscriptions are sent to a clerk in the publishing office, and matter for the Editor, if in the same enclosure, is likely to be overlooked unless it is on a separate piece of paper, so that it may be promptly sent to the Editor.

MAKERS OF WROUGHT-IRON, CEMENT-LINED PIPE.

THE Connecticut Pipe Manufacturing Company, of New Haven, Conn., write:

"We notice in your issue of September 20, an inquiry from Thomas J. Callahan, of Renovo, Pa., who wishes to know parties manufacturing wrought-iron, cement-lined pipe.

"It is our pleasure to inform you that we are very busy with all sizes of pipe up to 27 inches in diameter, and that we manufacture this pipe of the best wrought iron and pure cement only. Our improvements and success with composite underground conduits has been an inducement to the following parties to manufacture under our patents:

"The Penn Pipe Manufacturing Company, Germantown Junction, Philadelphia; the New York Pipe Manufacturing Company, Hastings on the Hudson, N. Y.; the Illinois Pipe Manufacturing Company, Peru, Ill., and the U. S. Construction and Pipe Manufacturing Company, San Francisco, Cal."

DELTA METAL.

ACCORDING to *Glaser's Annalen*, Delta metal, to which so much prominence has been given in the last few years, is a very old alloy, having been known to the old Egyptians. It was first prepared, however, in a scientific manner by Alexander Dick, a German, in 1882. This metal is an alloy of copper, iron and zinc, resembling aich-metal and sterro-metal, which contain the same elements, and are largely used for heavy guns. The Delta metal is prepared by taking advantage of the fact that melted zinc will dissolve about 9 per cent. of its weight of iron. The saturation point of the zinc depends upon the temperature of the metals during the process—the higher the temperature the greater the amount of iron absorbed. At a white heat nearly 20 per cent. is taken up. The fluid alloy is then mixed with an amount of copper or copper and tin, which varies according to the purpose for which the metal is intended. The oxides present are removed by the addition of a small quantity of manganese, usually in the form of copper manganese alloy.

MINNEAPOLIS, Minn., is now expending $150,000 in the first experiment in paving its streets with Trinidad asphalt.

DOMESTIC
PLUMBING HEATING LIGHTING & VENTILATION
ENGINEERING

ELECTRIC MOTORS.

(Continued from page 283.)

THE "C. & C." MOTOR.

The "C. & C." Electric Motor Company, 402-404 Greenwich Street, New York, makes the motor of corresponding name, shown in Figs. 4, 5 and 6. Figure 4 represents the standard form of the motor of three horse-power, Fig. 5 shows it connected to a Lidgerwood hoist, and Fig. 6 shows it in combination with a 30-inch Blackman ventilating fan. For small organs, and where light power is required, a motor and 4-cell battery outfit has been used.

The lower pole pieces of the "C. & C." motor are cast in one piece with the bed, the upper one being a separate block. To these pole pieces are bolted the field magnet cores. The latter are of forged wrought iron, shaped like segments of a circle. This form of magnet construction is claimed to give the shortest possible magnetic circuits, and to thereby reduce the quantity of iron used and the power required to excite the magnets. The motor is a very compact machine requiring but little space. An improved Siemens winding is used, and the armature and commutator are divided into more than the usual number of sections, thereby, it is claimed, diminishing the danger of short circuits in the commutator. The bearings are self-aligning, so that they cannot bind, allowing the armature to be taken out and replaced without trouble. The wearing parts are of hard cast bronze. An improved adjustable feed oil-cup is used. The brush holders are supported on brass rods attached to a rocker arm, which may be tightened or loosened at will. The pressure of the brushes may be adjusted by a slight movement of a single nut. The machine stands on a stout hard wood base provided with three slotted tracks on which the motor can be moved laterally by means of a hand-wheel. The motors are made for both arc and incandescent circuits, and range from ⅛ H. P. to 40 H. P.

In addition to what we have here illustrated, the "C. & C." Motor Company turn out a number of other special motor combinations, among them smaller fan outfits than the one shown in Fig. 6, and blower combinations. The latter were first constructed for ventilating engine and boiler rooms on board ship, and have been supplied to the U. S. cruisers "Baltimore," "Charleston," "San Francisco," "Philadelphia," and "Petrel," where they are reported to have thus far given entire satisfaction.

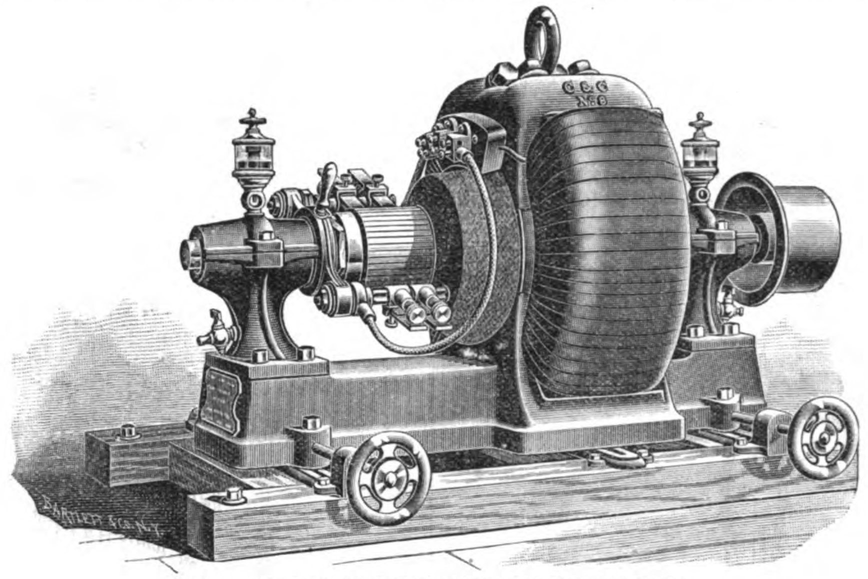


FIG. 4.—STANDARD FORM OF THREE H. P. MOTOR.

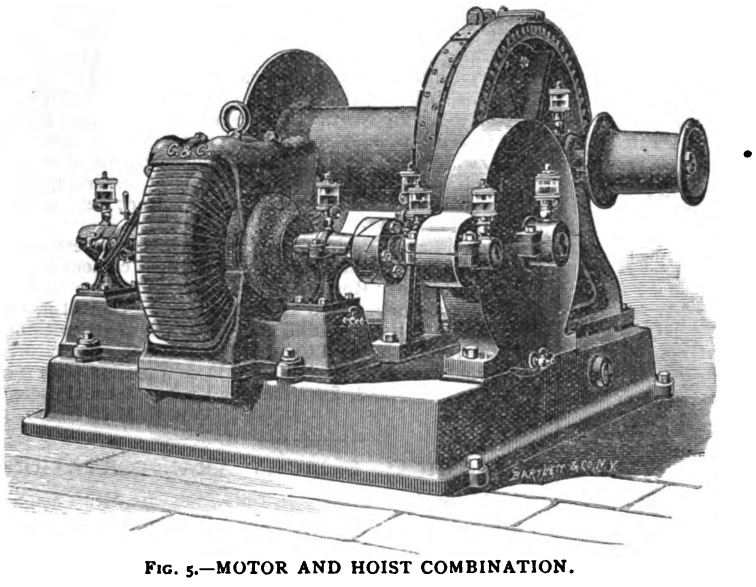


FIG. 5.—MOTOR AND HOIST COMBINATION.

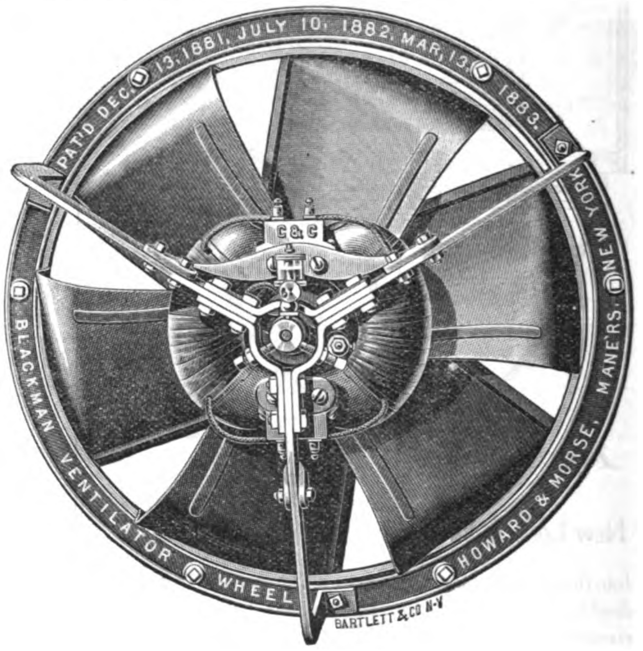

PAT'D DEC. 13. 1881, JULY 10. 1882, MAR. 13. 1883.
C&C
BLACKMAN VENTILATOR WHEEL
HOWARD & MORSE, MAKERS, NEW YORK
BARTLETT & CO N.Y.

FIG. 6.—MOTOR AND FAN COMBINATION.

THE "C. & C." MOTOR, MADE BY THE "C. & C." ELECTRIC MOTOR COMPANY, NEW YORK.

Eight sizes of these blower combinations are made, the capacity of the blowers ranging from 450 to 4,840 cubic feet of air per minute.

THE BAXTER MOTOR.

A ¼-horse-power Baxter motor, made by the Baxter Electric Manufacturing and Motor Company, of Baltimore, Md., is shown in Fig. 7. The Baxter motors are made for both constant current (arc light), and constant potential (incandescent) circuits. The very small sizes, $\frac{1}{16}$, $\frac{1}{12}$ and $\frac{1}{10}$ horse-power are made for arc light circuits only, and are specially intended for light-running sewing machines and other similar work. The $\frac{1}{10}$ horse-power motor is in extensive use in driving ventilating fans, pumps, small lathes, scroll saws, etc.

The motors are simple in design and construction, and are claimed to embrace the most careful workmanship. The arc-light circuit motors are supplied each with a switch attached to the base for shutting off the current altogether.

The constant-potential motors are not provided with a switch attached to the base, but in its stead have three binding posts, to which the line wires leading from an independent switch are connected. This independent switch is a combination automatic cut-out resistance-box and hand switch, and is a very valuable adjunct. It enables the operator to perform all the operations necessary in starting a machine of this class by the simple movement of a single lever. When a constant-potential motor is started, the current that passes through the armature is very great, and is only reduced to a safe limit when the machine attains its normal speed. If, on account of overloading or any other cause, the proper speed is not reached very soon, the wire on armature will be burned. If the load is light the start will be very violent, and may do damage either to the motor or machinery it drives. If at any time while the motor is in operation it is loaded down with machinery so as to be compelled to put forth more power than its rated capacity, the current will increase and if it is overloaded enough the increase in current will be sufficient to melt the wire; therefore it is desirable to have some safeguard to protect the machine against such accidents.

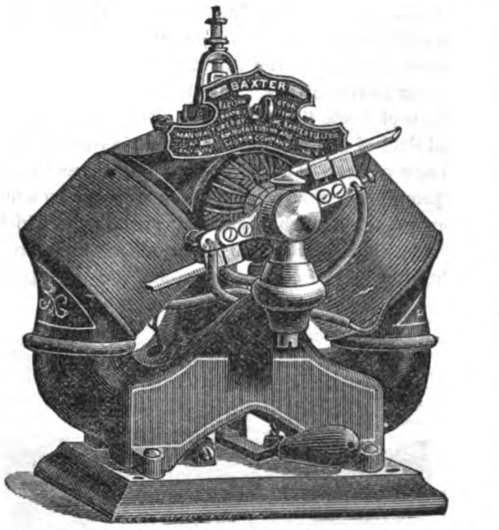


FIG. 7.—MOTOR MADE BY THE BAXTER ELECTRIC MFG. AND MOTOR CO., BALTIMORE, MD.

The Baxter arc light motors range in power from $\frac{1}{16}$ to 10 horse-power, and the incandescent light motors from ½ to 10 horse-power.

(TO BE CONTINUED.)

HOT-WATER HEATING IN AN APARTMENT HOUSE.

FIGURE 1 is a diagram of the heating main, return main and branches, that are supported from the cellar ceiling and connect with the radiators of a five-story house in Brooklyn, N. Y.

H is a No. 131 Gurney hot-water boiler, 40x64 inch, with a 12-inch smoke-pipe and 804 square inches of grate area, catalogued to heat 2,000 square feet of radiator and pipe surface. Owing to a lack of head room the boiler was set in a grouted pit, P, dug for it in the cellar bottom. As the job was needed in a hurry, a boiler was taken from stock which did not have 4-inch couplings to correspond with the direct and return mains R and S, and, to secure full section of connections, each was attached by four 2-inch branches, K K, etc., to the existing couplings. The direct and return branches are of the same sizes at the same places throughout the system, and the lower sections of the risers at A, B, C, D, E and F are of the same size as their connecting branches shown in Fig. 1. N is a 1-inch emptying pipe. The riser A supplies one radiator in the dry room; risers B and D each supply four radiators; risers C and E each supply five radiators; riser F supplies one radiator to warm the halls. The combined net area of radiating surface is nearly 1,400 square feet. All the pipes shown in Fig. 1 are jacketed with asbestos.

The first story of the house is used for a shop, and has only two radiators; the second story is occupied as a residence by the owner, and has four radiators besides that in the hall. Each of the three stories above is occupied by a family, and has four radiators. Figure 2 shows a first floor room arranged as a clothes drying room. It is about 12'x12'x9½' high, and has a set of clothes lines, L L, etc. A simple radiator coil, B, of about 40 square feet surface, is supplied from riser A, Fig. 1, and is designed to heat the room sufficiently to dry the clothes.

Figure 4 shows the connection of the radiators to the risers at E, Fig. 1. Both risers terminate, between the ceiling and floor, in elbows H H, to which the branches F F for radiator A are attached. Below the elbows, and also between the floor and ceiling, are tees to which nipples N N are connected. These have elbows P P, to which the next sections of risers E' E' are screwed. The arrangement is the same at the next floor except that the tees are reversed so as to bring the third set of risers into line with the first, and so on for successive stories, as shown in Fig. 4. These offsets in the risers are made to counteract the tendency that the water would have if the pipe were straight to flow to the top without circulating through the radiator branches.

In Fig 3 the supply to radiator A is through pipe D, which is controlled by valve C; B is an air valve. Figure 5 shows the 25-gallon galvanized iron expansion tank, which is placed in the hall of the upper story. It is connected with one of the fifth story radiators by the 1-inch pipe B, and can be filled from city pressure through the key valve C. D is a 1-inch overflow pipe discharging into an adjacent water-closet cistern.

Fig. 1

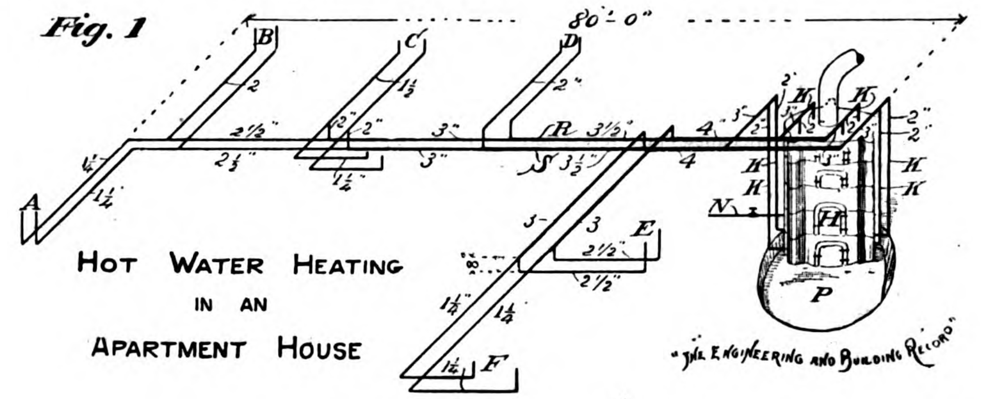
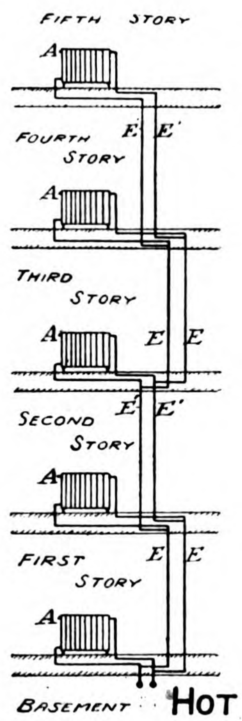

80'-0"
B
C
D
2"
1½
2½"
2½
2"
3"
R 3½
S 3½
4
5
2½"
3
E
1¼
1¼
F
A
H
K
N
P
HOT WATER HEATING IN AN APARTMENT HOUSE
"THE ENGINEERING AND BUILDING RECORD"

Fig. 4



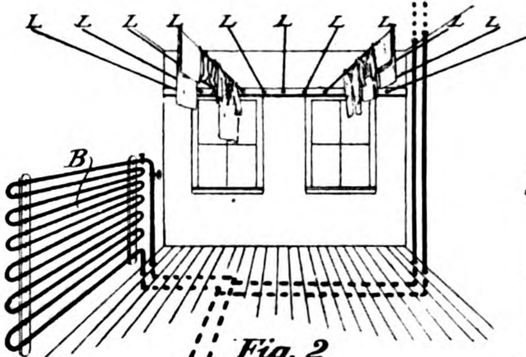


Fig. 2

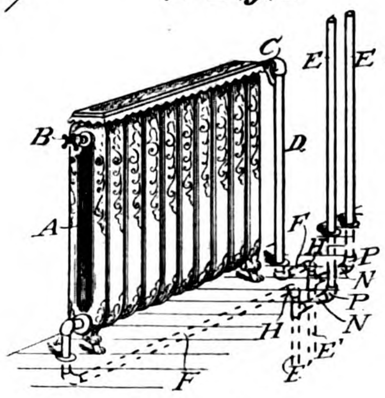


Fig. 3

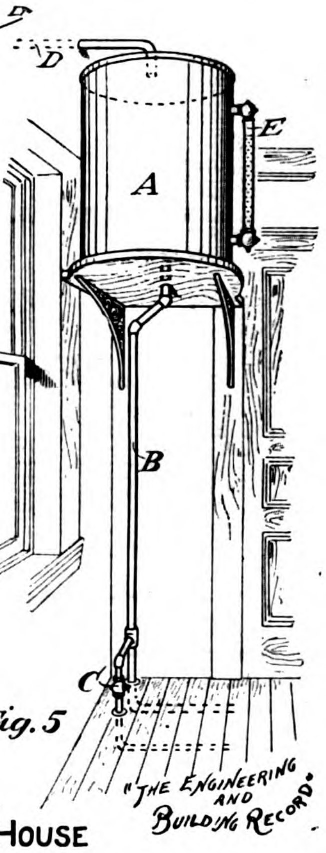


Fig. 5

HOT WATER HEATING IN AN APARTMENT HOUSE

The heating system was designed and put in by Johnson & Co., Catskill, N. Y.

THE interest felt in Europe in the canal system is shown by the international Congress on Inland Navigation, the fourth meeting of which was recently held at Manchester, England, the previous meetings having been at Brussels, Vienna and Frankfort. At this Congress all the leading European nations were represented, and papers were presented bearing on the subject of Inland Navigation in England, France, Belgium, Germany, Austria, Italy, Holland, Russia and America.

PARIS is soon to have its first cable railroad, which will connect the Belleville and Montmartre districts.

THE DANGERS OF ELECTRIC LIGHTING.

IN a paper on the above subject, presented at the recent annual meeting of the National Electric Light Association, Prof. Henry Morton, of Stevens Institute, stated that that part of the electric lighting problem relating to dangers to human life has recently been taken in hand by an organization known as the Employers' Liability Assurance Corporation.

This association, after collecting a mass of material from many sources, has formulated a series of rules for the protection of those employed in erecting and operating electric apparatus involving the use of powerful, and, therefore, dangerous currents. These rules have been generally approved of. From them are quoted the following:

"1st. Do not touch or handle any electric wire or apparatus of any sort while standing on the ground or while in contact with any iron work, gas or water pipe, or stone or brick work, unless your hands are covered with rubber gloves, and you are provided with such properly insulated tools as have been declared to be safe and in good order by the electrician or other competent officer of this company.

"If it is at any time necessary to stand on the ground, or any surface not insulated from the ground, while handling electric wires or apparatus, rubber boots or an insulated stool should be used.

"In moving wires, hanging on or lying over electric light wires, lamps or fixtures, use a dry hand line.

"2d. Never handle any electric wire or apparatus with both hands at once when this can be avoided, and if it is necessary to do so, be sure that no current is present, or that one or both hands are protected by rubber gloves or other efficient insulation.

"3d. When handling line wires, treat each and every wire as if it carried a dangerous current, and under no circumstances allow yourself to make contact between two or more wires at the same time.

"4th. Never open a circuit which has been in use without giving notice to the superintendent, or whoever is in charge, of your intention to do so, and at the same time request that the same line be opened at the main station, and kept open, until you have given notice that your work on that line is complete.

"5th. In the dynamo room never go near the belts or dynamos, nor touch any apparatus unless you are fully informed and instructed how to do so.

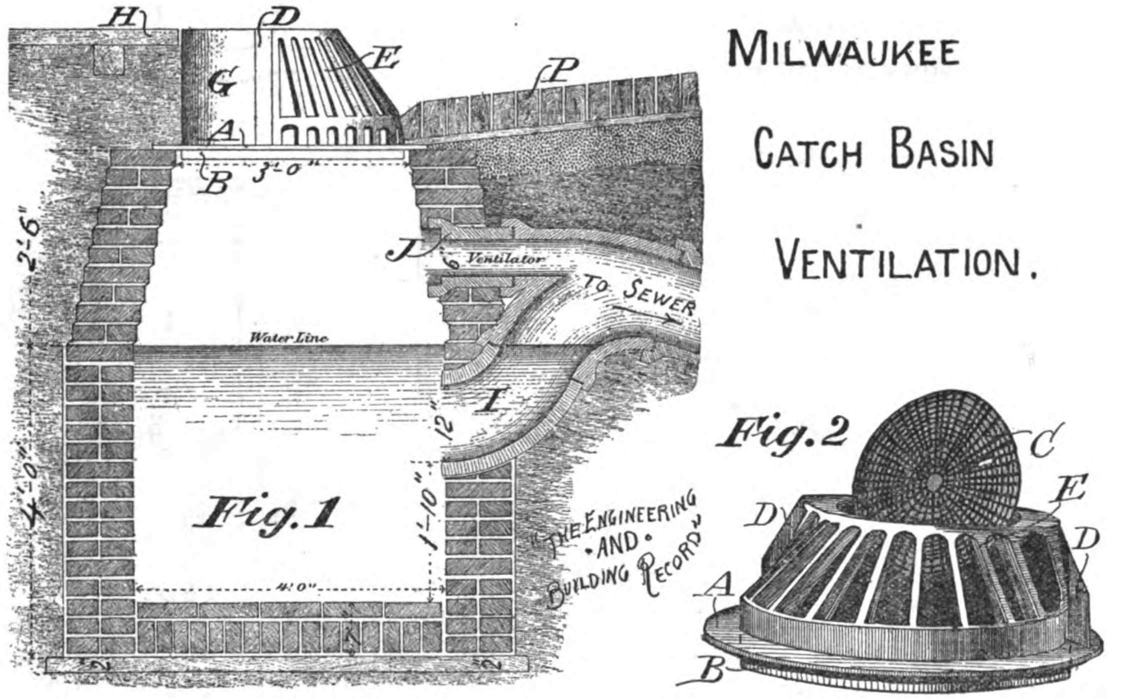
"Tools used by linemen should be provided with insulating handles of hard rubber or other equally good insulator. It is the duty of each lineman to look after his own tools and see that they are in good order, especially as to their insulation.

"6th. Lamp trimmers, and others engaged in the care of lamps, must see that the switch putting the lamp in circuit is turned off before they handle the lamp in any way.

"In construction work a space of at least 20 inches must be left between the holes for pins on the cross arms, so that a lineman may get to the pole and work without danger."

THE UTILIZATION OF FIRE DAMP.

ACCORDING to a report originally appearing in the *Zeitschrift fur das Berg Hutten und Salinenwesen*, and abstracted for the proceedings of the Institution of Civil Engineers, the most elaborate attempt ever made in Europe to obtain from a coal seam a natural combustible gas that should be capable of being used like the natural gas of the American oil region, ended in a conspicuous failure. The mine was situated at Erenenberg, near Aachen, and plenty of gas was apparently forthcoming when it was not wanted. Its systematic removal from the workings, for utilization above ground, was effected by an exhauster connected by a main and branch feeders with every part of the mine. The smallest feeders were 1-inch pipes, which terminated in suction roses perforated on the top side only, which were kept at the top of the levels by means of clamps attached to the timbering. The exhausted gas, which was necessarily a mixture of gases and air, was delivered into a double holder, so arranged that one-half was constantly being filled while the other was emptying. After a time, as this arrangement did not work satisfactorily, the holders were abandoned, and the gas forced by the exhauster directly into the delivery-pipe. The ultimate failure and abandonment of the experiment was due to the irregularity of the gas production in the mine, the air from which sometimes contained as much as 10 per cent. of fire-damp, and sometimes none at all—the variations occurring without any apparent cause, and rendering it impossible to work the exhauster with any reference to the production. The underground collecting arrangements also gave a great deal of trouble, and hindered the work in the headings. The gas, when it could be burnt, was applied to the firing of two boilers; a row of jets being introduced below the firebars from a tube connected with the main, and protected by a water seal. At all the joints of the gas-pipes wire gauze diaphragms, similar to those used in safety lamps, were inserted. The gas did not effect any economy with the boilers. It was also tried as an illuminant with the help of the Fahnejelm magnesia comb; but only the lower third of the rods could be brought to the proper degree of incandescence. The third suggested application of the gas, for driving gas-engines, was not tried.



Novelties.

Devices are described under this head purely and strictly as news; because believed to be new and calculated to interest readers.

In no case is pay accepted, directly or indirectly, for publishing a novelty notice.

As the subjects are selected for their supposed novelty and interest merely, it will, of course, be understood that the selection does not imply indorsement.

THE MILWAUKEE CATCH-BASIN VENTILATION.

THE report of the Milwaukee, Wis., Board of Public Works says, in speaking of sewer ventilation:

"The attempt to give an opening for sewer gases by perforating the covers of manholes with two holes of one inch diameter has proved a failure. These openings are too small and too liable to be clogged up by street travel, particularly during the winter months, with snow and ice.

"The simplest and most effective plan appeared to be to ventilate through the catch-basins on the corners of the streets, depending on the multiplicity of the openings and the free diffusion and consequent dissipation of noxious vapor for avoiding any nuisance to street travel.

"The fact that our catch-basins were originally all trapped to prevent floats, such as chips, straw, offal, etc., from finding their way into our sewers without any provision for the free ingress and egress of atmospheric air, made them necessarily a means of concentrating and combining all gases within the sewers.

"It became expedient, therefore, to devise some improvement, if possible, for retaining the usefulness of traps, and at the same time making them a safe and permanent means of ventilation.

"The accompanying drawing (Fig. 1) gives a sectional view of a catch-basin with combined sewer trap, with sewer ventilator attached. The improvement, as shown, consists of a pipe J, constructed in direct combination with the sewer trap I, and molded on to it so as to connect the upper portion of the interior passage of the trap with the interior of the adjacent catch-basin above the water line and with the outer air, thus providing in connection with the trap free ingress of atmospheric air to the connecting sewer and the free egress of noxious air or gas from the sewer, by one integral and economical device. The end of the ventilating pipe extending into the catch-basin is provided with a collar, so that it may be conveniently closed when desired.

"In a total number of 1,818 catch-basins, 199 are thus ventilated, and no complaint having been made against them in all this time, the reasonable conclusion is that they are not offensive to public travel, and that when once generally introduced they must satisfactorily solve the question of sewer ventilation."

The cover shown in the top of Fig. 1 is shown in detail in Figs. 2 and 3.

It has been in use in Milwaukee for several years, and consists of a casting with a round base having a flange A supporting it on the brickwork of the catch-basin. A flange B also extends downward, to prevent the water from washing away the mortar from between the bricks, and holds the cover in place. It is placed at the corner of a street, and forms part of the sidewalk, the back G being closed. The front consists of slanting bars E E, etc., which prevent rubbish from falling direct into the catch-basin. The bars will not hold the rubbish down and clog up like perpendicular bars. The flanges D D are for the pavement or stone to rest against.

When necessary to match the level of the sidewalk H, the height is increased by bolting cylindrical sections to the top, as shown in Fig. 3, the upper one being then fitted with the cover plate C; P, Fig. 1, is the pavement. Slightly modified patterns are employed when the catch-basins are used on the side of the street, not at a corner, or when at a corner not right angled.

The cover is made by G. Campbell & Sons, Centennial Bell and Iron Foundry, Milwaukee, Wis.

TRADE PUBLICATIONS.

THE C. & C. ELECTRIC MOTOR.

The C. & C. Electric Motor Company, 402-404 Greenwich Street, New York, have just completed a new catalogue devoted to the interests of their electric motor and motor combinations. Besides being a very attractive specimen of trade literature, with stiff covers, it contains a good deal of information of the kind in which popular interest now centers. The electric motor business has reached such prominence that particulars of the work to which the motors are adapted, the sizes and capacities in which they are made, their prices, and other allied data, are much sought after by prospective users, and it is to supply such information that the catalogue has been prepared. It is handsomely illustrated, showing different forms of "C. & C." motors and methods of application to various kinds of work, such as hoisting, driving ventilating fans and blowers, working church organ bellows, etc. A number of tables are added, giving capacities, speeds, and dimensions of the motors and special motor outfits. The closing pages contain directions for setting up and operating the motors, and testimonials from a number of users.

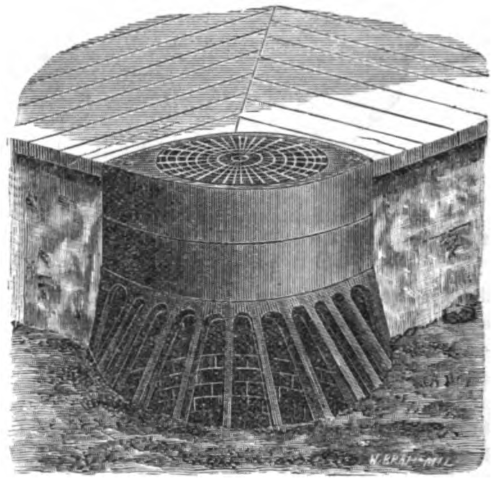


FIG. 3

THE DUNNING STEAM AND HOT-WATER BOILER.

The New York Central Iron Works, of Geneva, N. Y., are sending out a newly prepared circular giving illustrations and particulars of the Dunning boiler made by them. This boiler, as is no doubt well-known to many, is intended for both steam and hot-water heating. Different designs, magazine and surface burning, brick set and portable, are shown, and an extensive table of sizes, capacities, and prices is added. What may be taken as a mark of popularity of the boiler and of a wide circle of its acquaintances is the fact that the maker's name has not been given in the circular. Doubtless, however, this will prove no great obstacle to reaching them.

THE successful completion of the St. Clair Tunnel has stimulated projectors, and a company has been organized to build a similar tunnel under the Detroit River from Detroit to Windsor. This would be about 3,000 feet long under the river, and the approaches would be about 3,000 feet on either side, making a total length of about 9,000 feet. The top of the tunnel would be 48 or 50 feet below the water level, or from 13 to 15 feet below the river bed at the center. The estimated cost is $3,500,000 for a single-track tunnel, and the plan is to have it open to all connecting railroads.

THE pressure of natural gas wells in Indiana and Ohio is steadily diminishing, the diminution having already amounted to between 30 and 40 per cent. Professor Orton urges the imperative necessity of cities and States taking action to restrict wasteful use of gas; but even the strictest regulations, he says, cannot prevent the exhaustion of the supply in a few years.

THE NEW RIVER AND HARBOR BILL

In addition to appropriating money for work, as reported in THE ENGINEERING AND BUILDING RECORD for October 4, the River and Harbor Bill directs the Secretary of War, at his discretion, to cause examinations or surveys, or both, to be made, and the estimated cost of improvement to be estimated, at the following localities:

ARKANSAS.

Clarenden and the lower White River, to determine the effect of back water from the Mississippi River and its cause, and the means and cost of preventing injury therefrom.

ARIZONA.

Colorado River above Yuma to Eldorado Canyon, to determine the advisability and probable cost of improving said river; Sucarnochee River, from its mouth to the Mobile and Ohio Railroad Bridge; Mouth of Gunter's Creek at Guntersville, with the view of ascertaining the practicability and approximate cost of so improving the same as to secure a safe landing above high water mark; Alabama River, to ascertain cost of securing a six foot channel at low water from mouth to Wetumpka.

CALIFORNIA.

Sacramento and Feather Rivers, to be considered by a board of three United States engineers, with a view to project for future improvement; San Rafael River; San Simeon Bay; Alviso Harbor and straightening, deepening, and improving of Alviso Creek; harbor of refuge at Santa Cruz; improving and straightening Redwood Creek; Mokelumne River, for snagging; Redondo Beach Harbor.

CONNECTICUT.

Connecticut River, from Long Island Sound to Hartford, with a view to such improvement as will keep the channel from shifting its course at certain places; Shaw's Cove, New London Harbor; Connecticut River below Hartford; Saugatuck River; Stamford Harbor, Stamford; Cos Cob or Miamus River; Stony Creek River at Stony Creek.

DELAWARE.

Murderkill River; Broad Creek River; Mispillion River, with a view of cutting a canal so as to shorten the distance to the bay, and making an outlet in the bay which would furnish deeper water.

NORTH DAKOTA.

Creel's Bay, Totten Bay, and Minnewauken Shoals, in Devil's Lake, with an estimate of the cost of improving the same by dredging or otherwise, so as to re-establish the navigation of said lake.

NORTH DAKOTA AND MINNESOTA.

Red River of the North, with a view of improving the navigation of the same by the construction of a lock and dam at Goose Rapids in said river.

FLORIDA.

Charlotte Harbor; Peace River; channel lying north and west of the town of Cedar Keys, known as Boat or Number Four Channel; Indian River between Titusville and Jupiter Inlet; St John's River, from Jacksonville to Sanford, to obtain an estimate of the cost of deepening the channel so as to secure navigation for ocean steamers, and to report separately the cost of opening the channel of the river in the vicinity of Orange Mills; the upper part of the St. John's River, from Lake Monroe southward, or in a southerly direction through the river and connecting lakes to the head of steamboat navigation; St. Augustine, for improvement of channel so as to make a deep sea channel over the outer and inner bars.

GEORGIA.

Chattahoochee River, Georgia and Alabama, between West Point and Franklin; the inside route between Savannah, Ga., and Fernandina, Fla., with a view of obtaining a steamboat channel of seven feet depth at mean low water; the inside route between Doboy and Sopelo, with a view of making the same navigable for sea-going vessels; Brunswick Outer Bar, to determine the feasibility and cost of deepening the same to 26 feet at ordinary high water; Yellow River, from the Railroad Bridge near Covington to the Ocmulgee, with a view of obtaining a steamboat channel of five feet deep at mean low water.

ILLINOIS.

Mississippi River at Warsaw, Ill., with a view of removing bar; Slough at Hamilton, with a view to dredging out the same; Illinois River from La Salle to the Mississippi River, as recommended by Capt. W. L. Marshall, corps of engineers, in his report dated March 10, 1890, with a view to ascertaining what lands would be subject to overflow by the construction of a navigable waterway between Lake Michigan and the Mississippi River, but not more than $25,000 of the money appropriated for surveys shall be allotted to this river.

INDIANA.

Wabash River from Terre Haute to La Fayette with a view of removing obstructions of snags and bars and re-establishing the navigation of said rivers between these cities; with a view to improving the Ohio River, between the mouth of Green River, in the State of Kentucky, and the city of Evansville, in the State of Indiana, and confining the waters of the first named river within its present channel, and preventing danger to navigation from any changes therein, the Secretary of War is hereby authorized and directed to make, or cause to be made under his direction, a complete survey of the Ohio River between the points named, together with full estimates of any expenditures that may be necessary to prevent any injuries or threatened injuries to its permanent use and navigation.

IDAHO.

The Upper Snake River, between the Huntington Bridge and Seven Devils Mining District in Idaho, with a view of overcoming obstructions to steamboat navigation.

IOWA.

Mississippi River at and above Clinton, Iowa, with view of removing bars north of Little Rock Island.

KENTUCKY.

Russel's Fork of the Big Sandy River with a view of removing obstructions from the same; harbor of Owensboro, Ky., on the Ohio River; harbor of Smithland, Ky.

KENTUCKY AND TENNESSEE.

Mississippi River from high water mark Lake County, Tenn., to high water mark Fulton County, Ky., north and west of Reef Foot Lake, to ascertain if navigation of the river may not be improved by restraining the flow of water into said lake and adjoining lowlands; Green River, Ky., above the mouth of Big Barren River, completing survey with a view of extending slack-water navigation on Green River; Big Barren River, Ky., above Bowling Green with a view of extending slack-water navigation by additional locks and dams.

LOUISIANA.

Bayou Terre Bonne from Houma to Thibodeaux; Bayou Black to connect with Terre Bonne; Berwick's Bay to the Gulf, with a view of obtaining a deeper channel; Bayou Teche from Saint Martinsville to Port Barre; Bayou Vermillion, bay and passes; Bayou Black for connection between Calcasieu Lake and Sabine Lake; Bayou Des Glaises, with a view of clearing the stream of obstructions from the Atchafalaya River to Cottonport; Mermenton River, including its tributaries and course through Lake Arthur and Grand Lake to the Gulf of Mexico; Bayou Cocodrie, in Saint Landry Parish; Cane River, with a view of improving the same by locks and dams for the purpose of giving permanent navigation the year round; Shoals on Lake Pontchartrain near the Rigolets, known as the "Middle Ground," with a view of dredging a channel ten feet deep and revetting sides of the same; Bayou Castor; Corsica Shoal, situated at the lower end of Lake Huron, near the entrance to the Saint Claire River, with a view to its removal; the American channel of the Detroit River, beginning at the western boundary of the city of Detroit, and from thence continuously in American waters to Lake Erie, with a view to deepening said channel to the same depth as has been attained and is contemplated under present plan in the Canadian channel of said river, the said survey to be made in the channel of said river fronting the towns of Springwells, Ecorse, Monquagon, and Brownstown, and the American shore of said river to such a point in Lake Erie as may be necessary to reach a proper depth of water in said lake to correspond with the increased depth of the river contemplated by this bill; Rouge River, with a view of locating and constructing basin in said river, at a point on the same within four miles of its junction with the Detroit River, convenient for the turning and anchoring of vessels in the same; ship-channel, 20 feet in depth and of a suitable width in the shallows of the connecting waters of the lakes between Chicago, Duluth and Buffalo; Grand River, below Grand Rapids, with a view of determining the existence or non-existence of underlying rock, the hydraulics of the river and the detailed topography of the valley subject to overflow; re-survey and re-location of harbor line in Portage Lake, Houghton County, Michigan, in conformity with the provisions of recent law.

MINNESOTA.

Red River and tributaries above Fergus Falls and Crookston, and of Big Stone Lake, with a view to improving navigation thereon by the erection of suitable dams or by such other means as may be deemed best, together with an estimate of the cost: the Saint Louis River from Grassy Point in Saint Louis Bay to Fond du Lac, or the State line between Minnesota and Wisconsin.

MISSOURI.

Current River, from Van Buren River, Missouri, to its mouth; Missouri River, from the old mouth of the Platte River, Little Point, to a point opposite the city of Leavenworth, also of the river at the city of Western, Missouri, with a view of returning said river to its ancient channel, and the best plan of accomplishing the same.

MONTANA.

Missouri River, between Sioux City and Fort Benton; Missouri River, between Great Falls and canyon next below Stubbs Ferry; Tongue River, with a view of determining the practicability and approximate cost of straightening the channel of said river, immediately west of Miles City and north of the Northern Pacific Railroad track; Nebraska and South Dakota, Missouri River from the mouth of the Big Sioux River to the north line of the State of South Dakota; Yellowstone River, from its mouth to the mouth of Tongue River; Bayou Chevreuil and Bayou Tigre from Lake Des Allemands to points near Vacherie, Chigby and Malagay settlements in Saint James Parish for removal of bars and other obstructions to navigation.

MARYLAND.

La Trappe; Turner's Creek; Rock Hall Harbor; Nanticoke River, the northwest fork of the same; Linchester River; Patapsco River, from the Craighill Channel to the sugar refinery wharves, Curtis Bay; Susquehanna River, above Havre de Grace; Broad Creek; Warwick; Piscataway Creek; Saint Leonard's Creek; Newport Creek, head of Wicomico River, Charles County; Smith's Creek; Eastern Branch of the Potomac River, including that portion in District of Columbia; Saint Jerome Bay.

MASSACHUSETTS.

Canapitsit Channel, between the Island of Cuttyhunk and Neshawana, with a view of deepening the same and clearing the channel from obstructions to navigation; Menemsha Bite, an outlet into Vineyard Sound on the north shore of the island of Martha's Vineyard, with a view of preventing the closing of said inlet; Kingston Harbor, with a view to its improvement; Town River; shoals at the mouth of North River, with a view of removing the same and other obstructions; North River, Solem, from Beverly Bridge to the North Street Bridge; Mystic River, and the Malden River, a tributary of the Mystic, from the bridge of the Boston and Maine Railroad, eastern division, to the head of navigation on said rivers; Weymouth Back River; Essex River.

MAINE.

Kennebec River, from Waterville to steamboat wharf at Augusta, Me.; Sullivan Falls, Hancock County, Me., with a view to its improvement for navigation; Lubec Channel; Harbor of Bluehill, with especial reference to the removal of the ledges known as Middle Ground, eastern and western; Penobscot River; Pepperell Cove, forming the eastern boundary of Portsmouth River Harbor.

MICHIGAN.

Sebewaing River, with a view of deepening the channel from the mouth to the village of Sebewaing to the depth of eight feet.

NEW JERSEY.

Hackensack River, from below the Newark and New York Railroad Bridge, on Newark Bay, to the town of Hackensack; Pensauken Creek; Toms River; Little Egg Harbor Bay and Inlet including Great Bay with reference to establishing a harbor of refuge; Sound between Barnegat Bay and Great Egg Harbor Bay; Shark River; Goshen Creek; Cape May City, for breakwater; thoroughfare from Cape May to the Great Bay north of Atlantic City.

NEW YORK.

Buttermilk Channel and Gowanus Bay channels in New York Harbor, with a view of straightening the same by removing the shoals opposite the southeast side of Governor's Island, protecting the channels by a sea wall on Governor's Island, and to provide for the full width thereof a uniform depth of 26 feet at mean low water throughout these channels along the wharves of Brooklyn from a point opposite Wall Street Ferry to the foot of Bryant Street, Brooklyn; Bay Ridge Channel, with a view of removing the shoal and providing a uniform depth of 23 feet at mean low water opposite the Bay Ridge shore to the 23-foot curve in the New York Harbor; Hudson River at Cornwall from the Moodna River, otherwise known as Murderer's Creek, to the channel or deep water of the Hudson River; Inner Bay near mouth of Saranac River at Plattsburg, for harbor of refuge; Sag Harbor, Suffolk County, for breakwater; Princess Bay, Staten Island, for breakwater; Peconic River, Suffolk County, and Mattituck Bay, Suffolk County, for breakwater; from main channel from Jamaica Bay easterly to Long Beach Inlet, for canal; Champlin's Creek, in town of Islip. That the Secretary of War is authorized and directed to appoint a board of three officers of the Corps of Engineers, United States Army, whose duty it will be to thoroughly examine the obstructions to navigation in the Hudson River, between New York City and the State dam at Troy, New York, and report a project and estimate of the cost of widening and deepening said river between New York City and the city of Albany, and also between New York City and the State dam at the city of Troy for the navigation of sea-going vessels drawing 20 feet of water, and also a separate estimate of the expense of improving the river between Coxsackie and the State dam at Troy, to such an extent as to secure a navigable channel 12 feet deep at mean low water. Said board shall accompany their report with a statement as to the usefulness of such improvements and of their relations and value to commerce, and of the advisability of entering upon the same at this time; and the Secretary of War shall transmit said reports to Congress with his own views and those of the Chief of Engineers, United States Army thereon, and the expenses of said board shall be paid out of the appropriation made in this act for the improvement of the Hudson River, not to exceed $10,000; Boquet River, from mouth on Lake Champlain to Willsborough, New York; Bronx River; Port Day, above Niagara Falls; Westchester Creek, Westchester and New York Counties.

NORTH CAROLINA.

Waterway from Pungo River to the town of Sladesville: Northwest River up to Moyock; Drum Inlet; Waterway between Pamlico River and Bay River; White Oak River from Roberts' Landing to Collins Crossing; harbor of Washington, Pamlico River.

OHIO.

Conneaut Harbor; Grand River between Richmond and the mouth.

OREGON.

Tillamook Bay and Bar; Alsea Bay and River; Coos Bay, for improving upper harbor by removal of shoals and in dredging; the Lower Willamette and Columbia Rivers, with a view of securing 25 feet at low water from Portland to the mouth of the Columbia; the Yamhill River from its mouth to McMinnville, with a view of improving the same by removing snags and other obstructions; Willamette River, deepening channel on west side of Swan Island, improvement of navigation at Clackamas Rapids and Ross Island and near city of Corvallis; Lower Columbia River, on south side, between Astoria and Wood's Landing, for snagging; Young's Bay channel from the ship channel of the Columbia River to the head of Young's Bay, a distance of 1½ miles, with a view to improving the same by dredging, so as to secure a depth of 18 feet at low tide; Lewis and Clarke's River, for snagging; Coquille River, for deepening channel from Coquille City to Myrtle Point to four feet at mean low depth.

PENNSYLVANIA.

Delaware Bay, with a view of determining the best site near the mouth of the same for a National harbor of refuge suitable for deep draught vessels. The examination to be made by a commission of three engineer officers, who will make the examination and submit to the Secretary of War a report thereon with a project and estimate of cost of construction of such a harbor of refuge; the west branch of the Susquehanna River in the State of Pennsylvania, in order to ascertain if the navigation of said river can be materially and permanently improved by the construction of embankments or otherwise; such survey also to be made with a view of ascertaining the best practicable method of confining the waters of said river in times of great flood, to the general course of its channel; Tionesta, from the town of Tionesta, to the village of Balltown, with a view to the improvement and the removal of obstructions.

RHODE ISLAND.

Watch Hill Cove, in Little Narragansett Bay; Narragansett Bay Channel, between Starve Goat Island and the main land, with a view of deepening the same; Newport Harbor, south of Goat Island, with a view to the removal of the Spit at the south end of the Island.

SOUTH CAROLINA.

Wateree River, from Camden to the falls of the Catawba, also of the bend or curve in said river about four miles below Camden, between the plantations of Witte and Williams, to determine if it is advisable in the interest of navigation to make a cut-off across the neck of said bend; Black River, from Kingstree to its mouth.

TENNESSEE.

Obion River, from its mouth to the crossing of the Louisville and Memphis Railroad in Obion County; Little Pigeon River, from mouth to Sevierville; Memphis Harbor, especially for the removal of the bar forming opposite the upper part of the city or the prevention of the river bank taking the form that the natural forces are now giving it.

TEXAS.

Brazos River, from its mouth to Waco; Sabine River, from where said river empties in Sabine Lake to Sudduth's Bluff, on said Sabine River; survey to remove obstructions at mouth of Double Bayou in Chambers County, to remove obstructions; Colorado River, with a view of removing raft at mouth of same; St. Charles Bay, with a view of removing obstructions at mouth of same; Aransas Bay, to remove Half-Moon reef; West Galveston Bay, from Christian's Point, with a view of reopening the channel through West Bay; Trinity River, from its mouth to Dallas.

VIRGINIA.

Waterway to connect Lynn Haven Bay with eastern branch of Elizabeth River; Potomac Creek; Chickahominy River, from Holly Landing to Long Bridge; Tangier Harbor; Wicomico River; Nottoway River, from mouth of river to Courtland; West Neck River, to and beyond Dozier's Bridge; western branch of Elizabeth River; Upper Machodoc Creek; Crane's Creek; Nandua Creek; Piscataway Creek.

WEST VIRGINIA.

Elk River, with a view of improving the same by locks and dams.

WASHINGTON.

Nooksack River, Skagit, Snohomish, D'Wamish, Black, Puyallup, Nasal, North, Gray's Deep, Skamakawa, and Crooked Rivers; Gray's Harbor and Bar, and extending up Chehalis River to Montesano; Gray's River, for snagging; Swinomish Slough, with the view of constructing a ship channel through the same, connecting Saratoga Passage Skagit Bay with Padilla Bay, and to report the most suitable and feasible plan for making such improvement, with the cost of the same; Shoalwater Bay, from and including its entrance to South Bend, about two miles up the Willapah River, and from said South Bend, about ten miles up said river, to Woodward's Landing, with a view to improving the same for navigation; Olympia Harbor, from deep water in Budd's Inlet to Fourth Street Bridge in the city of Olympia, and separately from said bridge to the mouth of the Des Chutes River at Tumwater, and to report as to the most practical and convenient channel and the most feasible, economical, and suitable plan for improving the same for navigation by the class of vessels employed on Puget Sound, and also to cause to be made an estimate of the cost of each of such improvements; Columbia River, from the mouth of Willamette River to the upper limits of the city of Vancouver, with a view of establishing a ship channel; for a ship channel between Port Townsend Bay, Puget Sound and Oak Bay.

WISCONSIN.

Allonez Bay at the west end of Lake Superior, also the Nemadji River for a distance of four miles above its mouth, with a view of determining the best method of improving and making them available as a portion of the harbor system of the city of Superior; Harbor at Hudson, with a view to prevent the city being cut off from the navigable channel of the Saint Croix Lake, as a result of the Government dike now constructed at that point, and with a view to the feasibility of conducting the waters of Willow River past the city of Hudson into the navigable channel of the lake.

VIRGINIA AND MARYLAND.

Potomac River, up to the City of Washington, with the view of removing obstructions and deepening the channel.

SECTION 18. That for examinations, surveys and contingencies, and for incidental repairs, for which there is no special appropriation, for rivers and harbors $225,000; Provided, That no survey shall be made of any harbors or rivers until the Chief of Engineers shall have directed a preliminary examination of the same by the local engineer in charge of the district, or an engineer detailed for the purpose, and such local or detailed engineer and the division engineer of the locality shall report to said Chief of Engineers whether, in their opinion, said harbor or river is worthy of improvement, and shall state in such report fully and particularly the facts and reasons on which they base such opinions, including the present and prospective demands of commerce; and it shall be the duty of the Chief of Engineers to direct the making of such survey, if, in his opinion, the harbor or river proposed to be surveyed be worthy of improvement by the general Government; and he shall report to the Secretary of War the facts, and what public necessity or convenience may be subserved thereby, together with the full reports of the local engineer; and provided further, that no survey for new works other than those designated by law shall be made, and the Government shall not be deemed to have entered upon any project for the construction or improvement of any waterway, harbor or canal mentioned in this act unless or until the work of construction shall have been actually appropriated for. Said reports of preliminary examinations and surveys shall be made to the House of Representatives, and are hereby ordered to be printed when so made.

GAS AND ELECTRIC LIGHTING.

LUDLOW, KY.—The subject of public lighting is being discussed at this place.

GRENADA, MISS.—Electric lights are proposed for this place.

HASTINGS, MICH.—An electric light plant is to be established at this place.

VENICE, ILL.—The Village Board has granted a franchise to Gustavus Niemann and others for the establishment of an electric light and power plant. The ordinance conveys a monopoly of 20 years, with a limit of one year in which to complete the work. The village is given the privilege of having as many lights as required at 10 per cent. below current rates.

DARIEN, GA.—It is probable that operations will soon be commenced on the electric light plant proposed for this place.

YORK, PA.—Important improvements are soon to be made to the local gas works.

SHIPPENSBURG, PA.—A company has been organized, the object of which is to establish an electric light plant here. Estimated expenditure, $10,000.

MANCHESTER, VA.—The citizens of this place will decide the electric light question at a public election to be held soon.

MARION, PA.—New gas works will be established at this place by M. C. Watson and others, who will expend $250,000 on the project.

KINGWOOD, W. VA.—This place is to have electric lights at an early day.

RIVER FOREST, ILL.—The people of this place have voted in favor of electric lights.

CONTRACTING NEWS DEPARTMENT.

A WEEKLY RECORD

OF SPECIAL INTEREST TO CONTRACTORS, BUILDERS AND MANUFACTURERS OF ENGINEERING AND BUILDING SUPPLIES.

CONTRACTING INTELLIGENCE.

Our readers will oblige us by notes, clippings, or any information which will put us in the way of obtaining early and reliable news for our "Contracting Intelligence." *Information of importance sent to us exclusively, and not elsewhere published will be liberally paid for.*

For works for which proposals are requested see also the "Proposal Columns," pages i-ii-306.

LACK of space compels us to omit a list of projected buildings in New York, Brooklyn and Philadelphia.

WATER.

For Additional Water Items see Proposal Columns.

LANCASTER, PA.—The experts who have been investigating the water-works matter at this place, have submitted a report recommending the construction of a new reservoir of about 40,000,000 gallons capacity; also the addition of a new pumping engine with a capacity of about 12,000,000 gallons.

ALEXANDRIA, LA.—The City Council is considering the water-works matter, and is called upon to decide whether a water-works or electric light plant should be established, as the taxpayers do not favor having both at once.

MADISON, N. J.—Water-works are being constructed here by Moffett, Hodgkins & Clarke, under the superintendency of Edward O. Geran.

GREELEY CENTER, NEB.—City Clerk J. B. Gaffrey writes: "We are not ready at present to do anything in regard to water-works; not before spring. When we are I shall inform you."

HARDWICK, VT.—Postmaster Ira A. Shattuck writes: "Messrs. Aiken & Bridgman are to put in a system of village water-works sufficient for fire and domestic purposes—large enough for a village of 3,000 to 5,000 inhabitants."

WESTFIELD, PA.—The sum of $25,000 is to be expended on a water-works plant to be established at this place by a company of which J. H. Miller is president.

MADISON, ILL.—The Madison Water-Works Company will soon erect a plant at this place, at an estimated outlay of $20,000. Charles D. McLene can furnish particulars.

DOVER, N. J.—Important improvements and extensions are soon to be made to the local system of water-works.

CHAMBERSBURG, PA.—The water-works project at this place has progressed so far that proposals for doing the work will soon be wanted.

KALKASKA, MICH.—The work on a system of water-works here is to be commenced immediately by the Michigan Pipe Company, of Bay City, Mich. About 3½ miles of Wyckoff pipe, 30 hydrants and valves, special castings, etc., will be used.

BELVIDERE, ILL.—A complete system of water-works is to be established at this place.

LA GRANGE, GA.—The establishment of a system of water-works is now being agitated in La Grange, and a vote by the citizens, for or against the issuance of bonds for that purpose, will be held some time soon.

CHICAGO, ILL.—The Finance Committee of the City Council has decided to recommend the construction of a new water supply system for Lake, a suburb of this city, at a cost of $1,000,000.

LINCOLN, ILL.—Regarding the report that this place was to have water-works, John H. Starkey, City Clerk, writes: "We have a good system of water-works, that was put in in 1886 by New York parties."

ATLANTA, GA.—The Hall Bros., civil and mining engineers, have completed a report of their survey of a waterway to North Peachtree, estimating the cost at $223,000.

BUTTE, MONT.—The surveyors for the Silver Bow Water Company's new pipe line from the head of German gulch have reported the additional water supply to the city from that gulch is just what is wanted, and that operations can proceed at once.

SAVANNAH, GA.—The Savannah Water Company will extend its mains to Petersburg, a suburb of this city.

COLDWATER, MICH.—The following proposals for certain furnishings for the water-works system at this place, have been opened.

BIDDER.	VALVES.						HYDRANTS.	
	4-inch.	6-inch.	8-inch.	10-inch.	12-inch.	Amount.	3-noz.	2-noz.
Holyoke Hydrant and Iron Works	....	....	....	....	....	....	$2.80	$22.50
Bourbon Copper and Brass Works	....	$11.50	$17.50	$23.00	$33.00	....	32.00 34.50	28.00 30.00
National Tube Works	$8.50	14.00	21.00	29.00	38.00	$1,296.00	29.30 31.55 39.00	25.00 26.50 28.60
Eddy Valve Company	....	....	....	....	....	1,244.00	....	....
*Rensselaer Manufacturing Company	8.10	12.90	19.50	27.50	35.50	1,227.50	....	....
R. D. Wood & Co	7.90	12.50	18.75	26.50	35.00	1,189.05	33.50	31.00
Galvin Brass and Iron Works	7.90	11.85	18.50	26.75	34.75	1,159.50	32.50	24.00
Holly Manufacturing Company	7.45	12.00	18.40	31.00	42.50	1,179.10	....	....
E. Mansell	10.00	16.25	27.50	37.33	51.80	1,598.45	....	....
Moffett, Hodgkins & Clarke	8.48	13.06	19.36	29.49	40.00	1,259.00	25.66	23.32
Frontier Iron and Brass Works	5.70	9.25	15.25	22.50	28.00	921.65	38.00	36.00
Galvin Valve and Hydrant Company	7.50	12.00	18.00	26.00	35.00	1,143.00	28.00	26.00
Approximate Numbers	32	42	13	5	1	....	25	75

*Awarded contract. Boxes only—Brigham and Fay Company, $361.75. Boxes each—Holyoke Hydrant and Iron Works, $425.

PUMPING STATION.—George Camike, Coldwater, deductions made, $8,208; Campbell & Baer, Hillsdale, Mich., complete, $8,333; Brown & Sherman, amended bid, Coldwater, Mich., $7,566; Moffett, Hodgkins & Clarke, complete, $7,800.

PUMP WELL.—Brown & Sherman, Coldwater, 20 feet deep, $725; 25 feet deep, $1,014; 30 feet deep, $1,582; 40 feet deep, $2,720; Moffett, Hodgkins & Clarke, Syracuse, N. Y., 20 feet deep, $2,500; 25 feet deep, $3,500; 30 feet deep, $5,000; 40 feet deep, $7,000; Dowagiac Construction Co., Dowagiac, Mich., 30 feet deep, $3,700; T. C. Brooks, Jackson, Mich., 30 feet deep, $6,000.

ARTESIAN WELL.—Dowagiac Construction Co., Dowagiac, Mich., for 8 6-inch wells, 50 feet deep, $2,161.14; 65 feet deep, $2,464.17; 70 feet deep, $3,562.34; 75 feet deep, $2,663.50; 80 feet deep, $2,760; strainers for all, $280 extra; Island City Well Co., Eaton Rapids, Mich., all $250 per foot for 6-inch wells; National Water Supply Co., 6 wells, $2,385; 10 wells, $4,305; Cook Well Co., St. Louis, Mo., 6-inch well, 55 feet deep, $240, each well; 8-inch well, 55 feet deep, $294; 6-inch well, 95 feet deep, $335; 8-inch well, 95 feet deep, $415.

PUMPING MACHINERY AND BOILERS.—Hughes Steam Pump Co., 12-horse power, four bids, as follows: $4,000, $3,460, $3,510, $2,890; Lansing Iron and Engine Works, boilers only, $1,794; Erie City Iron Works, boilers only, $1,485; Jackson Foundry and Machine Co., boilers only, $1,600; Holly Manufacturing Co., engine, four bids, as follows: $2,500, $3,500, $2,800, $3,900. Price of two pumps twice that of one, less 10 per cent of the total amount. Deane Steam Pump Co., engine, $5,630; E. Mansell, complete, $2,603.

MASON CITY, ILL.—Considerable pipe will soon be wanted at this place for the water-works plant, which is at present under way.

TARBORO, N. C.—The water-works question is still the all-absorbing topic at this place.

BUENA VISTA, GA.—According to reports the water-works system projected for this place will soon take shape.

SUTTON, NEB.—The following bids for constructing a water-works system were received by A. A. Richardson, Lincoln, Neb., Oct. 1, Contracts awarded as follows: Porter Boiler Manufacturing Co., Chicago, stand pipe, $2,500; boiler $500; John McCarthy, Wymore, Neb., base of stand-pipe, $900; Tamaqua Mfg.Co., hydrants, $783; Bourbon Copper and Brass Works, Cincinnati, valves, $193; E. C. McCushland, Grand Island, Neb., pipe laying, 8, 6 and 4-inch, 19 cents per foot; Fredericks & Wentz, Sutton, Neb., house, $700; South St. Louis Foundry and Pipe Co., St. Louis, pipe, $33; special, $56. All bids on wells and machinery rejected.

WESTCHESTER, PA.—The Water Committee of the Borough Council has for several days been prospecting in the eastern part of West Goshen township for a more adequate supply of water for the town, the recently established industries in the place having made such a step necessary.

ATLANTA, GA.—The *Atlanta Constitution* publishes the following proposals for the construction of a new water supply, on the two lift scheme at this place, which were opened October 1, by the General Committee on new Water-Works:

Filters.—National Water Purifying Co., New York, $24,900, bid including buildings, etc; Hyatt Pure Water Co., New York, $26,704.

Pumping Engines.—Holly Manufacturing Co., Lockport, N. Y., 6,000,000-gallon engine, $28,120 and $41,600; 10,000,000-gallon engine, $49,900 and $72,800. Henry R. Worthington, 6,000,000-gallon engine, $37,000; 10,000,000-gallon engine, $40,000.

Boilers.—Atlanta Machine Works, $14,700; Holly Manufacturing Co., $21,240.

Pipe.—Anniston Pipe Works, W. F. Plane, agent, cast-iron pipe and specials as per printed advertisements, 20, 30 and 36-inch cast-iron pipe, $22.95 per ton; specials at $2.35. W. H. Merigold, Anniston, Ala., 36-inch pipe, $5 per lineal foot; 30-inch pipe, $1.25 per lineal foot; 20-inch pipe, 85 cents per lineal foot. For solid rock excavation add $1.25 per cubic feet. R. D. Wood & Co., Philadelphia, 33, 30, 20-inch pipe, $25 per ton; specials, 2½ cents per pound; Y's and breeches, 3 9/10 cents per pound. The McNeal Pipe and Foundry Co., Burlington, N. J., 36, 30, 20-inch pipe at $29.71 per ton; specials, 2¾ cents per pound. The Addyston Pipe and Steel Co., Cincinnati, O., pipe, $28 per ton; specials, $60 and $80. Dennis, Long & Co., Louisville, Ky., pipe at $25.80 per ton; specials, 3 cents per pound. Howard-Harrison Iron Co., Bessemer, Ala., pipe, $22.24 per ton; specials, 2½ cents per pound. E. Sutphin, St. Louis, Mo., 20-inch pipe, $3.25 per lineal foot; 30-inch pipe, class B, $5.76 per lineal foot; 30-inch pipe, Class C, $6.24 per lineal foot; 36-inch pipe, $9.25 per lineal foot; valves, 20-inch, $145; valves, 30-inch, $420; valves, 36-inch, $570. This bid includes the laying of pipe. 20-inch pipe, 80 cents per lineal foot; 30-inch pipe, $1.48 per lineal foot; 36-inch pipe, $4.67 per lineal foot. Gloucester Iron Works, Philadelphia, 36-inch pipe, $28.91 per ton; 30-inch pipe, $28.91 per ton; 20-inch pipe, $28.91 per ton; special castings, above sizes, $55 per ton. Dunn Bros., Birmingham, Ala., or Rome, Ga., 36-inch pipe, 75 cents per lineal foot; 30-inch pipe, 52 cents per lineal foot; 20-inch pipe, 36 cents per lineal foot.

Valves.—Bids to furnish valves for the works were received from the Eddy Valve Co., Waterford, N. Y., and the Ludlow Valve Manufacturing Co., Troy, N. Y.

The following are the bids on a scheme contemplating only one lift. These bids were presented by request of the Water-works Committee, at a subsequent session. The H. R. Worthington Co., of New York, put in a bid reading: For two 7,000,000-gallon engines, $85,000; a 10,000,000-gallon engine, $17,250, and nine boilers, $16,047. The Holly Co.'s bid was: For two 7,000,000-gallon engines, $99,000; a 10,000,000-gallon engine, $22,500, and eight boilers, $1,600. The one-lift scheme suggest two 7,000,000-gallon engines at the river, with 10,000,000-gallon engine to raise the water from the river to the reservoir. The bids were referred to a special committee. The contract for furnishing the pipe was awarded to the Howard Harrison Iron Company, of Bessemer, Ala.

GALVESTON, TEX.—Some time ago the City Council advertiseed for bids to sink an experimental well, to demonstrate if pure, wholesome water could be obtained by that process. Only one bid was received, and that not being satisfactory, at a meeting of the Council held recently, the Water Committee was authorized to contract with any reliable well boring company which would agree to sink a deep well. The Council has already set aside $24,000 for this purpose, and has authorized the committee having the matter in charge to expend any reasonable amount above that sum for the purpose of securing such a well.

WASHINGTON, D. C.—An exchange publishes the following item: "The acting Vice-Commercial Agent of the United States at Noumea, New Caledonia, informs the Department of State in a dispatch under date of August 14, that the municipal authorities of that city have invited bids for the construction of a projected water supply between the Dumbea River and the city of Noumea. For the information of any American firms who may desire to bid on the work, the acting Vice-Commercial Agent, in his dispatch, informs the department that similar works have been constructed for the city of San Diego, Cal., which presents a remarkable analogy with the situation of Noumea. The Dumbea River is about 30 kilometers from the city. The estimated cost of the work is about 2,500,000 francs ($500,000), the Government will furnish labor at 50 centimes (10 cents) per day. The department will be pleased to aid American firms all they can in obtaining the necessary information to enable them to bid on the work."

MERIDEN, CONN.—The Water Committee has submitted its report to the Common Council on the question of an additional water supply. The report recommends the North Side site as the most available, and places the cost at $200,240. No action has as yet been taken on the report.

RICHLANDS, VA.—It is stated that the contract for constructing a system of water-works at this place has been awarded to Howard Murphy, of Philadelphia, Pa.

EATONTON, GA.—Regarding the report that this place was to have a system of water-works, Town Clerk D. B. Nesbet writes: "There are no prospects for water-works in our town at present."

ROCHESTER, N. Y.—Contracts will soon be let for numerous water-works extensions.

GRENADA, MISS.—At a public meeting held September 24 it was decided to settle the question of water-works and electric light by a special election. The proposition is for the city to father the enterprise by the issuance of $20,000 of bonds, to run 20 years.

EAU CLAIRE, WIS.—Reports say that negotiations are pending for the purchase of the Dells Water Power Company, the Eau Claire Gas Company and the Brush Electric Light Company, by a syndicate of Maine capitalists.

GOSHEN, IND.—There is now a scheme on foot at this place to make an expenditure of $20,000 on a system of water-works.

MISHAWAKA, IND.—A water works company has been incorporated for the purpose of introducing water in this place; capital stock, $20,000. For particulars address Wallace H. Dodge, as above.

RIVER FOREST, ILL.—A water works system is one of the improvements proposed for this place.

MILFORD, MASS.—A new pump, with a daily capacity of 1,500,000 gallons, is to be added to the plant of the local water company.

OCONTO, WIS.—A water-works system, with 11 miles of pipe and 80 hydrants, is to be established at this place.

LEXINGTON, NEB.—A. A. Richardson, engineer, Lincoln, Neb., is drawing plans for $20,000 water-works for this place.

WATER VALLEY, MISS.—The people of this place have voted the sum of $10,000 for water-works, and if the Board of Aldermen indorse their action, operations will soon commence.

San Angelo, Tex.—The President of the San Angelo Water-Works Company, writes: "The City Council is soon to act on our proposition to enlarge, remodel and extend our works. New source of supply, new pumping machinery, additional tower, and 6 miles of cast-iron mains extensions."

Hingham, Mass.—Several thousand feet of water mains are to be laid in this place.

Hebron, Neb.—Plans and specifications are now being prepared for a $25,000 waterworks for this place by A. A. Richardson, engineer of Lincoln, Neb. For further information apply to A. A. Richardson, engineer, Lincoln, Neb.

Jersey City, N. J.—A contract for 200 lengths of 8-inch cast-iron pipe, and 600 lengths of 6-inch, has been awarded to R. D. Wood & Co., of Philadelphia, for $26.95 per gross ton.

Toronto, Ont.—Among the improvements proposed for the water-works system at this place is the addition of two 10,000,000 gallon pumping engines.

Fargo, Dak.—At the meeting of the Council next week steps will be taken to immediately commence to lay mains, as far as the finances permit, in those portions of the city which have hitherto been without a water supply. For particulars address Mayor Ball, as above.

Parkersburg, Pa.—The citizens of this place are taking steps towards organizing a company for the purpose of supplying the town with water.

McKeesport, Pa.—The Superintendent of the water-works at this place has recommended the addition of two compound condensing engines, an additional rising main and a new power house, the entire cost being estimated at $40,000.

Benton Harbor, Mich.—The Board of Trustees of this place has granted a franchise to the Benton Harbor Water Supply Company to establish and maintain a system of waterworks here. Several miles of mains will be laid and 75 hydrants will be used. For particulars address George B. Thayer, City Clerk, as above.

Wilton, Iowa.—The projected waterworks system for this place will cost $14,000.

Waterbury, Conn.—The question of improving the water supply at this place is receiving the attention of the local authorities.

Blaine, Wash.—J. W. Tanner, City Clerk, writes: We have a water-works under construction, which will be completed by the 1st of January, 1891. Franchise granted to the Northwest Water Company, and operated by the same.

Water-Works.—See our Proposal Columns for information regarding water-works and water-works furnishings at the following places: Keithsburg, Ill.; Philadelphia, Pa.; Austin, Tex.; Ashland, Ky.; Berryville, Va.; Toronto, Canada; Rushville, Ind.

SEWERAGE.

For Additional Sewerage Items see Proposal Columns

Des Moines, Iowa.—Civil Engineer B. Schreiner writes: "The improvement of the sewerage system of this city consists, besides some laterals of smaller extent, of a 66-inch intercepting sewer, which will be completed before the fall season ends. This sewer will be at present one mile long, with future extension of perhaps another mile. This sewer is calculated to drain about three square miles, and was mainly constructed to facilitate the drainage of cellars and basements, as the underground water in these localities rises to within two to three feet to the surface. The price for this sewer is $5.65 per lineal foot, including manholes and catch-basins."

Joliet, Ill.—A general sewerage system, to cost about $140,000, will likely be projected here next season. Plans were made some time since by Charles H. Ledlie, C. E., of 417 Olive Street, St. Louis, Mo.

Knoxville, Tenn.—It is expected that Colonel Hartford will render his report regarding his survey looking to the construction of a sewerage here very soon, after which the final steps will be taken in the matter by the Board of Public Works.

Sacramento Cal.—The question of a system of drainage for this city is at present being discussed by the local officials. County Surveyor Boyd has just completed a survey of the place, and it is expected that important steps will soon be taken.

Albany, N. Y.—The following proposals were received by the Board of Contract and Apportionment, October 6, for the placing of certain drains: John Doyle offered to lay 2,180 lineal feet of 18-inch pipe for $3 per foot; 916 feet of 15-inch pipe for $2.75 per foot; 3,248 feet of 12-inch pipe for $2.50 per foot; 170 feet of 6-inch pipe for 60 cents per foot; 60 Y branches for the 18-inch, $6.50 each; 33 15-inch Y's, $5.80 each; 94 12-inch Y's, $5.50 each; 15 manholes, $70 each; 4 lampholes, $20 each; 14 receiving basins, $95 each; 60 feet of 3-foot culvert, $4.50 per foot; 200 feet of 2-foot square box drain, $1.50 per foot. William S. Dyer, for the first item, $1.53; second, 95 cents; third, 69 cents; fourth, 25 cents; fifth, $3.25; sixth. $2.25; seventh, $1.95; eighth, 47½ cents; ninth, $10; tenth, $80; eleventh, $1.63; twelfth, $1. John J. Holler, first, $2.18; second, $1.85; third, $1.60; fourth, 25 cents; fifth, $3.85; sixth, $3.05; seventh, $2.60; eighth, $55; ninth, $14; tenth, $95; eleventh, $4; twelfth, 50 cents. William E. Murphy, first, $3; second, $3; third, $285; fourth, 50 cents. fifth, $9; sixth, $8.50; seventh, $8; eighth; $50; ninth, $16; tenth, $90; eleventh, $3.50, twelfth, 60 cents. Thomas Reilly, first, $4.90; second, $4.75; third, $4.60; fourth, $2.30; fifth, $860; sixth, $790; seventh, $740; eighth, $99; ninth, $75; tenth, $190; eleventh, $6; twelfth, $3.

Orange, N. J.—The Citizens' Committee, appointed to confer with the Common Council Committee on the plans for the proposed sewerage system, has submitted its report to the people. The report recommends the house sewerage system, as designated by C. Ph. Bassett, C. E., to which the consulting engineers have given their approval, "provided the ground water drainage is excluded from the house sewers, is complete and sufficient, both for the present and for the forty years next to come." It is also provided that "the ground water piping be connected with the storm water system and not with the house system." The Committee also recommends that the proposed system be adopted by the city, as soon as the power to act is given. Henry Graves is chairman of the Committee.

Far Rockaway, N. Y.—Civil Engineer Thomas D. Smith has been requested by the Board of Sewer Commissioners of this place to prepare two maps, one showing the outlines of a gravity system having one outlet, and then a similar system having two outlets, either to be made available with or without a system of deodorization, as might subsequently be determined upon. These maps are to show the locations of all main and lateral sewer pipes, the necessary depth of cuttings, etc. It is expected that Mr. Smith will make a report at a meeting of the Board to be held in a few days.

Quincy, Mass.—The Committee on Sewerage has submitted its report to the City Council. It recommends the adoption of an act to authorize the city to adopt a system of sewerage or sewage disposal for a part or the whole of its territory, in accordance with any general plans which have been or may be approved by the State Board of Health, the authority to construct, lay, maintain, repair, alter and operate to vest in a Board of Commissioners, to be appointed by the Mayor as soon as practicable after the passage of the act. The matter was laid on the table.

Woonsocket, Mass.—At a meeting of the Business Men's Association of this place, held October 7, the sewerage question was discussed. James Murray is president of the Association.

Scranton, Pa.—It is proposed to establish a system of sewers at South Scranton.

Mt. Vernon, O.—Plans and specifications for the main sewer in Eastern District No. 2 are on file in the office of the City Civil Engineer, who can furnish particulars regarding further operations.

Newport, R. I.—Numerous sewer extensions are to be made at this place.

Iron Mountain, Mich.—John J. Saving, City Clerk, writes: "The sewerage system contemplated by this city has fallen through for the present."

Macon, Ga.—It is stated that John T. Boifeuillet will introduce a bill in the Legislature to sewer this city. After this action is taken the people will be called upon to vote on the question.

Sewers.—See our Proposal Columns fo information regarding sewer construction a the following places: Jersey City, N. J. Dayton, O.; New York City; Denver, Col. Albuquerque, N. M.

BRIDGES AND IRON STRUCTURES.

For Additional Bridge Items see Proposal Columns.

Philadelphia, Pa.—The specifications for the approaches to the proposed bridge over the Schuylkill River at Walnut Street, this city, are now ready and are in the hands of Louis Wagner, Director of Public Works.

Boston, Mass.—The following bids were received October 4 for widening the drew of the North Harvard Street bridge: George H. Cavanaugh, $9,500; Alexander McInnis, $10,153; W. A. Kenrick & Son, $10,169.92; John Cavanaugh, $7,900; May & Ellis, $8,750.

Sioux City, Iowa.—An ordinance requiring the building of a viaduct over the railroad tracks on lower Fourth Street has been passed by the City Council, and the City Engineer has been instructed to make the necessary plans and specifications. The proposition of the Chicago, Milwaukee and St. Paul Co. to build a viaduct over its track on Fairmount Avenue has also been accepted by the Council.

Scranton, Pa.—It is more than probable that this city will pass the ordinance authorizing the erection of several bridges.

Baltimore, Md.—According to reports the Baltimore and Potomac Railroad Co. will soon bridge its tracks in this city.

Charlotte, N. C.—Reports say that the Charlotte, Columbia and Augusta Railroad Co. may erect an iron bridge over its tracks, in this city. Address the Chief Engineer, this city.

McKeesport, Pa.—The proposed bridge, to be known as the Port Vue structure, to span the Youghiogheny River, at Thirteenth Street, is to be erected.

Biddeford, Me.—A new bridge is to be erected at this place. Address the County Commissioners, as above.

Augusta, Ga.—The bridge projected to span the Savannah River, to be built by the North Augusta Company, is soon to be commenced. General Manager James V. Jackson expects to receive the plans and specifications from Grant Wilkins, the contracting engineer of the bridge, and then proposals will be advertised for. It is proposed to open the bids October 20.

Zanesville, Ala.—A new bridge is to be erected over Village Creek, at this place. Address Clerk Miller, of the City Court, for details.

Knoxville, Tenn.—The following bids for the erection of an iron bridge on Fifth Avenue, this city, were received by the City Engineer, October 4: King Iron Bridge Co., Cleveland, O., with Dalton rail, $14,500; with Cincinnati rail, $14,835; Wrought Iron Bridge Co., Canton, O., $15,200; Youngstown Bridge Co., Youngstown, O., $15,450; Smith Bridge Co., Toledo, O., $15,549; Massillon Bridge Co., Massillon, O., $15,600 through truss; $15,700 low truss; Chicago Bridge and Iron Co., Chicago, Ill., $15,789; Edge Moor Bridge Works, Edge Moor, Del., $16,349.

Knoxville, Tenn.—This city is considering plans for replacing the Gay Street bridge with a plate girder one; length, about 600 feet; roadway, 22 feet; two 8-foot sidewalks; capacity 100 pounds over all.

Knoxville, Tenn.—The Cherokee Land Company of this city will build, at an early date, a highway bridge across the Tennessee River here. The bridge will be about 1,200 feet long, including approaches. J. C. J. Williams, President.

Pittsburg, Pa.—The project to construct a bridge from Ella Street, Sixteenth Ward, to Ridge Street, Thirteenth Ward, over the valley, has been returned to the Council with a negative recommendation.

Baltimore, Md.—Proposals will soon be wanted for the construction of the Monroe Street Bridge, the plans, etc., for which are now being made.

Boston, Mass.—Plans for a bridge to be erected at Roxbury, over the tracks of the Fitchburg, to abolish the present grade crossing, have been submitted to the City Council for approval. The estimated cost of the bridge proper is placed at $78,142.

Dallas, Tex.—Contracts for the erection of bridges over Turtle Creek, at Lemmon Avenue and Peak Street, have been awarded to the George E. King Bridge Company.

Hancock, Md.—It is probable that the proposed bridge to be erected over the Potomac River, at this place, will soon be built, at a cost of $16,000.

Charlotte, S. C.—Reports say that the Charlotte, Columbia and Augusta Railroad will bridge its tracks at this place.

West Bay City, Mich.—The Saginaw River is to be bridged at this place by a $41,000 structure, the plans for which are now being prepared.

Bridges.—See our Proposal Columns for information regarding bridge construction at the following places: Augusta, Ga.; Zanesville, O.; Becket, Mass.; Helena, Mont.; Greenville, S. C.; Dublin, Ga.; Houston, Tex.; Philadelphia, Pa.

RAILROADS CANALS ETC.

Alton, Ill.—The Holmes syndicate has purchased the two street railroads here, and will build a new line, and operate all three by electricity.

Knoxville, Tenn—The Knoxville Street Railway Company is having surveys made under direction of W. C. Crozier, C. E., for an extension of its system to Lounsdale, about two miles.

STREET-WORK AND PAVING.

Westminster, Md.—The sum of $30,000 remains to be expended on improving the streets of this place.

Toledo, O.—Numerous street improvements are soon to be made in this city.

Montreal, Can.—The Sicilian Asphalt Paving Company has been awarded the contract for laying an asphalt sidewalk, one inch thick, on a 4-inch concrete foundation, at $3.23 a square yard, and 49 cents for the curb stone.

Salt Lake City, Utah.—Numerous streets of this city are to be repaved.

GAS AND ELECTRICITY.

Wilton, Iowa.—An electric light plant is to be established here at once.

Atlanta, Ga.—The Atlanta Electric Illuminating Company has been organized at this place with M. H. Atkinson for President, and a capital stock of $100,000.

Little Falls, N. Y.—A citizens meeting was held at this place October 4, for the purpose of looking into the advisability of organing a local electric light company with a view of utilizing the East Canada Creek for power. The meeting resulted in appointing the Hon. S. M. Richmond chairman of a committee to confer further in the matter with the Village Trustees.

Toronto, Ont.—Rumors say that this city will soon want bids for lighting the public streets by gas, as the electric lights are to be abandoned.

Leechburg, Pa.—An electric light plant is to be established at this place.

Berlin, Wis.—An electric light plant is to be established at this place, at a cost of $12,000.

Oscoda, Mich.—The people of this place have decided in favor of establishing an electric lighting plant.

Alexandria, La.—The question of establishing an electric light plant is being discussed.

Jamaica, N. Y.—A few weeks ago the Trustees of this village awarded a contract to the National Electric Manufacturing Company to light the village by electricity at the rate of $17.50 for each lamp of 32 candlepower. The Jamaica Gas Company wanted $24 per lamp. Three electric companies competed, and the National was the lowest bidder. On October 8 the gas company took an assignment of the contract. The assignor will put in the plant as provided for in the contract. The number of lamps will be 150 at starting, but 200 will be required to fully light the village.

Santa Fe, N. M.—The sum of $25,000 is to be expended on an electric light plant for this place.

Electric Railways.—New electric railways will be established, and improvements will be made to those already in operation at the following places: Olympia, Wash.; Lawrence, Mass.; Venice, Ill.; Sacramento, Cal.; Knoxville, Tenn.; Barnegat, N. J.; Philadelphia, Pa.; Eau Claire, Wis.; Cheyenne Park, Col.; Reading, Pa.; Schenectady, N.Y.; New Haven, Conn.

BIDS OPENED.

Albany, N. Y.—Superintendent of Public Works Hannan awarded the following contracts October 7: For superstructure of an iron bridge east of Lock No. 42, Erie Canal, near Herkimer, to Groton Building Co. at $2,070. For rebuilding culvert at Mechanicsville, to Cunningham & Riley, Sandy Hill, at $5.597.30. Improving 3,900 feet of canal wall near Mechanicsville, to same parties at $29.389. Improving wasteway north of Mechanicsville, to same parties at $5,708.75. Improvements to canal wall near Lansings waste weir to J. W. Whalen, of Whitehall, at $10,144.25. Improving 3,200 feet canal wall near Searles waste weir to Gardin & Dardes, of Fort Edward, at $18,011.50.

Brooklyn, N. Y.—Bids for two new boilers at the penitentiary were received by the Charities Commissioners October 4. They were as follows: R. A. Robbins, $2.497; Peter J. Donahue, $2,300; C. E. Jackson (for the Vertical Tube Boiler Company), $1,975; Smith Brothers (for the Brooklyn Iron Works), $2,475; Alexander Reid, Jr., $2,220; Donigan & Swift, $2,042; Blake & Williams, $2,087; Reene & Thomas, $2,200.

Ogdensburg, N. Y.—The E. H. Cook Company, of Rochester, N. Y., has secured the contract for heating the St. Lawrence State Hospital for the Insane, located at this place, the figure being $100,000.

Minneapolis, Minn.—The contract for 90 miles of the extension of the Soo from Hankinson, N. D., northwest, has been let to Linton & Co., 401 Nicollet Avenue, Minneapolis. Work will begin at once and pushed to completion as fast as possible.

GOVERNMENT WORK.

Washington, D. C.—The following proposals for the work specified were opened on the given dates by the Supervising Architects of the Treasury Department:

Pittsburg, Pa.—Low-pressure heating and ventilating apparatus of the Court House and Post-office at this place, opened October 8. Bidders: Schaefer & Becker, Cleveland, O., $75,230.30; Q. N. Evans Construction Co., New York, $76,209; Kelly & Jones Co., Pittsburg, Pa., $64,493; Crook, Horner & Co., Baltimore, Md., $59,867.43; Samuel I. Pope & Co., Chicago, Ill., $46,850; John Lyon, $61,075.66.

Eastport, Me.—Rolled iron beams, girders, etc., for the first story of the United States Custom House and Post-office at this place. Opened October 7. Bidders: Dearborn Foundry Co., Chicago, Ill., $880,000; Charles Raffen & Co, Chicago, Ill., $1,115,000.

NAVY DEPARTMENT.

Norfolk, Va.—For tile capping for the marine railway at the Navy Yard at this place. Opened October 8. Bidder: Holtzclaw Bros., Hampton, Va., $2,369.

Boston, Mass.—Pumping plant for the dry dock at the Navy Yard at this place. Opened October 8. Bidders: Holly Manufacturing Co., Lockport, N. Y., $156,400; Southwark Foundry and Machine Co., of Philadelphia, Pa., $149,890; Samuel I. Pope & Co., Chicago, Ill., $134,197.

Norfolk, Va.—For connecting the new pumps with the old dry docks at this place. Opened October 8. Bidder: Crook, Horner & Co., Baltimore, Md., $14,809.

Washington, D. C.—Bids were opened at the Navy Department, October 6, for the construction of the three steel tugs for the use of the navy, to cost not exceeding $35,000 each. The bids were as follows: Globe Iron Works Company, of Cleveland, O., for three tugs, $103,500, or at the rate of $34,500 for each, The Pusey & Jones Company, of Wilmington, Del., for one tug $45,000, for two tugs, $44,000 each, and for three tugs, $43,000 each. John H. Dialogue, of Camden, N. J., for three tugs, $99.900, at the rate of $33,300 for each. People's Machine and Boiler Works, of Baltimore, Md., for one tug, $34,500, and for two tugs, $34,250 each. Neafie & Levy, of Philadelphia, for one tug, $33.364, and for three tugs $100,000, or $33,333⅓ for each. The Samuel L. Moore & Sons Company, of Elizabeth, N. J., for one tug, $34,500, for two tugs $34,125 each, and for three tugs $34,000 each. Harrison Loring, of Boston, Mass., for three tugs $97,314, or at the rate of $32,438 each. The bid of Neafie & Levy is irregular in not being according to the plans of the Department.

Trenton, N. J.—The following proposals for the construction of a bridge over Stony Brook, at Mone's Mills, were opened by the Board of Chosen Freeholders, October 8: Iron work. New Jersey Steel and Iron Company, $1,800; Penn Bridge Company, Beaver Falls, Pa., $1,820; Wallis Iron Works, Jersey City, $1,985; Pittsburg Bridge Company, Pittsburg, $1,810; Millicken Brothers, New York, $1,875; Groton Bridge and Mfg. Co., Groton, N. Y., $1,806; Wrought Iron Bridge Company, Canton, O., $1,809. Mason work: James Duncan, $3,481; Chatten & Ewing, $2,489; A. M. Walton, $2,790; J. J. Johnston, $2,646. The contract was awarded to the lowest responsible bidder. The contract on the iron work was awarded to the highest bidder, on the grounds that such action would insure a complete job.

INDUSTRIAL.

Natural Bridge, Va. — The syndicate which recently purchased the park surrounding the Natural Bridge, will improve the property by building upon it a substantial stone hotel at a cost of $250,000. A feature of the improvement will be the illumination of the bridge and grounds by electricity.

Pullman, Ill.—S. S. Beman, architect, is preparing plans for a $250,000 repair shop for the Pullman Palace Car Co. It will be 500 feet square and furnished with steam heat and electricity.

PROPOSALS.

(Continued from page ii.)

U S. ENGINEER OFFICE, 18 W. SARATOGA Street, Baltimore, Md., September 30, 1890.—Proposals for completing the **SHIP-CHANNEL** leading to the harbor at Baltimore, will be received until noon of December 2, 1890, and then opened. The attention of bidders is invited to the acts of Congress approved February 26, 1885, and February 23, 1887, vol. 23, page 332, and vol. 24, page 414, Statutes at Large. For information, apply to WM. P. CRAIGHILL, Colonel Corps of Engineers, U. S. A. 22

OFFICE OF LIGHT-HOUSE INSPECTOR, Third District, Tompkinsville, N. Y., Post-Office Box 2128, New York, N. Y., October 9, 1890.—Proposals will be received at this office until 1 o'clock P. M. on TUESDAY the 11th day of November, 1890, for furnishing to the Light-House Establishment such **IRON BUOYS** and appendages, mooring-chain, and bells, as may be required during the fiscal year to end June 30, 1891. The articles to be furnished embrace nun, can, bell whistling and ice buoys, shackles, swivels, mooring-chain, ballast balls, iron and stone sinkers, etc., all of which are enumerated in the specifications attached to the form of bid, which may be obtained on application to this office. Contracts will be awarded on each item separately, and bidders are required to state the time when they will agree to deliver the articles. The right is reserved to reject any or all bids, to strike out any item or items in the specifications, and to waive any defects. HENRY F. PICKING, Captain, U. S. N., Light-House Inspector, Third District.

WATER-WORKS, Keithsburg, Ill.—Proposals are wanted until October 23, for constructing a standpipe system of water-works. Address J. L. Noble, Mayor, as above.

BRIDGE, Augusta, Ga.—Proposals are wanted until October 20, for the construction of a bridge to span the Savannah River. Address Grant Wilkins, 9½ Peachtree Street, Atlanta, Ga.

CITY HALL, Keithsburg, Ill. — Proposals are wanted until October 23, for the completion of a city hall for said city. Address J. L. Noble, Mayor, as above.

PILE WORK, Savannah, Ga. — Proposals are wanted until October 20, for constructing training walls in the Savannah River. Address O. M. Carter, First Lieut. Corps of Engineers, U. S. A,

WATER POWER, Winnipeg, Manitoba.—Proposals are wanted until October 15, for the construction of the work necessary to make available the water power of the Assiniboine River. Address Joshua Callaway, Chairman Special Water Power Committee, as above.

BRIDGE, Zanesville, O.—Proposals are wanted until November 11, for the construction of a bridge across the Muskingum River. Address J. A. Knight, Auditor, as above.

STREET WORK, Jersey City, N. J.—Proposals are wanted until October 20, for the improvement of Woodward Street. Address E. A. Dugan, Chairman of Streets and Sewers, as above.

SEWERS, Jersey City, N. J.—Proposals are wanted until October 20, for the construction of the Hopkins Street Sewer. Address E. A. Dugan, Chairman of Streets and Sewers, as above,

BRIDGE, Becket, Mass.—Proposals are wanted until October 16, for the construction of an iron bridge at this place. Address J. A. Hunt, as above.

RESERVOIR, Philadelphia, Pa.—Proposals are wanted until November 7, for the construction of a reservoir. Address Louis Wagner, 1321 Filbert Street, as above.

CAST-IRON PIPES, Philadelphia, Pa.—Proposals are wanted until October 16, for cast-iron pipes, special castings, etc. Address Louis Wagner, 1321 Filbert Street, as above.

LAVATORY BUILDING, Boston, Mass.—Proposals are wanted until October 20, for building a woman's lavatory at Charlesbank. Address Park Commissioners at Boston, Mass.

HOSPITAL, Atlanta, Ga.—Proposals are wanted until October 20, for labor and material required in constructing the buildings for the Grady Hospital. Address Jacob Elsas, Chairman Building Committee of Grady Hospital, as above.

Building Intelligence.

BOERNE, TEX.—Dr Barpitz can furnish information regarding a $100,000 hotel to be built here.

CADILLAC, MICH. — Lumber mill, cost, $50,000; o, Cobb, Mitchell & Co; b, not let.

Saw mill; cost, $10,000; o, F A Diggins & Co; b, not let.

CAMBRIDGE, MASS. — Howard st, fr dwell; cost, $12 200; o, D W Chamberlain, a, Chamberlain & Austin; b, R L Snow.

CHATTANOOGA, TENN.—A hotel to cost $250,000 is to be erected on Cameron Hill in this city.

CINCINNATI, O.—Fairfield and Lincoln avs, 2½-story br dwell; cost, $15,000; o, Mrs Hannah Marks; c, Jas Griffith & Sons.

Poplar, near Linn st, 3-story br slaughter house; cost, $8,000; o, Gottlieb Earhart.

CLEVELAND, O.—Wood and Lake, br and st apartment house; cost, $18,000; o, Robt Blee; a, Lehman & Schmitt; b, McMullen & Collister.

Bolivar, Sheriff and Huron, market bldg; cost, $300,000, o, Stock Co; a, as above; b, not let.

DALLAS, TEX.—The Oriental Hotel to be erected at this place will cost $600,000.

GALVESTON, TEX.—Av I bet 20th and 21st sts, electric street railway station; cost, $15,000; o, Wm H Sinclair, President Galveston Street Ry. Co; a, N J Clayton & Co.

GENEVA, ILL.—Burnham & Root, architects, Chicago, Ill, have the plans for a new court-house for this place. Contract not let yet.

HARVEY; ILL.—Charles Denham, of the Harvey Land Association, and others, are interested in the construction of a new hotel, to cost $25,000.

MINNEAPOLIS, MINN.—It is stated that a proposition was closed October 6 by which a new theater will shortly be opened in this city, at a cost of $75,000. Thomas Low, the street railway builder, has agreed to build the structure.

MINNEAPOLIS, MINN. — The Franklin Av M E Church will build a new church at Portland av and 22d st. Reputed cost, $80,000. Dr R N McKaig, pastor, taking active interest in plans.

MONTCLAIR, N. J.—Fullerton av, cor Plymouth st, addition to Congregational Church, and chapel for the same church on the adjoining lot; cost, $30,000 each; o, Congregational Church Society; a, J C Cady, of New York; b, not let.

NEW ORLEANS, LA.—A project is on foot to build a $1,000,000 resort hotel here; Mayor Shakspeare can give information.

NEWTON, MASS.—Prince st, fr dwell; cost, $8,000; o, Geo P Howlett; a, C H McClare; b, Briggs Bros.

SAGINAW, MICH. — S Franklin, 5-story and basement furniture store and offices; cost, $20,000; o, J L McCormack; a, F W Hollister; b, Wm Meuller.

SALEM, MASS.—A fire engine house, to cost $24,000, is to be erected in this city.

SARATOGA, N. Y.—A large bathing establishment will be erected here over the old Putnam Spring.

BUILDING INTELLIGENCE.

SIOUX CITY, IOWA.—Cor Douglas and 12th sts, stone Episcopal church; cost, $50,000; o, St Thomas Society; a, Henry M Congden; b, not let.

SOUTH BEND, IND.—Corner Notre Dame and Jefferson sts, 2½-story br and s dwell; cost, $10,000; o, Mrs M Coquillard.

ST. LOUIS, MO.—Olive st and Grand av, br hotel; cost, $18,500; o, Harriet Beers; b, A E Cook.

S w cor Leonard av and Locust st, br car-house; cost, $7,000; a, Mo R R Co; a, Milburn & Rich.

Finney av and Sarah st, br dwell; cost, $12,000; o, J E McGueness; b, T C Higgins.

Finney ave and Sarah st, br dwell; cost, $8,000; o and b, same as above.

9th and Arsenal sts, br stock house; cost, $30,000; o, A B Bwg Ass'n; b, sub-let.

N w cor 23d and Montgomery sts, br store and ten; cost, $7,500; o, Allenberg Bros; b, Wm Paul.

S w cor 12th and McGirk sts, br office bldg; cost, $7,000; o, Louis Obert; b, H H Schumaker.

S e cor Spring and Garfield avs, br church; cost, $10,000; o, First German Congregational Church; b, sub-let.

ST. PAUL, MINN.—Plans are being prepared for a new hotel at White Bear Lake, to cost $100,000. J D Ramaley will build it.

A permit has been issued to A H Wilder for the inside alterations in the 2-story br bldg on E 4th st, between Jackson and Sibley; estimated cost, $10,000.

Robert nr Delas, 3-story br and s stores and dwell; cost, $16,000; o, C F Meyer.

Case nr Arkwright, 3-story br stores; cost, $30,000; o, John Dale, President, St Paul Building Improvement Company.

Iglehart nr Fisk, 2 2-story br dwells; cost, $10,000; o, Burton & Ford.

TOMAHAWK, WIS.—A hotel, to cost $40,000, is to be erected at this place.

WATERBURY, CONN.—The School Committee has recommended that a new school building be provided, and it is understood that steps will be taken toward that end.

WILLIMANSETT, MASS. — br factory, 30x40; o, Springfield Facing Company; a, G P Alderman, of Holyoke.

WOOSTER, O.—Br business bldg; cost, $12,000; o, Jacob Frick; a, H. B Smith; b, not let.

WORCESTER, MASS.—Pleasant st, br theater; cost, $10,000; o, R C Taylor; a, Cutting & Forbush; b, day work.

Buildings.—There is nothing over $7,000 in value to report at the following places: Geneva, N. Y.; Binghamton, N. Y.; South Bethlehem, Pa; Pottstown, Pa.; Harrisburg, Pa.; Wilkes Barre, Pa.; Allegheny, Pa.; Poughkeepsie, N. Y.; Galveston, Tex.; Waco, Tex.; Madison, Wis.; Zanesville, O.

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IMPROVEMENT OF PUBLIC HIGHWAYS.

A NUMBER of States in the Union seem to be waking up at last to the necessity of having better country roads and a better system of making and repairing them, a matter in which THE ENGINEERING AND BUILDING RECORD has taken great interest, as is shown by the numerous articles upon the subject to be found in its columns during the past few years.

The importance of securing skilled engineering supervision, both for the construction and maintenance of highways, instead of leaving them to the tender mercies of the road overseers or highway commissioners, as they are severally entitled, in different localities, is patent to anyone who has given the subject any attention or thought. The engineer should not be an inexperienced one—still less a mere country surveyor—who, from his ignorance of the work of construction, would be easily hoodwinked by contractors, or over-ridden by the Board of Supervisors or other authority by whom he may be employed. One of the worst features of the old system is permitting road taxes of any person to be worked out by his day labor, or that of his teams or hired men, a practice which has frequently been condemned by many writers. Nothing could be more wasteful in labor or more inefficient.

Ohio has taken the lead, at least amongst the Western States, in requiring road taxes to be paid in cash, and strong efforts are being made both in Pennsylvania and Rhode Island to have laws passed abolishing the present practice of working them out. In Georgia and Alabama the necessity of highway improvement is generally acknowledged, and organized efforts are being made to obtain the necessary legislation for this purpose, though the advantages of securing the services of experienced engineers seem hardly yet to be understood or appreciated.

In Tennessee, however, as a consequence of the agitation of the subject, Dr. Olin H. Landdreth, of Vanderbilt University, who has for some years given to it much thought and study, has prepared for the consideration of the Tennessee Road Congress a bill for a new highway law for the State, in which the necessity for experienced engineering superintendence is given prominence. The bill seems to have been drawn with much skill and care. The practice of engaging the services of engineers for the improvement of roadways in different parts of New Jersey is also coming into more extended use. Taken altogether, there is every indication that the subject is, at last, to receive intelligent consideration from the proper authorities, and that something substantial will be done in the way of road improvement and maintenance.

POLITICS IN MUNICIPAL ENGINEERING.

THE New York daily press recently noticed the discharge of two employees by the Dock Commissioners, on the complaint of the Chief Engineer of the Dock Department, for inefficiency. The discharged men have set up a plea that they are members of the Grand Army, and have engaged an attorney to demand their reinstatement on this ground, compelling the Commissioners to refer the matter to the Corporation Counsel for an opinion. They, of course claim that they are not inefficient; but their interested statements would weigh little compared with the evidence of a skilled and reputable engineer like the present head of the engineering corps of the Dock Department.

Incompetent men and shirks are, naturally, to be found amongst the veterans as well as in all other classes, and whilst the tendency to give to men who risked their lives for the country during the war, a preference in public employment is defensible, no sentimentality should stand in the way of their prompt discharge if unable to properly fulfill their duties; still less if they presume upon their membership in the Grand Army to neglect and shirk their work.

This is only another phase of the crying evil of political management of public works in most of our large cities. The engineer is held responsible for the economical and efficient management, as well as for the quality of his work, and yet is often compelled to employ men, thrust upon him by party tricks and ward politicians, among whom the available places are parcelled out. If he attempts to discharge them for inefficiency, or even for worse cause, he is thwarted by the political "pull" at once exerted in their behalf. When, as was the case under the previous Croton Aqueduct Commission, such protection is extended to inspectors, the results must necessarily be disastrous. It may be too much to expect the near approach of an entire separation of politics from the expenditure of money for public works, but at least the responsible engineer, who has so much to do with the life and health of the community, should not be deprived in any degree of his power of removing his subordinates for cause, no matter to whose influence they may owe their appointments.

STEAMSHIP FIRE-ROOM VENTILATION.

FROM England comes a report that *The Lancet* recently sent a special reporter on board some ships to look into the conditions under which stokers work, the result being an article headed "Floating Death Traps," and descriptive of a state of things which an English contemporary hopes is confined to few vessels.

Unfortunately, *The Lancet's* article is not at hand and its exact nature, therefore, a matter of speculation. It is pretty safe to assume, however, that the article deals with the almost intolerable temperatures found in steamship fire-rooms, and the directly related subject of ventilation. From the information made public from time to time, of the exacting character of the work performed by firemen aboard a large number of steamships, and of the distressing conditions under which this work must be carried on, the general conviction can scarcely have been escaped that the problem of how to maintain a fairly comfortable atmosphere for these men to work in has received but scant attention. It is not to be expected that with blazing furnaces in necessarily cramped spaces temperatures much below 100° Fahr. can be secured, but, on the other hand, there is little reason why they should range from 20 to 40 degrees above this point. And yet such high temperatures are by far more common than ship-owners are willing to admit. That they can be avoided has been conclusively shown.

The whole matter, as pointed out in an earlier issue, is one of expense, and comparatively trifling expense too; but there is little hope of having the evil remedied so long as there is nothing to compel ship-owners to avail themselves of the existing means of bettering the fireman's condition, and so long as men can be found to fill the places vacated by others.

PRIZE FOR WATER-WORKS PROJECT.

About sixteen years ago the King of Belgium instituted an annual prize of 25,000 francs with a view of encouraging intellectual works upon various subjects. The prize which is to be the object of the international competition for 1893 will be awarded for the best work on the means of procuring for large cities, and particularly the city of Brussels, an abundant supply of the purest drinkable water, provision being made for the anticipated increase of population. Both manuscripts and printed works will be admitted for competition. The new edition of an existing work will only be receivable if it includes considerable modifications and developments published in the years 1889, 1890, 1891 or 1892. The works may be written in French, Flemish, English, German, Italian or Spanish. Foreigners desiring to compete will have to forward their works before the 1st of January, 1893, to the Minister of Agriculture. Industry and Public Works, in Brussels. Any manuscript work for which the prize may be awarded must be published during the course of the following year. The decision upon the competition will be given by a jury appointed by His Majesty the King of the Belgians and composed of seven members—three Belgians and four foreigners of different nationalities.

DESIGNS FOR THE FINE ARTS BUILDING AT NEW YORK.

The following members of the jury appointed to select plans for the new fine arts building at New York, met on the 14th, inst., in the rooms of the American Fine Arts Society, William M. Chase, President of the Society of American Artists; Russell Sturges, President of the Architectural League; Howard Russell Butler, President of the American Fine Arts Society; E. D. French, President of the Art Students' League, and Edward H. Kendall, Chairman of the Committee on Site and Plans. The Society of the American Artists, the Architectural League of New York, and the Art Students' League, which, in conjunction, compose the American Fine Arts Society, issued a circular some time ago, which was sent to a number of architects asking them to compete for plans of a new building, to be known as the Fine Arts Building, and in which each society was to occupy a specified part.

Three plans were selected at the recent meeting, out of thirty-one that were submitted in response to the circular, as coming within the requirements of the society and being particularly good. These will be returned to the architects, who will have sixty days to perfect them under the instructions of the society, when one of them will be selected for the building.

The three successful architects whose designs were thus chosen are, H. J. Hardenberg, of No. 10 West Twenty-third Street., with associate artists Walter C. Hunting and John C. Jacobsen; second design, Edmund B. Wells, of No. 111 Broadway, and the third by Babb, Cook & Willard, of No. 55 Broadway, all of New York.

THE PENNSYLVANIA SHIP CANAL.

According to Pittsburg reports the surveys of the Pennsylvania ship canal are practically finished, and the commission appointed by the Legislature will ask the State to complete the canal.

The commission find the scheme feasible, and favor a route along the Beaver River to Lake Erie. The commission, as a body, have not yet given any figures as to what it would cost to build the canal, but as individuals they have admitted that it would cost as much if not more than the Welland canal, which connects Lake Erie and Lake Ontario.

The Board of Brooklyn Bridge Experts held three meetings during the past week. One meeting was given over to the continuation of the examination of the plans. At the other two, Messrs. Charles E. Emery and W. E. Worthen were allowed to explain their ideas.

THE DUNDERBERG SPIRAL RAILROAD.

T. L. and H. J. Mumford, the controllers of the Mauch Chunk Switchback Railroad, have for several years thought of building a similar railroad and a hotel on one of the Highlands of the Hudson. In pursuance of this idea, experimental surveys were made on all the mountains in the neighborhood of West Point. The Dunderberg was the last to be examined, and was at once selected on account of its magnificent views and owing to its being the most accessible, and having, in addition, the advantage of being nearer the metropolis. As a result of this project a spiral railway is now being built up the side of the mountain. The cars will be drawn up by cable, the arrangement used being said to be perfectly safe. There will be two planes, one 600 feet in elevation, and the other ascending 400 feet more. At the top of each of these planes will be a stationary engine, which will perform the work of hauling up the trains. The cars will return to the foot by a spiral gravity railroad over ten miles in length, of an extremely circuitous route and commanding over six or eight entirely different views of the Hudson and surrounding country. On the extreme top will be erected a hotel. The Hudson River Improvement Company is carrying out the project.

ELECTRIC LIGHT IN THE SUEZ CANAL.

The regulations for the use of the electric light came into operation in March, 1887, and during the remainder of that year (according to statistics given in the recent British consular report from Port Said), the number using it was 394. In 1888 the number rose to 1,611, and last year reached 2,445. The average time of transit has also been considerably shortened. In 1886, it was 36 hours; in 1887, 33 hours, 58 minutes; in 1888, 31 hours, 15 minutes; and in 1889, it had been reduced to 25 hours, 50 minutes. The average time for using the electric light in 1889 was 22½ hours. The shortest time taken by a steamer in the transit of the canal in 1889, was 14¾ hours, which is 10 minutes less than the fastest passage on record previously.

AMERICAN INSTITUTE OF ARCHITECTS.

The twenty-fourth annual convention of the American Institute of Architects will be held at the Arlington Hotel, Washington, D. C., beginning October 22, 1890. The following is the order of proceedings and general information:

The meetings will be held in the Arlington Hotel, the rate being reduced from five to four dollars per day for the occasion. It is desirable, so as to expedite business and pleasure, to have all members stop at the same hotel.

The Board of Directors will meet on Tuesday afternoon, October 21, at 4 o'clock.

Afternoon Session, Wednesday, October 22, 4 o'clock.—Roll call. Address of welcome by the Hon. J. W. Douglass, President Board of Commissioners, District of Columbia; address by R. M. Hunt, F. A. I. A., President of the American Institute of Architects; reports of the Board of Directors, Treasurer, Committees and Chapters; the Trustees of the Corcoran Gallery of Art especially open, and invite members of the Institute and their ladies to the Gallery in the evening between 8 and 9 o'clock; the Cosmos Club will receive members after 9 o'clock.

Morning Session, Thursday, October 23, 10 o'clock.—Reports of committees, etc.; papers; Sketch of the History and Status of the American Institute of Architects, A. J. Bloor, F. A. I. A.; Foundations of Kansas City Hall, S. E. Chamberlain, F. A. I. A.; Science of Æsthetics, Henry Rutgers Marshall, F. A. I. A. Afternoon trip to Mt. Vernon and oyster lunch on the boat, given by the Washington architects. The "Charles Macalester" will leave the Seventh Street wharf promptly at 3 o'clock P. M.

Morning Session, Friday, October 24, 10 o'clock.—Election of officers; final business before the Convention; adjournment, followed by a visit to the White House. The afternoon, visitors can devote to sight-seeing in the city, as follows:

Mr. Edward Clarke will meet in his office in the Capitol at 3 o'clock all who wish to see that building. Mr. J. H. Windrim will receive at 2 o'clock, in the office of the Supervising Architect, Treasury Department, all who wish to examine the Treasury and Supervising Architect's office. Mr. G. Brown Goode will meet, in the reception-room of the National Museum at 2 o'clock, all who wish to see that building. Mr. Adolph Cluss will await in the reception-room, at 3 o'clock, those who wish to visit the Patent Office.

Other members of the Washington Chapter will hold themselves in readiness to accompany parties of visitors to any point of interest about the city which they may desire to see. The railroads will give a return rate for one-third the regular fare, in accordance with circular already issued by the Secretary. The architects who attend the convention will confer a favor on the Committee of Arrangements by signing the Register of the convention, which will be in the office of the Arlington Hotel, immediately upon their arrival.

CEMENT AT STETTIN, GERMANY.

According to a recent report by Andrew F. Fay, United States Consul at Stettin, Germany, there are in the neighborhood of that city six manufactories of cement—viz.: Stettin Portland Cement Company, the Star Portland Cement Company, the Bredow Portland Cement Company, the Pomerania Industrial Verein, all located at Stettin; the Mercun Cement Company, located at Jatsnick; the Gristow Cement Company, located at Gristow.

The total output of these six corporations amounts to about 1,000,000 barrels per annum; each barrel contains 170 kilograms (375 pounds). About 750,000 barrels are sold for domestic use, and the remaining 250,000 barrels are exported to the following named countries: Norway, Sweden, Denmark, United States, Russia, Austria (very little), Brazil, and Australia. The exports to Russia are diminishing very fast, inasmuch as the product of the Russian manufacturers is said to be very good.

The cost of the manufacture, including labor, is about 23 cents per 100 pounds. It may be a few cents more or less, according to the prevailing conditions and the year; however, the cost seldom exceeds that figure. The industry is in a prosperous condition.

OBITUARY.

Edward Balbach, Sr., the founder of the smelting works of E. Balbach & Son, at Newark, N. J., died on October 14, in his 87th year.

Commander Charles L. Huntington, of the U. S. Navy, died at Brooklyn, N. Y., on the 14th inst. He was recently detached from the command of the "Pensacola" on account of ill health.

Prof. Austin Phelps, of Andover, died at his Bar Harbor, Me., cottage on October 13, after a long illness. He was born in Brookfield, Mass., in 1820, and was graduated in 1837 at the University of Pennsylvania.

John R. Mawle, of Cookshire, P. Q., a civil engineer who assisted in the laying out of the Upper Coos, N. H., Railroad, and who was afterward in the service of the corporation, died recently at Dartmouth, N. H., aged 26.

Thomas Franklin Hoxey died on the 14th inst. at Paterson, N. J. He was born at Paterson, March 5, 1841, and was the oldest son of General Thomas D. Hoxey. He was an engineer by profession, and engaged most of his life in contracts for railroad building, and the construction of reservoirs for the Paterson Water-Works and the improvement of streets and roads.

Col. Herbert A. Hascall, U. S. A., retired, died in Chicago, on the 14th inst., after a long illness, aged 76. Colonel Hascall earned a reputation as a fearless officer in Florida during the Seminole outbreak, was in Utah during the Mormon troubles, and saw much active service in the Civil War. He was at one time professor of mathematics at West Point.

PERSONAL.

Martin Aulls & Follett, civil and consulting engineers, are the successors of Lowrie & Aulls, of Denver, Col.

Y. Foster Crowell, M. Am. Soc. C. E., has been called by the Government to Hayti to examine the question of local railroad matters.

F. Harvey Smith, C. E., formerly in the City Engineer's Department at Springfield, Mass., is now engaged on the sewerage system at Talladega, Ala.

Clift. Wise, Chief Engineer of the Minneapolis Street Railway Company, has severed his connection with that company. Mr. Wise has accepted a position with a new electrical company, and will have his office in New York.

D. M. Scott, M. E., who has lately been connected with the Detroit Heating and Lighting Company, at Chicago, has associated himself with the National Hot Water Heater Company, and will make his headquarters at their Chicago office.

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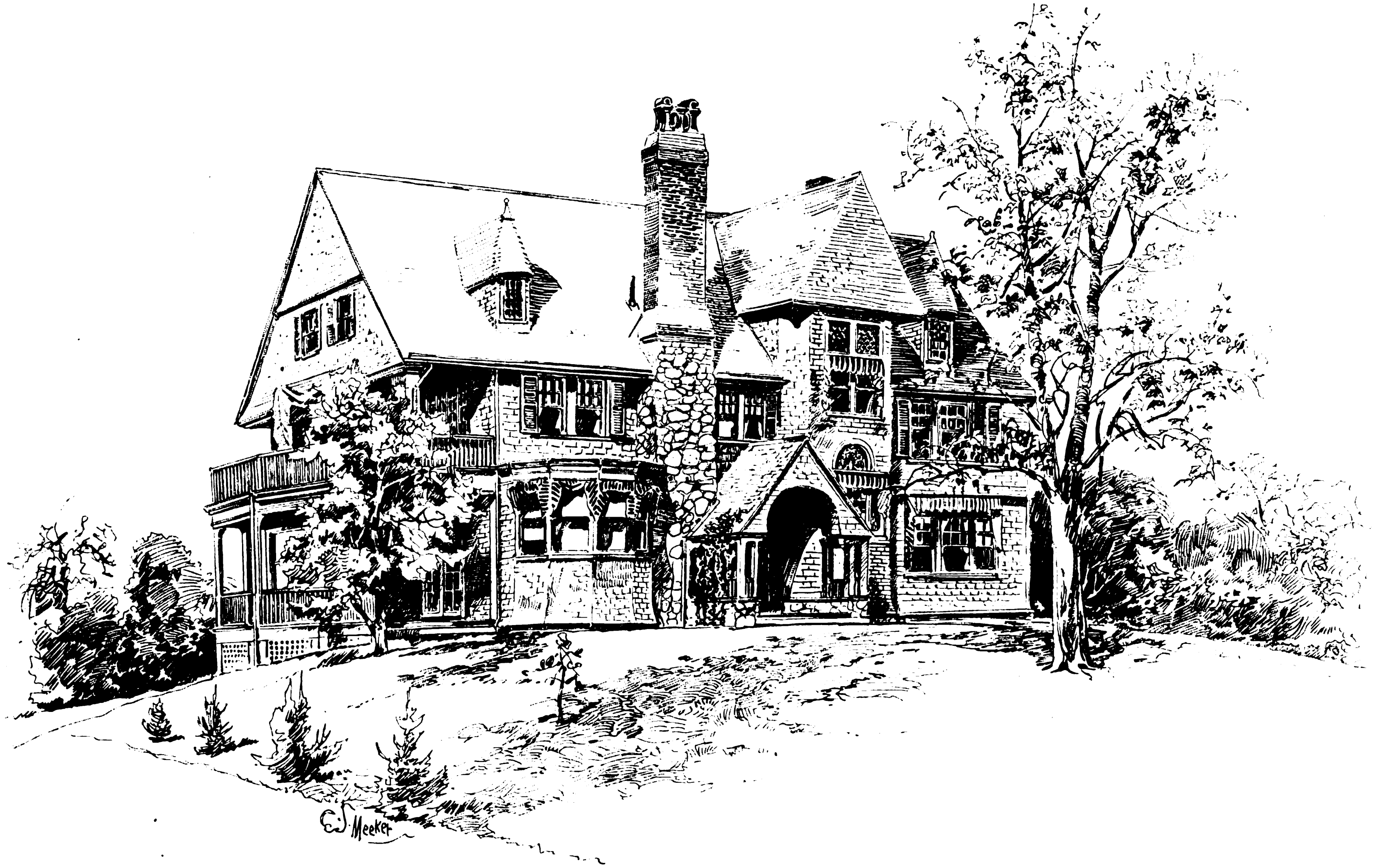

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ENGINEERING SOCIETIES.

A meeting of the Engineering Association of the Southwest was held at Chattanooga, Tenn., on October 10 and 11.

The Committee on the "Cause of the Setting of Cement," appointed at the Louisville meeting, submitted a report on the chemical relations involved in the process of setting, prepared by Dr. W. L. Dudley, of Vanderbilt University. The final report will be presented at a later meeting.

Mr. James A. Fairleigh, engineer in charge of the construction of the new Tennessee River Bridge, at Chattanooga, gave a detailed account of that structure, illustrating his remarks by elaborate drawings and maps. The subject was discussed at length by Mr. Thacher, of Louisville; Mr. Whinety, of Cincinnati; Colonel Barlow, of Nashville; Captain Chamberlain, of Chattanooga, and Professor Landreth, of Vanderbilt University.

Messrs. Joseph C. Guild and William Bowron, both mining engineers, of Chattanooga, entertained the visiting members with explanations of the geology and the mineral deposits of the Chattanoogo district, and illustrated their remarks by references to a very large and complete map of the Chattanooga mineral district, prepared for the Chamber of Commerce.

HOUSE OF REV. WILLIAM LAWRENCE, BAR HARBOR, ME.—ROTCH & TILDEN, ARCHITECTS, BOSTON, MASS.

An amendment to the constitution of the association was proposed reporting a change of the name of the association to the "Engineering Association of the South." The amendment will be discussed at the annual meeting at Nashville, Tenn., in November, and then go to the membership for ballot.

The Boston Society of Civil Engineers held a regular meeting on Wednesday evening, October 15, at 7.30 o'clock, with Vice-President William E. McClintock in the chair; S. E. Tinkham, Secretary, and about 60 members and visitors present.

The following were elected members: Charles F. Baxter, Boston; Frank A. Bayley, Cambridge, Mass.; Charles A. Bowman, Winchester, Mass.; Benjamin F. Goodnough, Brookline, Mass.; Ernest G. Hopson, South Framingham, Mass., and Arthur C. Moore, Sturbridge, Mass.

E. S. Dorr exhibited and explained a diagram for determining approximately the sizes of sewers.

Albert F. Noyes, referring to a map, briefly recounted the reasons for building an addition to the Newton, Mass., Water-Works, rendered necessary from the fact that certain elevated points in various sections of the city are without a sufficient water supply and pressure for fire purposes, etc.; and H. D. Woods gave a detailed description of the construction of the covered reservoir and filtering conduit now being built for the above works, illustrating by colored drawings.

The last paper of the evening was by H. H. Carter, who spoke on the settlement of large embankments, having special reference to the one between Squantum and Moon Island, in Boston Harbor, and illustrating with drawings.

The above papers were informally discussed by various members.

A regular meeting of the American Society of Civil Engineers was held October 15, Vice-President Alphonse Fteley presiding.

Past President William E. Worthen presented a paper on "Steam Heating," which elicited supplementary remarks by J. B. Francis, and discussions by C. E. Emery, W. J. Baldwin, A. Fteley, G. H White, H. W. Brinckerhoff, A. G. Brinckerhoff, F. W. Skinner, and others.

There was an attendance of about 70.

MEETINGS OF ENGINEERING SOCIETIES.

The American Society of Civil Engineers holds its r gular meetings on the first and third Wednesday in each month, at the House of the Society, 127 East Twenty-third Street, New York.

The Boston Society of Civil Engineers holds its regular meetings at the American House, Boston, at 7.30 P. M., on the third Wednesday in each month.

The Western Society of Engineers holds its regular meetings at its hall, No. 67 Washington Street, Chicago. at 7.30 P. M., on the first Wednesday in each month.

The Engineers' Club of St. Louis holds regular meetings in the club's room, Laclede Building, corner Fourth and Olive Streets, St. Louis, on the first and third Wednesdays in each month.

The Engineers' Club of Philadelphia holds regular meetings at the House of the Club, 1122 Girard Street, Philadelphia.

The Engineers' Society of Western Pennsylvania holds regular meetings on the third Tuesday in each month, at 7.30 P. M., at its rooms in the Penn Building, Pittsburg, Pa.

The Engineers' Club of Cincinnati holds its regular meetings at 8 P. M. on the third Thursday of each month at the Club rooms, No. 24 West Fourth Street, Cincinnati.

The Civil Engineers' Club of Cleveland holds regular meetings on the second Tuesday of each month, at 8 P. M., in the Case Library Building, Cleveland. Semi-monthly meetings are held on the fourth Tuesday of the month.

The Engineers' Club of Kansas City meets in Room 200, Baird Building, Kansas City, Mo., on the second Monday in each month.

The Engineering Association of the Southwest holds regular meetings on the second Thursday evening of each month at 8 o'clock, at the Association headquarters, Nos. 63 and 64 Baxter Court, Nashville, Tenn.

The Civil Engineers' Society of St. Paul meets at St. Paul, Minn., on the first Monday in each month.

The Montana Society of Civil Engineers meets at Helena Mont , at 7.30 P. M., on the third Saturday in each month.

The Civil Engineers' Association of Kansas holds regular meetings on the first Wednesday in each month at Wichita, Kan.

The New England Water-Works Association holds quarterly meetings in Boston at Young's Hotel.

The Canadian Society of Civil Engineers holds its regular meetings on each alternate Thursday, commencing with the 9th of October, at the House of the Society, 112 Mansfield Street, Montreal.

The Engineering Department of the Brooklyn Institute, Brooklyn, holds regular meetings, at 8 P. M., on the third Tuesday of each month. Until the Institute building is repaired, the meetings will be held in the rooms of the Young Men's Christian Association Building, 502 Fulton Street.

The convention of the American Institute of Architects will be held in Washington, D. C., beginning on October 22, and continuing until the business has been completed.

PHILADELPHIA CHAPTER OF THE AMERICAN INSTITUTE OF ARCHITECTS.

At a meeting of the Philadelphia Chapter, held Tuesday evening, October 14, the following were elected officers for 1890–91: T. P. Chandler, Jr., President; George C. Mason, Jr., First Vice-President; Lindley Johnson, Second Vice-President; Amos J. Boyden, 413 Walnut Street, Secretary; William C. Prichett, Jr., Treasurer; Isaac Pursell, T. Roney Williamson, other members of Executive Committee; Frank Miles Day, Librarian; Frank E. Meade, Assistant Librarian; Frank Miles Day, Wilson Eyre, Jr., Walter Cope, Amos J. Boyden, John Stewardson, Education Committee. The Chapter now has 75 members.

English capitalists are reported to have obtained options on about twenty sewer pipe manufactories, mostly at Akron, Columbus and other Ohio towns, for the purpose of forming a sewer pipe trust.

One of the results of the rapid growth of incandescent electric lighting is the increase in the price of platinum. The metal i[illegible] in every incandescent lamp, making connecti[illegible]bon filaments.

A BIRMINGHAM SHIP CANAL.

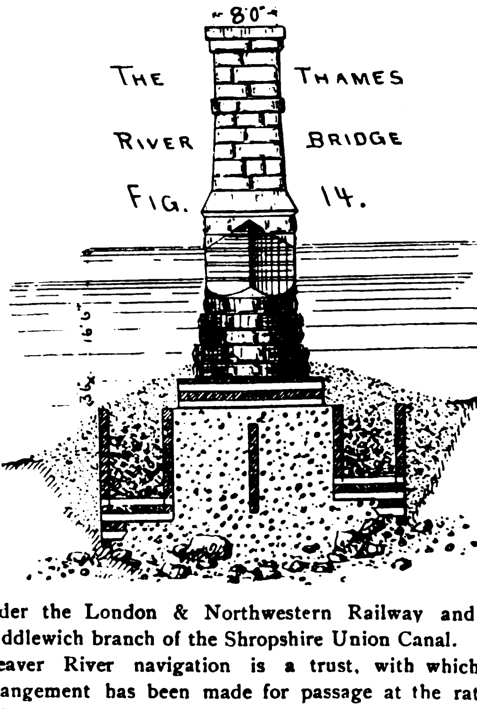
The demand of the traders of Birmingham and the midlands for better and cheaper communication with the sea has lately shown signs of revival, according to the London *Times*, in consequence of "the measure of revision which the Board of Trade offer in their newly published report on railway rates falling so far short of the requirements of midland traders that they begin to despair of relief through legislation, and they are, therefore, turning once again to the consideration of the obvious alternative, namely, improved water communication." After some consideration of rival routes, the one toward Liverpool has been adopted, passing through the heart of the Black Country to Wolverhampton, and thence, in a line nearly due north, through the potteries to Stoke-on-Trent. From this latter town it passes in a northwesterly direction through Kidsgrove and Wheelock to Winsford, where it joins the Weaver. Between Birmingham and this point of junction the distance is 61 miles, and the Weaver navigation extends for another 20 miles to the Mersey, which it strikes at Weston Point, 15 miles from Liverpool. The canal is to be 72 feet in minimum width and capable of accommodating sea-going vessels of 300 tons, or barges of 400 tons.

As the scheme is in the hands of a strong provisional committee of well-known local men, and is favored not only by the commercial classes of Birmingham and its vicinity, but by the land-owners along the proposed route, by the Manchester Ship Canal Co., and by the Mersey Docks Board, it seems likely to be carried out. On the other hand, of course, it must reckon on the determined opposition of the railroad companies, whose interest it so seriously threatens, and the costs of promotion, therefore, are likely to be heavy.

The estimated cost, including promotion, is not expected to exceed £3,000,000, and the promoters calculate that a charge of four shillings per ton on the carriage of 2,000,000 tons of merchandise yearly would earn 10 per cent. on the capital. The traffic over a single canal connected with Birmingham amounted during 1885 to 7,327,269 tons, including merchandise, 972,749; pig iron, 586,434; coal, 3,333,865: iron-stone, 495,912; sand, 115,791; lime and limestone, 140,828; road materials and manure, 525,249; bricks, 460,359, and in the same year 1,499,795 tons of goods were carried into Birmingham by rail and 263,660 tons were taken out. Therefore the amount of traffic does not seem excessive, and as the freight charge on scrap iron from Birmingham to Liverpool, apart from terminal charges, is 10 shillings per ton, the charge of four shillings for carriage seems reasonable.

The carriage of the above estimated merchandise is to be done by the company, which proposes purchasing a fleet of 30 steam barges, each carrying 250 tons, and 30 other barges, carrying 300 tons, to be towed, and a speed of eight or nine miles is expected, so that it will be possible to traverse the distance from Liverpool to Birmingham in 24 hours. It is estimated that each pair of barges will make about 70 trips per annum, giving a gross carrying power of 1,155,000 tons, in addition to which will be the traffic carried in private boats.

The levels of the canal, commencing at Birmingham at an elevation of 453 feet above the sea, fall to tide water at the emptying of the Weaver into the Mersey. This fall will be overcome by the balanced caissons or hydraulic lifts designed by Mr. Clark, and in such successful use on several European canals. The first lift at Wolverhampton will overcome a difference of level of 60 feet, with one or two heavy cuttings between that place and Birmingham. At Trentham there will be a tunnel 900 to 1,200 feet long through a ridge. From this the new canal will run parallel to the Trent & Mersey Canal, which, in a distance of seven miles has 25 locks, the passage of which occupies the best part of a working day. In the new canal this fall will be overcome by four lifts. At the junction with the Weaver River navigation, at Winsford, the descent will be made in two stages, as it will be necessary to go under the London & Northwestern Railway and the Middlewich branch of the Shropshire Union Canal. The Weaver River navigation is a trust, with which an arrangement has been made for passage at the rate of eight pence per ton, or eight mills per ton mile, said to be favorable terms. The locks on the Weaver are 220 feet long, 42 feet wide, with 15 feet of water on the sills. It is stated that the sides and bottom of the new canal are to be lined with 9 (?) feet of concrete, to withstand the wash of the passing boats, and that the width of 72 feet was adopted instead of 60 also on account of the waves generated by the passing tugs.



THE THAMES RIVER BRIDGE.*

Abstracted from the recently published report of Alfred P. Boller, Chief Engineer.

FLOOR BEAMS, PEDESTALS AND PIERS.

Figures 2 to 13, inclusive, illustrate some characteristic details of the construction of the superstructure shown in the general elevation on page 295. The other connections, though carefully designed for the given conditions, do not present features differing essentially from the usual first-class work of this kind in American railroad practice.

Figure 2 is a half elevation (at Z Z, Fig. 4), of an end floor beam in the 310-foot span. Figure 4 is an elevation at Y Y, Fig. 2, and Fig. 3 is a section at X X, Figs. 3 and 4, with the end post and lower chord removed to show the connection of floor beam and pedestal.

Figure 5 is a half elevation of an intermediate floor beam of the 164-foot 6-inch span, and shows the riveted connection to the floor beam of the cap B, which receives the lower chord pin.

Figure 6 is a half elevation of an intermediate floor beam of the 310-foot span, and shows its rigid connection to the vertical post by the angles H and D. F F are lateral rods attached to pin G. Figure 7 is a half elevation of the end floor beam of the draw span. Figure 8 is an elevation from T T, Fig. 7, and shows, in addition, the end post, lower chord and pedestal. Figure 8*a* is a section at Q Q, Fig. 8; C is a box inclosing and supporting the lifting gear, which is operated by the 3½-inch shaft I, driven through bevel gearing from the pivot pier. On shaft I is fixed the 13-toothed pinion J that meshes into the 36-toothed gear wheel K. The latter is keyed to the 9-inch cylindrical pillar L, which has a ½-inch thread, giving it vertical motion in its bearings M M. N is a foot piece attached to L, and making contact with the bedplate O when the draw is closed.

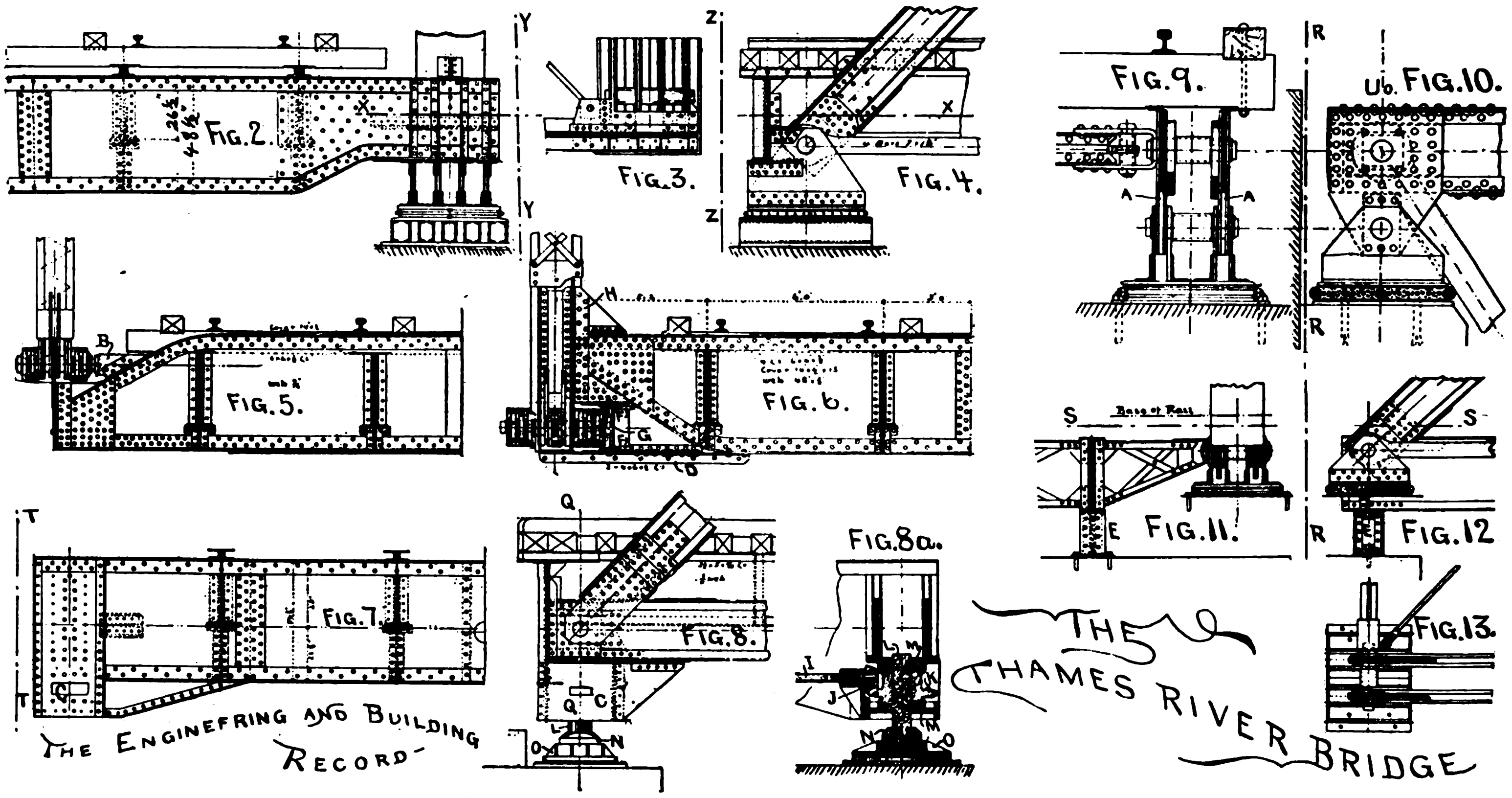


Figure 10 shows the rocker bearing on links A A, at the expansion ends of the end spans. Figure 9 is an elevation and section parallel to R R, Fig. 10. Figure 11 shows the support on the box pedestal E, of a track stringer at the west approach. Figure 12 is an elevation at R R, Fig. 11, and Fig. 13 is a section at S S, Figs. 11 and 12. Figure 14 shows the foundation of pier V. Figures 15, 16 and 17, show the construction of pier II. The other piers are similar to this.

A scheme, now said to be under consideration by the Caledonian Railway Company, Scotland, to accelerate their through traffic from England to the North of Scotland, involves either the bridging or tunneling of the Forth. There would thus seem to be promise of a rival to the present famed Forth bridge.

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*An historical and fully descriptive account of location, conditions, comparison and construction of foundations, design of superstructure, turning gear, signal apparatus and final tests, was published October 11.

PHILADELPHIA BRIDGE SPECIFICATIONS.

In the specifications just issued by the Department of Public Works, of Philadelphia, Pa., for wrought-iron approaches to the proposed bridge over the Schuylkill River, at Walnut Street, an unusual feature is noticed in the description of the longitudinal and transverse plate girders, for which the dimensions of all the principal angles and plates are given separately so as substantially to constitute a mill bill of material.

Besides the usual requirements for first-class girder work the specifications contain the following clauses:

"Bituminous concrete shall be laid upon the floor of roadway extending from curb to curb, 38 feet 2 inches in width. It shall be 1¼ inches in depth on the flat plates at curbs, and 1 inch in depth over crowns of the three middle rows of buckled plates of roadway.

"The bituminous concrete shall be composed of finely-grounded Val de Travers asphalt mastic, 50 parts, containing in itself as imported, not less than 15 per cent. by weight of bitumen; refined Trinidad asphalt, 10 parts; washed pea gravel and fine broken stone not exceeding ½ inch in largest dimensions, free of dust, 40 parts. The materials shall be heated at the bridge in the usual French kettles. The mastic and refined asphalt shall be heated together to a temperature of about 300° Fahr. The fine pebbles shall then be added and the whole mass thoroughly stirred and incorporated, forming an asphalt mortar. With this asphalt mortar the bituminous concrete will be formed, composed of two parts of asphaltic mortar and generally three parts of fine broken stone of a size suitable for the purpose and never exceeding 1½ inches in their largest dimensions. The proportion of stone may be decreased if desired at the time of construction, and it shall be heated to about 300° Fahr. before being mixed with the mortar. The concrete thus made shall be poured upon the wrought-iron deck of roadway, and by means of smoothing irons and wooden rubbers brought to a true grade.

"The surfaces upon which this composition is placed shall be free of moisture, and the face of cast-iron curb shall be painted with pure asphalt. All joints shall be absolutely water-tight."

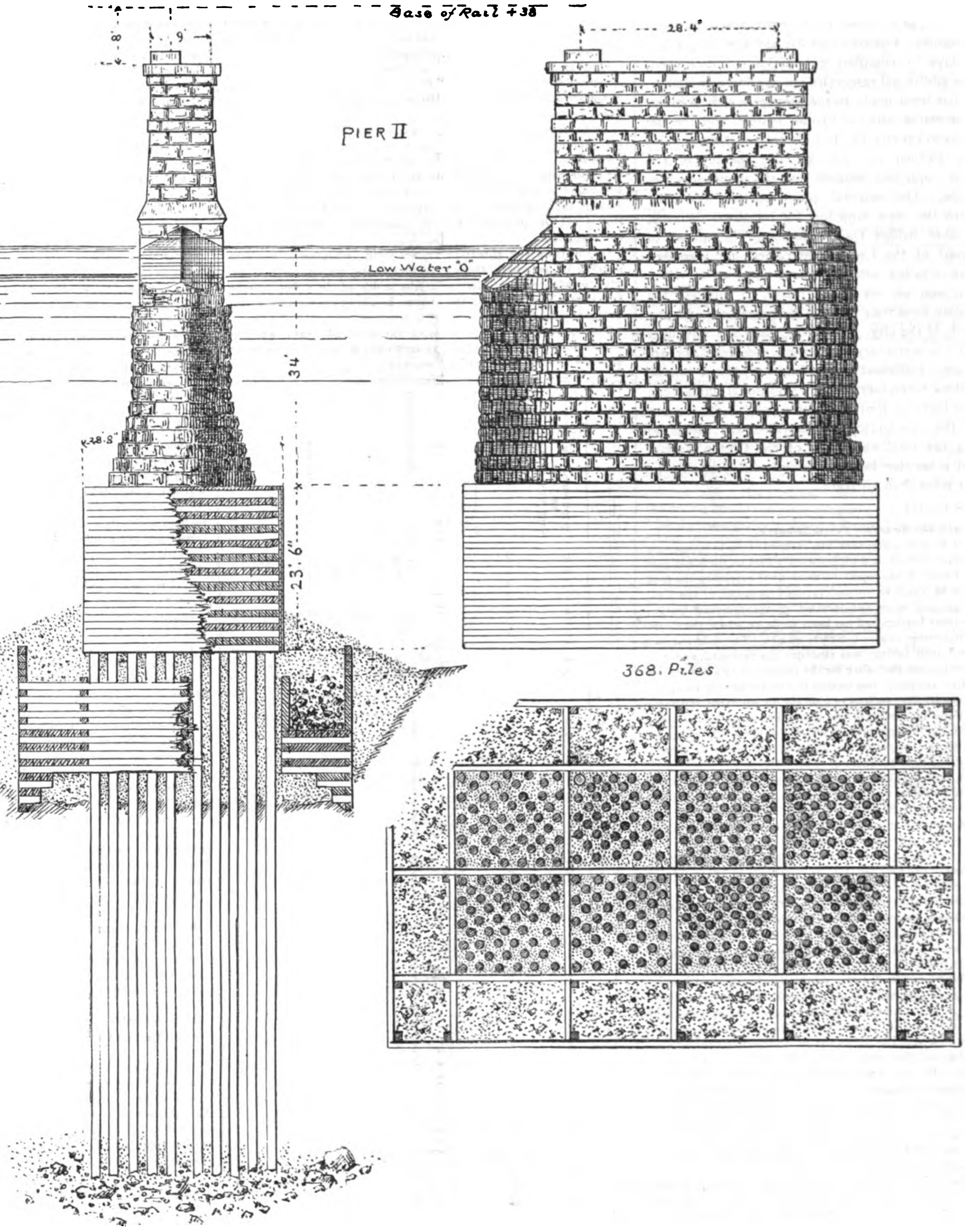
According to the recently issued report of S. M. Gray, City Engineer, of Providence, R. I., the average daily consumption of water in that city, for the year 1889, was 5,786,961 gallons. This includes waste and leakage, and the additional supply of about 18 miles of distributing pipes located in adjoining towns, and of the greater part of the State Institutions at Cranston.

ZINC IN CONTACT WITH BRICKWORK.

In an item which has appeared at intervals during the last two years, and is credited to a German paper, it is stated that in building the Berlin city market halls a portion of the zincwork which rested upon brick walls rapidly decayed, and as a preventive, the introduction of roofing-felt between the brickwork and the zinc is suggested.

Referring to this, Messrs. A. & C. Harston of London, England, write as follows to the *Building News*:

"There may be something peculiar in German bricks or mortar; but we have had a large experience in zincwork in England, and have never found any premature decay in the turns-up or flashings against brickwork. As to the introduction of roofing-felt under zinc, your readers should be cautioned against the recommendation. We were called in to report on the defects of a large flat, not laid under our superintendence, under the zinc of which roofing-felt had been laid over the boarding of the flat. No other cause of the decay of the zinc could be found than that the acids of the tar-felt had acted chemically on the zinc, and pitted it all over with small holes. No doubt hair-felt, not tar roofing-felt, would have been harmless, if unnecessary; but roofing-felt is always worked up with coarse tar, and should for this purpose be avoided."



Figs. 15, 16 and 17.
From the recently published report of Alfred P. Boller, Chief Engineer.

THE NEW CROTON DAM.

THE subjoined report of Chief Engineer A. Fteley, submitted to the Aqueduct Commissioners, of New York City, on October 8, has so important a bearing on the question of New York's water supply, which has always been fully discussed in our columns, that we give it practically in full and reproduce some of the most striking of the drawings that accompany it.

The report is a summary of the results and conclusions of Mr. Fteley's special investigations of the last two years, and will be submitted by the Commissioners to the "public hearing" on October 27. It describes the original conditions and proposed system, the present conditions and the future necessities and possibilties. So long ago as 1880, in a season of drought, Isaac Newton, then chief engineer, reported that the storage supply was within 15 days of complete exhaustion. Since then, though some additional reservoirs are nearing completion, no increase has been made to the storage which is maintained in connection with the Croton system, and the delivery of water to the city has been increased from 115 to 150 million gallons per day by the opening of the New Croton Aqueduct without at all increasing the actual supply. The original plan was to construct *simultaneously* the New Aqueduct for increased delivery, and the Quaker Bridge Dam to impound the rainfall of the largest part of the Croton water-shed, for increased storage; then to follow with additional dams across tributary streams, and on the upper levels, to increase the storage capacity from time to time. in accordance with the growing needs of the city. However, only the aqueduct and some of the secondary dams were completed, or are under contract. Sufficient supply for the present can be secured by these secondary dams. Additional supply can be secured in three or four years at a cost of $2,500.000 by building the new Croton Dam. This will utilize 30 per cent. of the total water-shed of the Croton Valley, which would otherwise be wasted, and will probably be adequate for more than 20 years.

The report reads:

To the Honorable the Aqueduct Commissioners:

GENTLEMEN: In December, 1888, you instructed me to investigate anew the question of building a high masonry dam on the lower part of the Croton River. I was especially desirous of extending the field of investigation in regard to the underground formation of the Croton Valley, above and below the location of the proposed Quaker Bridge Dam, where borings had not been made or where they were not sufficient in number to give complete results. The field covered by the diamond drill borings was consequently extended, and test holes were driven along the valley for the purpose of establishing, on a continuons line. the depth and quality of the underlying rock, and wherever the results were such as to indicate an apparent favorable location, additional holes were driven across the stream for the purpose of ascertaining the approximate sections of the solid rock under the surface. Especial attention was given to such places as present promising superficial indications.

The general results of these investigations show that the rock underlying the valley forms an excessive trough, the bottom of which lies from 60 to 100 feet or more below the bed of the river; this trough is filled with drift material, generally composed of hard pan and boulders, and, at places, of peculiarly hardened sand.

The present river bed is mostly in the drift, sometimes directly over the thalweg of the rock depression; sometimes on either side, so that the greatest depth of the rock is found either in the river bed itself or at a distance from it. At places the rock crops out in the river bed itself; but in such cases it has been invariably found that it dips sharply therefrom. The lowest point examined on the river, about a mile from its estuary, Fig. 3, may be mentioned as presenting on the surface remarkable favorable indications, the stream being there inclosed in a narrow canyon between two walls of rock; as, however, the appearance of the rock on the left bank left some doubt about its soundness and continuity, borings were made, which developed important layers of very soft material underlying the superincumbent rock, at such a depth as to put out of the questton the advisability of building at that point a very high dam; especially as the proximity of the Hudson River, and the great depth of the water, might have presented too great risks of loss through percolation.

Rock was also found in the river bed, at points marked: "Intermediate," "Cornell's," "Purdy's Brook," "Wire Mill Bridge," "Bailey's Brook," and "Location 2," Figs. 1, 2 and 3, and on other sheets, but at all these points, as previously stated, the rock was found to dip under the other side of the valley.

The investigation just referred to was made with the aid of two, and subsequently of three diamond drills; also by means of numerous test pits and trenches wherever the rock was supposed to be sufficiently near the surface to be reached with that simpler and less costly method, 176 holes were bored, covering a total aggregate of length of 14,005 feet.

After comparing the various sections which have been investigated, diagrams of which accompany this report, I do not think it necessary to call your further attention to more than three sites, below the present Croton Dam—viz.:

First.—The site of the proposed Quaker Bridge Dam.

Second.—The site designated as "Cornell's."

Third.—The site designated as "Location 2," C and D, a little less than a mile below the Croton Dam. (See Fig. 3 and other sheets.)

Quaker Bridge site is well known to you.

The Cornell site, Fig. 3, is located one and one-quarter miles abov Quaker Bridge, and presents several favorable features.

At that point, the width of the valley at high-water line is 1,736 feet; the greatest depth at which the rock is found is 23, nearly 40 feet higher than at Quaker Bridge; the earth excavation necessary at that point is larger, but it would take place at such a distance from the river as not to be in the way of the greatest freshets. A portion of the surface on the south side is favorably situated for the construction of a partial earth embankment and the overflow could conveniently take place over a spill-way of great length, built in an almost parallel direction with the contours of the valley on the northern bank of the river, the surplus water thus flowing in a channel with a gradual slope from its highest point to the river bed.

The water shed at that point is only one and one-half square miles less than it is above Quaker Bridge. The storage will be practically the same; the dam would not be as handsome a structure, but it would cost less, and its total height would be 40 feet less at the deepest point; the conditions as to the imperviousness of the side hills would, to all appearances, be superior.

On the whole, if it were found advisable to build the originally proposed high dam at Quaker Bridge, or in its vicinity, the merits of Cornell's site should be carefully considered before deciding on a final location.

In these two cases it is thought that, owing to the great height of the proposed structure, an all masonry section should be mostly used; earth banks with a masonry core have been used successfully for lesser heights, and, if built to the height necessary in the cases now under consideration, might be found equally reliable; but, in view of the importance of the interests involved, it is believed that this is not the place for trying an experiment of such a character and magnitude.

On the third site (Location 2), an earth embankment would be justified by practice, although an all masonry section could, if desired, be adopted. At that point the width of the valley between flow lines is 1,000 feet, and the extreme height of the crest above the river would be 100 feet.

The accompanying table, showing the principal features of the structure and the estimated cost in each case, is given for the better understanding of the following remarks:

Location.		Extreme Height* above River Bed.	Extreme Depth below River Bed.	Extreme Total Height.*	Length of Dam between Flow Lines	Capacity in Gallons.	Estimated Cost.			Probable Time of Construction.	Water Shed above Dam.
							Dam Proper.	Railroads, Roads, Bridges and Clearing.	Muscoot Dam, as previously estimated.		
Quaker Bridge..........		Feet 180	Feet. 91	Feet. 271	Feet. 1,402	34,000,000,000	$4,087 000	$1,075,000	$300,000	6 years.	377.8 square miles.
Cornell's...		159	70	229	1,736	30,000,000,000	3,650,000 (Approx'te)	1,075,000	300,000	5 years.	376.3 square miles.
No. 2.	Masonry.	105.5	100.5	206	995	16,000,000,000	2,450,000	910,000	300,000	4 years.	355.4 square miles.
	Earth and Masonry as Recommended.	105.5	100.5	206	995	16,000,000,000	1,750,000	910,000	300,000	3 to 4 years.	355.4 square miles.

* Top of Dam assumed at elevation 206 feet.

Before going further in the comparison of the four structures just referred to, permit me to call your attention a moment to the general conditions of the water-shed of Croton River, which is now being further utilized for the water supply of New York, and to the facts which render the construction of a dam on the main stream a matter of necessity.

The water-shed can be divided into two parts: one containing all the partial sheds corresponding to the various reservoirs built, in process of construction, or proposed, the other covering all the territory between these reservoirs and Croton Dam. This territory will vary in area according to the number of smaller reservoirs that may be built on the affluents, but it must necessarily be large; on the map appended to the report of the Chief Engineer of the Department of Public Works of February 21, 1883, it is represented as being 115 square miles, or about one-third of the whole water-shed. This area can be diminished by the location of additional dams on the lateral streams, but it would remain to large to be overlooked. The only possible means of collecting the drainage from the lower territory is a new reservoir of large capacity on the main stream, the present Croton Lake not being of sufficient capacity to perform that function.

Not to build such a reservoir at a low point on the main stream would be equivalent to the exclusion from the source of supply of a large portion of the water-shed.

This fact is forcibly illustrated by the records of the storage during the dry season. For instance, in the middle of September of the present year, when the present storage basins, owing to the dry weather, had been drawn from to the extent of a number of feet below the flow line, a copious rain produced a heavy overflow of Croton Dam, amounting to over 600 million gallons per day, while the upper reservoirs, covering comparatively limited territory, had shown but a small increase. It is true that subsequent rains filled all the reservoirs after a few days, but had dry weather prevailed instead, the waste of water over Croton Dam would have been keenly felt.

An additional and very weighty argument in regard to the location of such a reservoir is that, although the present Croton Dam has rendered good service for half a century, it must be conceded that it is not built in such a manner as a structure should be, on which depends the very life of New York, and it is necessary that it be replaced by a more substantial one. It may be said also that, inasmuch as the important parts of the New Aqueduct system are now built in view of the construction of a high dam on the lower part of the river, the rest of the work should be made to conform to the existing features.

For these reasons, and in view of the fact that the capacities of the Croton water-shed must be as fully developed as circumstances will warrant, it is hoped that the necessity of a large reservoir built below the present Croton Dam is sufficiently demonstrated, but the site where the dam forming such a reservoir should be built has not been as ye decided upon by your Commission.

When the work now in your charge was begun, the plan adopted included the location, in connection with the New Aqueduct, of a single reservoir a short distance above Quaker Bridge, the intention being to build from time to time, as the wants of the city should warrant, a number of large although smaller reservoirs higher up on the water-shed. The plan was then consistent and it was indorsed by high authorities; the reservoir being single had to be of a large capacity in order to furnish the required storage. One of the most essential conditions, however, for the carrying out in a full and consistent manner, the plan of the designers, was to begin the construction of the dam simultaneously with that of the New Aqueduct, or a short time afterwards, inasmuch as it would have required most probably not less than six years to complete an undertaking of such magnitude.

The situation is now radically different. Owing to the delay in coming to a decision as to the location of the Quaker Bridge Dam, it became evident that no additional storage could be procured at the time of the completion of the New Aqueduct, except by means of reservoirs which could be completed within a shorter time. The speedy procurement of such additional storage having become a question of absolute necessity, a dam on the east branch of Croton River was put under contract, then on Bog Brook, subsequently on Titicus River, and recently on the west branch near Carmel; in addition the Amawalk Dam is being built by the Department of Public works.

The dams just enumerated are designed to intercept the drainage of the upper parts of the water-shed, but the necessity of one being built on the lower part of the main stream remains, as has been explained, for the storage of the rain water which falls in the lower part of the basin.

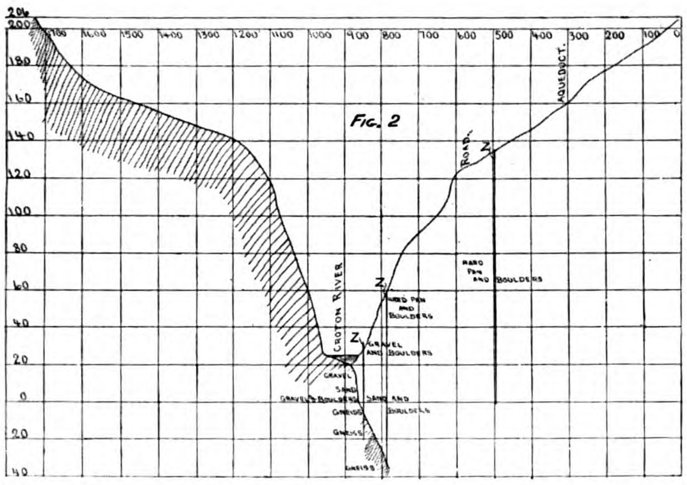
At this time, however, it may be properly questioned whether, at least for a long time to come, as large a storage as was to be provided by the Quaker Bridge Reservoir is consistently needed, and whether it would not be more advisable to build, at a smaller cost, a structure of less magnitude, which would furnish ample storage capacity for the next 20 years, and possibly for the whole extent to which the supply from the Croton water-shed should be properly developed.

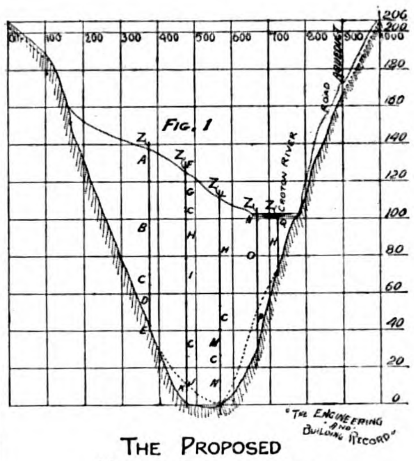
A site favorable for a structure of the kind just described has been found at the point already mentioned, nearly one mile below Croton Dam.

At that point the Croton Valley, if the water were raised to the same height as was proposed for the Quaker Bridge Dam, would form a reservoir of a capacity of 16 billion gallons. The following data in connection with it may be of interest. Above this site the water-shed has an area of 355 $\frac{37}{100}$ square miles; 22$\frac{4}{10}$ square miles less than at Quaker Bridge Dam, and 1$\frac{8}{10}$ square miles more than at the present Croton Dam.

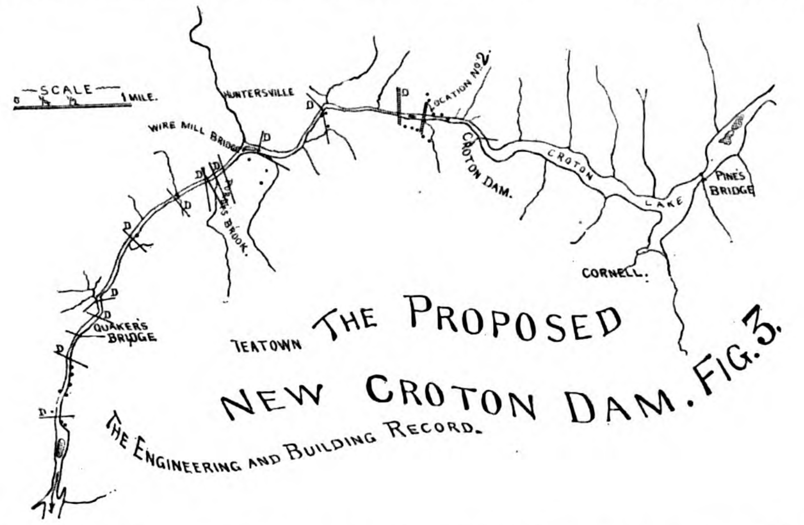
Records of the gaugings taken for many years show that the amount of water collected in the stream at Croton Dam in the year extending from February, 1880, to February, 1881 if entirely retained for the use of the city, would have furnished a daily average of a little less than 250 million gallons In order to ascertain the probable results of the system of storage, including the reservoir just mentioned at site No. 2, I caused computations to be made of the records of flow, day by day, during the extreme dry year 1880-81, and applied them to the probable management of the storage on the supposition that two such extreme dry years would follow one another, and that at the beginning of the first the reservoirs were, in one case, full, and in another case half full (see Fig. 4), the amount of water collected in and drawn from such reservoir being taken in proportion to its individual drainage area to the total area of the water-shed. The diagrams indicate the fact that, after taking into account the loss by evaporation, there would be left at the end of two years, just before the spring freshets, an amount of storage equivalent in the first case to 14,000 million gallons, in the second case to 8,000 million gallons, Owing to the well-known irregularity of the rainfall over various parts of the water-shed and in successive years, it is obvious that the actual distribution of the flow for two subsequent dry years would vary from the results just presented, but they are sufficient to show that, in the instance given, covering two successive very dry years, a daily supply of 250 million gallons would have been maintained, with a surplus equivalent to an additional daily quantity of about 40 million in one case and of 20 million gallons in the other.

In the uncertain condition of the census returns as regards the increase of the population of New York during the last decade, owing, also, to the exceptional condition of the water consumption of the city, which for years has been so inadequate that, since the opening of the New Aqueduct, it has shown in two months, I am informed, an increase of 35 million gallons per day (in all 150 million gallons), it is difficult to estimate how long the system of water-works just described would be sufficient; but unless waste is allowed to increase beyond ordinary limits it would be ample, if we include all the proposed reservoirs in the upper part of the water-shed, for the next twenty years.



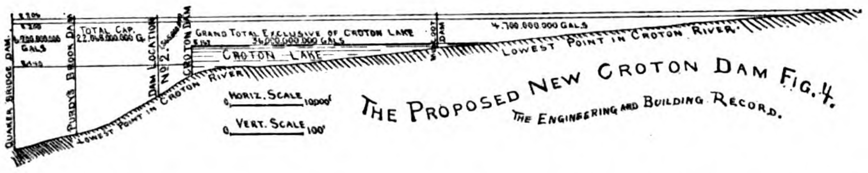


THE PROPOSED NEW CROTON DAM



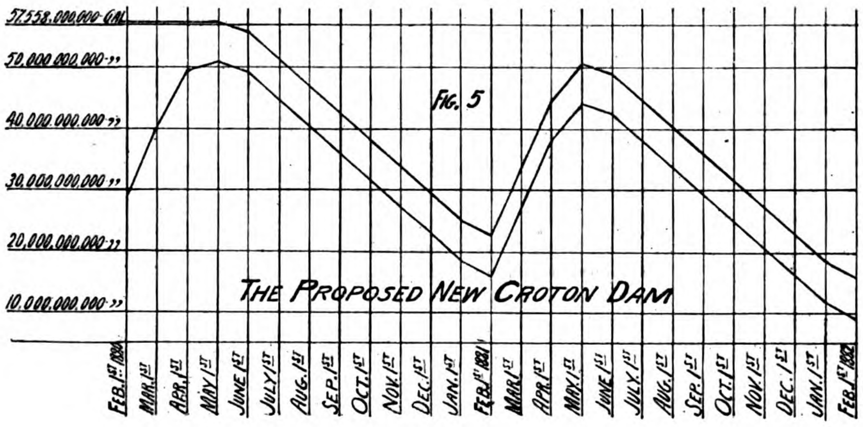
THE PROPOSED NEW CROTON DAM. FIG. 3.

THE ENGINEERING AND BUILDING RECORD.



THE PROPOSED NEW CROTON DAM FIG. 4.

THE ENGINEERING AND BUILDING RECORD.



THE PROPOSED NEW CROTON DAM

If this statement be admitted, it will be seen by reference to the table given above that the accumulated interest of the sum which could be saved at the present time by building the dam at Site No. 2 would be more than equal to the cost of its construction, and that, at the end of the time named, if it were found advisable to procure an increase of the water supply by the erection of a higher dam further down in the valley, it could be properly done without increased cost to the city, with the additional and obvious advantage of having two dams instead of one for the control of the immense body of water to be impounded.

By that time, also, the experience of a number of years in handling the constantly growing quantities procured from the water-shed would furnish increased and invaluable knowledge in regard to its capacities; in regard to the effect of the exceptionally large volume of the storage on the quality of the water; in regard to the subsequent advisability of accumulating the storage to add to the natural flow of dry years, and, ultimately, when the time would come for further action, in regard to an intelligent selection between an increase of the storage system of Croton water and the possible procurement of an additional and larger supply from the Housatonic River. At this point it may not be out of place to recall that your attention has already been directed to the advisability of preparing the way for future works by procuring a topographical survey of the 200 square miles of the Housatonic water-shed, which lie in the State of New York. It is to be regretted that doubts were expressed as to your jurisdiction in the premises, and that owing to them this useful work remains undone.

In conclusion: After reviewing the whole subject, and although fully recognizing the merits of the Quaker Bridge and Cornell's sites for the construction of a high dam, circumstances are now so different, owing to the construction of a number of reservoirs in the water-shed, from what they were when the new supply system was originally planned, that it is not thought advisable to recommend at present the construction of either.

A dam built at site No. 2, one mile below Croton Dam, is considered amply sufficient; its immediate construction is recommended and the accompanying plans, designed from the knowledge acquired of the topographical formation of that part of the Croton Valley, show its principal features. The dam could be entirely built of masonry; it is thought, however, that with the great size given to the spillway and the unusual height of the top of the structure above the latter, an earth embankment, as shown, would be sufficient and safe for a large part of the length, and could be built in less time, at less cost.

If compared with the higher dam formerly proposed its inferiority consists in draining a water-shed about six per cent. less extensive in area. Its superiority consists in the following: It can be built in much less time, three to four years instead of six; the land to be taken is of less area to the extent of 1,600 acres: the necessity of building a high and costly bridge at the Wire Mill Road and over the present Croton Dam, is avoided; the construction of new roads and bridges between this site and Quaker Bridge becomes almost wholly unnecessary, the whole cost is much less and, the dam being of much less height above the bed of the river, all the risks of accident, loss by leakage, delays, etc., which are proportional to the height and length of the dam are proportionally diminished.

The proposed dam, which, if built, would properly be named the New Croton Dam, is shown on the accompanying plan.

The spillway extends along the side hill a distance of 1,000 feet with a stepped channel to convey flood water to the river below. The height of its crest is at elevation 197 above tide, with three feet left for movable stop-planks. The top of the embankment is at elevation 220, and supports a road with a bridge over the spillway to connect with the highway on the other bank. The structure contains two sets of gates; one for the direct connection of the impounded water with the old aqueduct, the other of a very large capacity, for the emptying of the reservoir in case of need. The total contents of this reservoir would be 16,000,000,000 gallons. The same reasons which determined the construction of the Muscoot Dam, in connection with that of the Quaker Bridge Dam, for the purpose of keeping at an even and high level the water in the upper parts of the basin, exist in this case.

The location just described for a new Croton dam is not now mentioned for the first time. I am informed that at the time of the original construction of the present works the site had been seriously considered for the erection of the dam. Moreover, Chief Engineer Isaac Newton, of the Department of Public Works, in his report of February 21, 1883, refers to the fact that a dam could be built immediately below the present one, but that owing to the width of the valley, and to the absence of rock, he has not found it advisable to recommend it. His objection to the site is removed by the result of the underground survey now submitted to you.

With the construction of the new Croton Dam, the total storage available, including the present reservoirs and those under construction, would be over 50,000,000,000 gallons—*i. e.*, more than 200 days supply at the rate of 250,000,000 gallons per day, and would be larger after the construction of Reservoirs O and N, and others.

In the accompanying illustrations, Fig. 1 shows the profile at the point known as dam location No. 2, and recommended for the site of the new Croton Dam. The horizontal and vertical distances are marked on the margins, and the heavy line, with hatched edge, shows the position of the solid rock bed here continuous. Z Z, etc., are the sounding lines and the reference letter indicate the nature of the strata—viz.:

A, loam and boulders; B and H, hard pan and boulders; C, sand and boulders; D, hard sand and boulders; E, seam; F, loam and clay; G and O, hard pan and boulders; I, N and Q, gravel and boulders; J, rock, sand and gravel; K, soft gueiss rock; L, soil; M, hard sand; P, sand and soft rock.

Figure 2 is a similar diagram of the profile at one of the other proposed sites, which have been sounded by diamond drill borings. Here the rock exists, as indicated, on the left side and disappears altogether in the apparently similar right side.

Figure 3 is a diagram of part of the Croton Valley water-shed, and shows the Quaker Bridge and Croton Dam sites. Location No. 2, and at several places marked D D, etc., the positions suggested and examined for a dam site. The small black dots indicate the position of some of the diamond drill soundings.

Figure 4 shows the profiles and relative positions and capacities of the reservoirs formed by the different proposed dams.

Figure 5 shows, graphically, the storage capacities in two successive dry years of the proposed reservoirs, assuming them to have been respectively full and half full at first, and receiving the recorded rainfall, and drained by the estimated demand.

KEY WEST, FLA., is probably the first city which has thus far contracted for grading and paving the entire length and breadth of her streets. According to local advices, it is to be no piecemeal job, but one that, when completed, will thoroughly alter the face and appearance of the place, changing it from a third-rate country village as to streets and sidewalks, to a modern city.

NEW YORK is shortly to [illegible] ed wharf for the receipt of Southern frui [illegible] There is said to be only one other st [illegible] his country—at Boston, Mass.

PNEUMATIC HOISTING.

ACCORDING to a paper read at the New York meeting of the American Institute of Mining Engineers, a few weeks ago, by H. A. Wheeler, the system of pneumatic hoisting, as installed at the Hottingeur shaft of the Epinac colliery, Saone-et-Loire, France, was designed by M. Zulma Blanchet, who was the managing director of a large company operating several mines and a local coal-railroad at Epinac, in Central France. The first suggestion for thus using air was made in 1852 by M. Gruner, the Director of the School of Mines of St. Etienne, and a model constructed on this principle was exhibited by M. Cave, at the first Paris Exposition; but the credit of first putting the system into practical operation is due to M. Blanchet.

The vertical Hottingeur shaft, started in 1863, had reached a depth of 2,133 feet in 1871, and was to be sunk to a depth of at least 3,300 feet; but, unfortunately for the company and the entire mining world, no workable coal has thus far been met with, so that, instead of developing a large mine to raise over 700 tons a day, it still remains (1889) a prospect, while the plans of M. Blanchet were not satisfactorily completed on account of the great expense of installation and the discouraging nature of the explorations. So, although a thorough test of the system was not made, according to M. Blanchet's more advanced ideas, yet sufficient experience was gained to furnish evidence as to the practical desirability of this novel system of extraction.

M. Blanchet's plan was to have one or two continuous air-tight sheet-iron cylinders or large tubes extending from the bottom to the top of the shaft. Within the cylinder moved a piston, to which was hung a cage with as many decks as desired, nine decks being used at Epinac, while suitable air-tight doors open out at each level for allowing the decking of the cars. It was operated by exhausting the air from above the piston, and as the lower side was open to the atmosphere, the piston was raised by the difference in pressure of the atmosphere and the vacuum produced by the air-pump. For lowering, it was merely necessary to allow the air to re-enter above the piston by a throttle-valve, while the speed could also be regulated by throttling the escape of the expelled air from below the piston. It is obvious, that, neglecting the friction of the piston, any lifting capacity desired can be obtained for a given vacuum by merely increasing the diameter of the tube, while the speed of hoisting will depend on the capacity (size and speed) of the exhausting-engine to maintain this vacuum.

Besides its legitimate function as a hoisting device, M. Blanchet was enthusiastic about the additional services it would perform in cooling and ventilating the mine, through the introduction at each trip of the volume of air represented by the depth of the shaft and the diameter of the cylinder. With a tube 3,000 feet long, 63 inches diameter, there would be delivered into the workings during a round trip of 12 minutes a volume of 5,425 cubic feet of air per minute, which positive acquisition would be no insignificant item; and the deeper the shaft the greater would be the volume of air expelled at each trip. In coal practice, however, this amount of air would be entirely too small to be entitled to much consideration.

That the pneumatic system will be more exempt from accident than the cable system Mr. Wheeler considers hardly probable, in view of the want of a reliable, continuous system of recording the positions of the cage in the tube. Overwinding or carelessness on the part of the landers or engineers, quite a frequent cause of accidents at present, seems likely to become even more dangerous in the pneumatic system. The trouble arising from the distortion of the shaft with consequent jamming of the cage in swelling or heaving ground, would be exaggerated in the pneumatic system, with its train 52 feet long; for while the tube stands free by itself away from the shaft-lining, the displaced timbers supporting it would so distort and throw it out of line as to readily cause the jamming or sticking of the train in the tube.

The expense of the pneumatic system proper was given to Mr. Wheeler by M. Naugerode, the present superintendent, as follows: Tube and connections, $70,000; erection, including winch-engine, etc., $74,000; exhausting engine (or vacuum pump), $42,000; total, $186,000.

These figures show that the erection of the tube cost more than the tube itself, and that the tube (with its connections) cost about $35 per running foot. As there are 775 pounds metal per linear foot, this shows a factory cost of the tube of about 4½ cents per pound. It is probably safe to say that such a tube erected complete in this country would cost over $100 per linear foot. This does not include the vacuum engine, boilers, housing and the primary cost of first sinking the shaft. So that a pneumatic plant, complete, would call for at least double the capital of a rope-hoisting plant of equivalent grade, and when finished, aside from probably much greater operating expenses (fuel and repairs), would not have a fifth of the capacity of the cable system, as reckoned on the actual figures of the Epinac plant.

COST OF WATER IN DIFFERENT CITIES.

W. B. BULL, Superintendent of the Quincy, Ill., water-works, in a letter to a local paper, furnishes the following table, taken from the Erie, Pa., water-works report. It gives the cost of water to the average householder in 25 cities, compiled from official reports:

Allegheny City	$24.50
Boston	37.25
Buffalo	25.50
Chicago	21.75
Columbus, O	32.80
Dayton, O	45.30
Detroit	28.25
Erie, Pa	21.75
East Saginaw, Mich	26.50
Fall River, Mass	31.00
Grand Rapids, Mich	33.00
Indianapolis	32.00
Lawrence, Mass	25.80
Milwaukee	22.00
Minneapolis	26.00
Newark, N J	26.25
New York City	32.75
Omaha, Neb	30.00
Philadelphia	28.75
Pittsburg	23.50
Sandusky, O	25 50
St. Paul	24.80
Syracuse	31.75
Toledo	28.50
Utica, N. Y.	31.50

It appears from the above statement that $28.66 per annum is the average price paid for water by the householder circumstanced as above in the United States, if the above 25 cities afford a fair basis from which to construct an average.

STRENGTH OF MILL FLOORS.

THE following tables have been prepared and issued in circular form by C. J. H. Woodbury, one of the vice-presidents of the Boston Manufacturers' Mutual Fire Insurance Company, for the purpose of furnishing a convenient means for determining safe loads on floors; also for use in designing floors that are to be adapted to specific purposes. It is not assumed that these tables will do away with the services of an engineer in general construction, but rather that they may be convenient in many cases where the master mechanic of the works may make plans or supervise changes in construction. The utmost care should be observed to select the figure giving the greatest possible amount and concentration of load as the one which may be put upon any beam or set of floor beams, and in no case should beams be subjected to greater loads than those specified, unless a lower factor of safety is warranted under the advice of a competent engineer.

Mr. Woodbury states that whenever and wherever solid beams or heavy timbers are made use of in the construction of a factory or warehouse, they should not be painted, varnished, oiled, filled or incased in impervious concrete, air-proof plastering or metal for at least three years, lest fermentation should destroy them by what is called "dry rot." It is, on the whole, safer to make floor beams in two parts, with a small open space between, so that proper ventilation may be secured, even if the outside should be inadvertently painted or filled.

The tables apply to distributed loads, but, according to Mr. Woodury, the first can be used in respect to floors which may carry concentrated loads by using half the figure given in the table, since a beam will bear twice as much load when evenly distributed over its length as it would if the load was concentrated in the center of the span. The weight of the floor should be deducted from the figure given in the table, in order to ascertain the net load which may be placed upon any floor. The weight of spruce may be taken at 36 pounds per cubic foot, and that of Southern pine at 48 pounds per cubic foot.

Table I. was computed upon a working modulus of rupture of Southern pine at 2,160 pounds, using a factor of safety of six. In can also be applied to ascertaining the strength of spruce beams if the figures given in the table are multiplied by $\frac{78}{100}$; or in designing a floor to be sustained by spruce beams, multiply the required load by $1\frac{28}{100}$, and use the dimensions as given by the table.

The tables are computed for beams one inch in width, because the strength of beams increases directly as the width, when the beams are broad enough not to cripple; that is to say, a beam 14 inches in width will sustain twice the load of a beam 7 inches in width.

Example.—Required the safe load per square foot of floor which may be safely sustained by a floor on Southern pine 10 by 14-inch beams, 8 feet on centers, and 20 feet span. In Table I. a 1 by 14-inch beam, 20 feet span, will sustain 118 pounds per foot of span, and for a beam 10 inches wide the load would be 1,180 pounds per foot of span, or 147½ pounds per square foot of floor for Southern pine beams. From this should be deducted the weight of the floor, which would amount to 17½ pounds per square foot, leaving 130 pounds per square foot as a safe load to be carried upon such a floor. If the beams are of spruce, the result of 147½ pounds would be multiplied by $\frac{78}{100}$, reducing the load to 115 pounds. The weight of the floor in this instance amounting to 16 pounds, would leave the safe net load as 99 pounds per square foot for spruce beams.

TABLE I.—*Safe Distributed Loads Upon Southern Pine Beams One Inch in Width.*

(If the load is concentrated at the center of the span, the beams wil sustain half the amount as given in the table.)

Span, Feet.	DEPTH OF BEAM IN INCHES.														
	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
	LOAD IN POUNDS PER FOOT OF SPAN.														
5	38	86	154	240	346	470	614	778	960	....	....	.	...	...	..
6	27	60	107	167	240	327	427	540	667	807	...	..	.	....	....
7	20	44	78	122	176	240	314	397	400	593	705	826		....	....
8	15	34	60	94	135	184	240	304	375	454	540	634	735	....	....
9	..	27	47	74	107	145	190	240	296	359	427	501	581	667	759
10	..	22	38	60	86	118	154	194	240	290	346	406	470	540	614
11	..	..	32	50	71	97	127	161	198	240	286	335	389	446	508
12	..	..	27	42	60	82	107	135	167	202	240	282	327	375	474
13	..	..	..	36	51	70	90	115	142	172	205	240	278	320	364
14	..	..	...	31	44	60	78	99	123	148	176	207	240	276	314
15	..	..	...	27	38	52	68	86	107	129	154	180	209	240	273
16	..	..	..	...	34	46	60	76	94	113	135	158	184	211	240
17	..	..	..	...	30	41	53	67	83	101	[illegible]	140	163	187	217
18	..	..	...	...	..	36	47	60	74	90	[illegible]	125	145	167	190
19	..	..	...	...	...	....	43	54	66	80	96	112	140	150	170
20	..	.	...	...	....	...	38	49	60	73	86	101	118	135	154
21	..	..	...	...	....	....	....	44	54	66	78	92	107	122	139
22	..	..	...	...	..	....	...	...	50	60	71	84	97	112	127
23	..	..	...	...	...	..	....	...	45	55	65	77	89	102	116
24	..	..	..	...	..	...	....	...	....	50	60	70	82	94	107
25	..	.	...	...	....	..	....	.	....	46	55	65	75	86	98

Table II., Mr. Woodbury explains, applies to the design of floors whose strength must be in excess of that necessary to sustain the weight, in order to meet the conditions of delicate or rapidly moving machinery, to the end that the vibration or distortion of the floor may be reduced to the least practicable limit. The usual method of prescribing the limit which may be permitted in the deflection of beams on which machinery is to be operated has been to select a direct ratio to the span, customarily one four-hundredth, and to prescribe a proportionate deflection for all spans. Mr. Woodbury holds that a better rule would be to base the deflection which may be permitted upon the amount of curvature or distortion which the yielding of the floor may bring into effect upon the machinery. In the table the limit is that of load which would cause a bending of the beams to a curve of which the average radius would be 1,250 feet.

This table is based upon a modulus of elasticity obtained from observations upon the deflection of loaded storehouse floors, and is taken at 2,000 pounds for Southern pine. The same table can be applied to spruce, whose modulus of elasticity is taken as 1,200,000 pounds if sixteenths of the load for Southern pine is taken as the proper load for spruce; or, in the matter of designing, that the load should be increased one and two thirds times, and the dimension of timbers for this increased load is found for the table used for spruce.

It can also be applied to beams and floor timbers which are supported at each end and in the middle, remembering that the deflection of a beam supported in that manner is only four-tenths that of a beam of equal span which rests at each end; that is to say, the floor planks are two and one-half times as stiff, cut two bays in length, as they would be if cut only one bay in length. When a floor plank two bays in length is evenly loaded, three-sixteenths of the load on the plank is sustained by the beam at each end of the plank, and ten-sixteenths by the beam under the middle of the plank; so that for a completed floor three-eighths of the load would be sustained by the beams under the joints of the plank, and five-eighths of the load by the beams under the middle of the plank; this is the reason of the importance of breaking joints in a floor plank every three feet in order that each beam shall receive an identical load. If it were not so, three-eighths of the whole load upon the floor would be sustained by every other beam, and five-eighths of the load by the corresponding alternate beams.

The method of applying Table II. is similar to that already given for Table I. Repeating the former example for the load on a mill floor on southern pine beams 10x14 inches and 20 feet span laid 8 feet on centers; in Table II. a 1x14 inch beam should receive 61 pounds per foot of span, and for a beam 10 inches wide this would be 610 pounds per foot of span, or 75 pounds per square foot of floor for Southern pine beams. From this should be deducted the weight of the floor, which would amount to 17½ pounds per square foot, leaving 57 pounds per square foot as the advisable load to be carried on such a floor.

If the beams are of spruce the result of 75 pounds should be multiplied by sixteenths, reducing the load to 45 pounds. The weight of the floor in this instance amounting to 16 pounds would leave the net load as 29 pounds for spruce beams.

There are many instances where similar beams safely sustain loads far in excess of the above, but it is repeated that Table II. applies only to what is considered advisable to resist the amount of bending and vibration to which light machinery, running at high speed, should be subjected.

If the beams were two spans in length, they could, under these conditions, support two and a half times as much load with an equal amount of deflection, unless such load should exceed the limit of safe load as found by Table I., as would be the case under the conditions of this problem.

TABLE II.—*Distributed Loads Upon Southern Pine Beams Sufficient to Produce Standard Limit of Deflection.*

Span Feet.	DEPTH OF BEAM IN INCHES.															Deflection Inches.
	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
	LOAD IN POUNDS PER FOOT OF SPAN.															
5	3	10	23	44	77	122	182	259	....	.	. .	....	....	..	...	.0300
6	2	7	16	31	53	85	126	18	247	....	..	....	....	....	...	.0432
7	..	5	12	23	39	62	93	132	181	241	....	.	...	....	...	0588
8	..	4	9	17	30	48	71	101	139	185	240	305	....	....	....	.0768
9	.	..	7	14	24	38	56	80	110	146	190	241	301	...	....	.0972
10	..	..	6	11	19	30	46	65	89	118	154	195	244	300	. ..	.1200
11	..	..	..	9	16	25	38	54	73	98	127	161	202	248	301	.1452
12	..	..	..	..	13	21	32	45	62	82	107	136	169	208	253	.1728
13	..	..	..	..	11	18	27	38	53	70	91	116	144	178	215	.2028
14	.	..	..	..	..	16	23	33	45	60	78	100	124	153	186	.2352
15	.	..	..	.	..	14	20	29	40	53	68	87	108	133	162	.2700
16	..	..	..	..	..	...	18	25	35	46	60	76	95	117	147	.3072
17	..	..	..	..	..	...	16	22	31	41	53	68	84	104	126	.3468
18	..	.	..	.	..	..	...	20	27	37	47	60	75	93	112	3888
19	..	..	..	..	..	...	..	18	25	33	43	54	68	83	101	.4332
20	..	..	..	..	..	...	..	....	22	30	38	49	61	75	91	.4800
21	..	..	..	..	..	...	. .	...	20	27	35	44	55	68	83	.5292
22	..	..	.	..	..	...	....	....	....	24	32	40	50	62	75	.5808
23	..	.	..	..	..	...	....	....	..	22	29	37	46	57	69	.6348
24	..	..	..	..	..	...	. .	....	...	.	27	34	42	52	63	.6912
25	..	..	..	..	..	.	...	....	...	....	25	31	39	48	58	.7500

THE SEWAGE OF LONDON, PARIS, AND BERLIN.

IN a recent lecture at London, on the above subject, Dr. C. R. Drysdale declared that the only method of treating the sewage of large cities was that now employed at Berlin, Paris and Croydon. In his opinion, London presented a very bad example to other cities by the manner in which it dealt with the sewage. Paris had at present 1,500 acres of land in the Plain of Gennevilliers, cultivated by small proprietors, who made use of about 20,000,000 tons per annum to irrigate their farms. Some 3,000 acres had also been acquired at Achères, which it was proposed to cultivate in the same manner; and the authorities were contemplating still another sewage farm. The effluents were perfectly pure. The land at Gennevilliers often produced from $300 to $800 per acre. At Berlin the acreage in sewage farms amounted to 19,000 acres. To these the sewage was pumped from 12 pumping stations, through pipes 40 inches in diameter, and most of the farms had been under cultivation during the past 15 years About 2,000 hands were employed, and no case of typhoid occurred during the whole of last year. A sum of $16,055,000 had been borrowed for successfully dealing with the sewage of 1,500,000 of inhabitants. Sir R. Robinson estimated that the present sewage experiments for London, with over 5,000,000 inhabitants, would cost 10,000,000 of money. The effluents at Berlin were perfectly pure and drinkable, as at Paris. The Paris Commission recently sent to Berlin had reported the system a perfect success.

AUTOMATIC REGISTER OF MOVEMENTS OF THE FORTH BRIDGE.

THE Forth Bridge has been for some time entirely completed, the works have been dismantled, and the engineers' staff and the workmen have had to seek new fields of operations, some of the engineers having gone to Mexico, the United States, Greece, and India. The finishing touch, it is interesting to note, is the only thing in the way of ornament on the bridge, all else being indispensable parts of the structure. This embellishment, according to *Engineering*, consists of two brass plates placed on the south cantilever pier, in commemoration of the opening of the bridge by the Prince of Wales on March 4, 1890. The names of the directors, engineers, and contractors are also given. Sir John Fowler has had fitted at the end of the south main span, at which point the contraction and expansion joint is placed, an indicator to record the number of trains passing and the daily contraction or expansion of the bridge. The apparatus consists of a brass rod, with a pencil, attached to the end of the girder, and a clock with another brass rod fixed in its axle. Round the rod in the axle of the clock is wound a strip of paper about 4 inches wide with a weight attached to the end. The point of the pencil rests on this paper, which is, of course, constantly on the move as the clock winds down. The result is that as the cantilever contracts the pencil attached to it is pulled away; when it expands, the pencil is pushed forward, and a curve of contraction and expansion is thus produced by the movement of the paper and pencil combined. The same principle is applied to register the behaviour of the bridge while a train is passing. When the train enters on the one end of the cantilever it pulls the far off end down, and when it does so it also pulls the pencil, and thus a mark at right angles to the curve of contraction and expansion is made. When it passes to the other half of the cantilever, it pushes it forward and again a mark at right angles to the curve is made on the other side. Each mark indicates a train, and thus the simple apparatus serves three purposes. Recently there was a second sale of the plant in the works, and now the bridge alone stands without anything to indicate that it has only been just constructed. Of the 4,500 men who once were employed on the bridge only 80 remain, and of these 80 only 36 are likely to be permanently employed on the bridge. Their chief work will be to keep the bridge thoroughly painted both outside and inside. It is not generally known probably that the painting of the inside of the bridge is not yet finished. When the work has been once done only the junction of the members will require constant touching up. The paint on the other parts will last for two or three years. In order to overtake the work with as great convenience as possible, permanent steel staging has been devised. There will be a stage for each member. Each stage has been so constructed that it can be taken down and put up again in a form that will suit the place it is desired to get at. The management are at present troubled a good deal with requests for passes to inspect the bridge; but as walking over the bridge, owing to the narrowness of the sidewalk, is attended with considerable danger, very few are granted. The speed of the trains in crossing the bridge is not now limited, except in the case of freight trains, and with them it must not exceed 25 miles an hour. As there are only about 2 feet 6 inches between the pedestrian on the bridge and the flying train, it is seen that the precaution is wise. The average traffic on the bridge amounts to about 140 trains daily.

ONE of the matters to be discussed at the annual meeting of the American Institute of Architects, to commence at Washington, D. C., on the 22d inst., is the establishment of testing stations for building material. It is thought that the work of such stations will promote safe building, as it would give the architectural profession an opportunity to have new materials and methods of construction tested by trained officials.

Correspondence.

Communications giving information or opinions on matters of general interest to the engineer, the architect, the contractor, or the municipal officer, will be welcomed in this column. Fairness will suggest that when communications are sent simultaneously to this and other journals we should be informed of it at the time. Anonymous letters will not be noticed.

LARGE SIZE VITRIFIED PIPE FOR SEWERS.

CITY ENGINEER'S OFFICE,
OMAHA, NEB., October 8, 1890.

To the Editor of THE ENGINEERING AND BUILDING RECORD:

Sir: I have been much interested in the discussions in your paper lately regarding the material for small-sized sewers. The difference in practice seems to be great; so great, in fact, that I sometimes wonder if I am all wrong in what I am doing. In Omaha we have about 65 miles of pipe sewers, all of which have been laid since 1881. My practice has been to use vitrified pipe up to and including sewers of 24 inches in diameter. Our specifications call for extra strong pipe, 2 inches thick for a diameter of 24 inches. We have had no instance of failure of pipe, except where the trouble was with the foundation. Pipe sewers must have a good foundation and a firm, even bearing. This is of the greatest importance.

I fully agree with Mr. Hering in what he says regarding the method of laying pipe, and the relative value of pipe and brick sewers. In brick sewers, my practice is to use two rings of brick for all sewers over 24 inches in diameter up to 72 inches. From there on, I increase to three rings. Bricks are all supposed to be first-class sewer bricks, laid in Portland cement, tested to stand a tensile strain of 200 pounds per square inch after remaining one hour in air and 24 in water. These precautions would probably surprise Colonel Waring, who seems to think that as soon as the quantity of material is increased inspection and watchfulness are decreased in the same proportion. How absurd the proposition! If this be true, it is fair to infer that in a building a 16-inch wall would be weaker than one of 8 inches, because the latter would have better material.

My experience has been that contractors are governed almost entirely by the moral influence with which a department surrounds a work. They are as quick as school boys to ascertain their chances of slighting their work, and as quick to recognize thorough, vigilant inspection. It seems to me that your correspondent from Illinois is greatly at fault in recommending sewers of 5 feet in diameter, and in some cases "very much larger," to be built of a single ring, and I must confess that I cannot see one single reason why a single-ring sewer should be a "better job" than a sewer of the same size constructed of two rings.

In your last issue, Mr. Samuel Gray expresses my views almost exactly.

GEO. W. TILLSON,
City Engineer.

Questions and Answers.

All questions relating to building construction, paving, sewerage, water supply, or kindred subjects, will be welcomed in this column provided they relate to matters of general interest and are not such as should properly be referred to a consulting engineer. Answers will be carefully prepared and a proof of both question and answer mailed to the inquirer as early as proper consideration will permit. They will be published for the benefit of other readers as soon as convenient. The full name and address should be given, not necessarily for publication, but as a guarantee of good faith, and to facilitate further correspondence in case the question is not sufficiently explicit.

Inquiries of the Editor, in order to secure prompt attention, should *not be written on the same piece of paper as a communication* to the *Publishing Department*. Letters renewing subscriptions are sent to a clerk in the publishing office, and matter for the Editor, if in the same enclosure, is likely to be overlooked unless it is on a separate piece of paper, so that it may be promptly sent to the Editor.

LAYING WATER MAINS AROUND CURVES.

"WATER-WORKS," Newark, N. J., writes: "Will you kindly state in your next issue the maximum deflection, in inches, per length of 12 feet, allowable for laying water mains around curves, for sizes of 12-inch, 10-inch, 8-inch, 6-inch and 4-inch? How is the calculation made of the effect of pressure to open the joints, and how should they be secured against such contingency while being laid?"

[No hard-and-fast rule can be given to meet the above inquiry. The practice is not to deflect to such an extent as to prevent proper calking of the joint in its narrowest part. The depth and thickness of the joint, the character of the soil and the water pressure, are all factors to be considered.

Each joint should be well backed up with concrete between the outer edge of the pipe and the undisturbed bank of the trench. A curve of 100 feet radius can generally be laid with straight pipe. On curves of shorter radii ⅛ bends must occasionally be introduced.]

THE first electric underground wires are now being laid at Cincinnati.

DOMESTIC PLUMBING HEATING LIGHTING & VENTILATION ENGINEERING

ELECTRIC MOTORS.

(Continued from page 301.)

THE BARRIETT MOTOR.

The Barriett Motor, made by the New York Electrical Manufacturing Company, 10 West Twenty-third Street, New York, is constructed of few parts and in a manner calculated to give a low center of gravity and consequent freedom from vibration when running.

The cores of the magnets are made of Norway charcoal iron. The armature is a modification of the Siemens drum form. All the motors are equipped with automatic oilers of special design, insuring cleanliness and good lubrication.

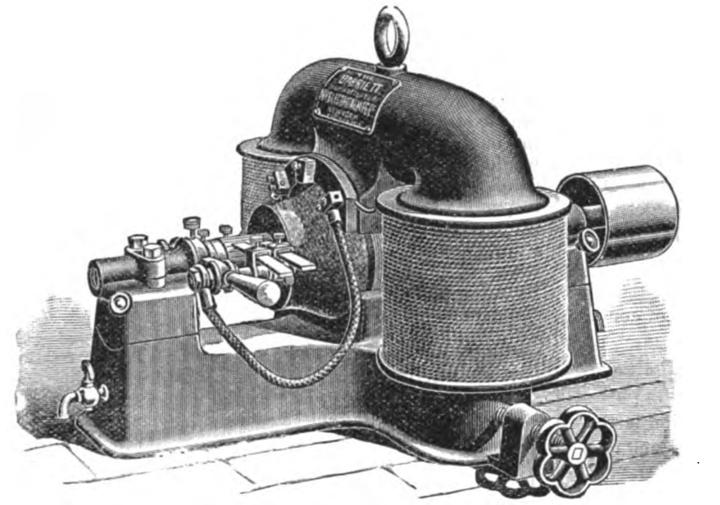


Fig. 8.- THE BARRIETT MOTOR.

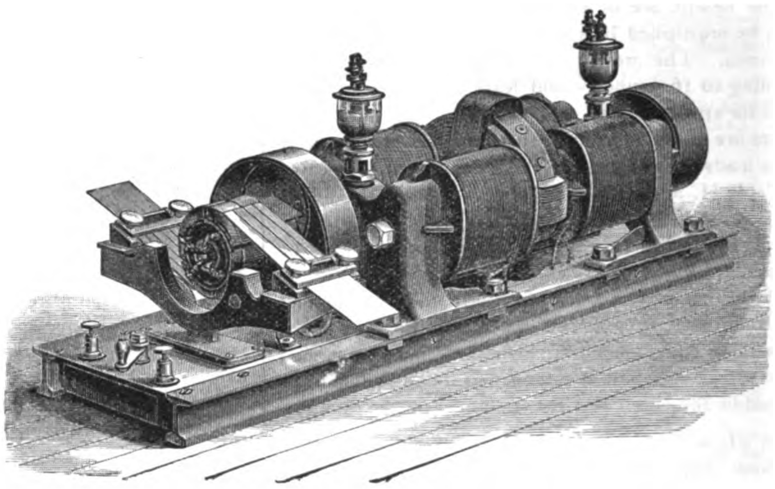


Fig. 9 —THE BRUSH MOTOR.

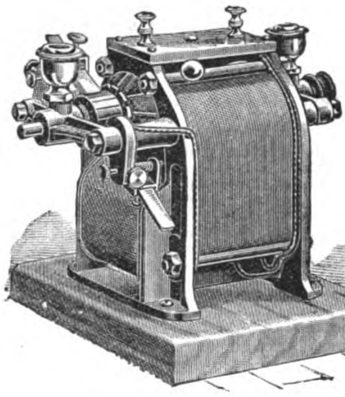


Fig. 10.—TYPE A.

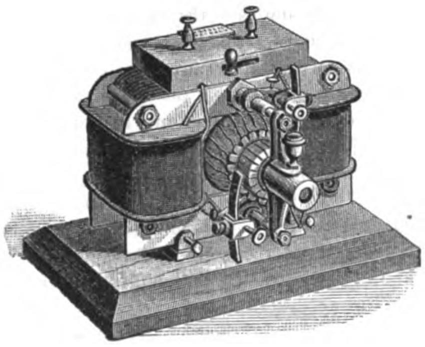


Fig. 11.—TYPE B.

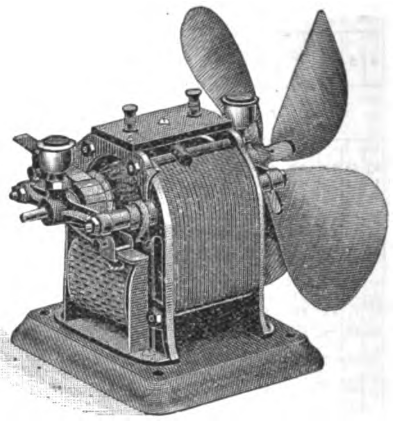


Fig. 12.—FAN OUTFIT.

THE A. B. C. MOTOR, MADE BY THE A. B. C. MOTOR CO., NEW YORK.

The motors are made in capacities ranging from $\frac{1}{2}$ to 25 horse-power. In addition, a special fan outfit of $\frac{1}{16}$ horse-power is put on the market. Figure 8 will help to give an idea of the general character of the design.

THE BRUSH MOTOR.

The Brush Motor is made by the Brush Electric Company, of Cleveland, O.

Figure 9 shows one of 1 horse-power. Several thousand Brush motors are now in use, doing various kinds of work. They are strong and compact, and claimed to be highly efficient. Their governing arrangements, also, are claimed to be excellent. According to the makers, not only are the similar parts of all the motors of a given size absolutely interchangeable, but the wearing parts and many other details of all the sizes commonly used are also interchangeable. This is a noteworthy advantage, and is of much importance to any one using a large number of the motors. All the mechanical details have been carefully considered and worked out.

Noteworthy applications of Brush motors are to be found in some of the large mines at Virginia City, in Nevada. Water power is there used to generate the current, and the motors furnish power for hoisting, working stamp mills, and other kinds of mining machinery.

The Brush motors range in capacity from $\frac{3}{4}$ horse-power up to 100 horse power.

THE A. B. C. MOTOR.

The A. B. C. motor is made by the A. B. C. Motor Company, 44 Gold Street, New York. Two types are shown in the accompanying engravings, Fig. 10 representing type A, which embraces the sizes $\frac{1}{12}$, $\frac{1}{8}$ and $\frac{1}{6}$ horse-power, and Fig. 11 representing type B, which continues the sizes by quarters up to 1 horse-power.

The principal feature of these machines is found in the laminated field magnet, which is claimed to be composed of the softest and purest iron obtainable. The advantages of this are universally recognized by electricians. The other features are stated to be a very slow speed, rendering countershafting frequently altogether unnecessary; the maintenance of a constant speed under all loads without sparking or noise; simplicity and durability of construction.

The $\frac{1}{12}$ horse-power machine is intended for use with either a primary or storage battery. Its principal use is for operating a ventilating fan or running a sewing machine, although it is not by any means confined to these purposes, but is available for any demands that may be made upon it up to $\frac{1}{16}$ horse-power. All the other sizes are constant potential machines (that is, intended for incandescent circuits), and are wound for any voltage up to 220. They are in use in machine shops, printing houses, and for operating pumps, blowers and fans. Figure 9 shows a $\frac{1}{8}$ horse-power motor with fan attached.

A third type of motor made by the company, and known as type C, embraces all powers from one horse-power upwards, and can be wound for any voltage up to 500.

(To be continued.)

A SIMPLE GAS RADIATOR.

A Brooklyn architect, Mr. G. L. Morse, has hanging over his office table a very simple and inexpensive radiator, of his own design, consisting of a cylinder of black sheet iron, 8 inches in diameter and 14 inches high, open at the bottom, but closed at the top. This is suspended from the chandelier directly over its drop light with an ordinary 6 foot fish-tail burner, which stands on the table, and Mr. Morse says that this arrangement will keep his private office, which is quite a good-sized room, some five degrees warmer than the adjoining rooms, even with the doors open—a difference of temperature which, at this time of year, will often just make the difference between comfort and chilliness.

This device, even if made to order, would cost but little, and could be readily improvised with a short length of stove-pipe by cleaning it of soot and closing the top, which, if appearance was not considered, could be most readily done by flattening the pipe. This closing the upper end is necessary, to avoid the current of cold air that would be drawn in along with the heated gases, if there were a draft through, and which would lower the temperature of the radiator. An old tin pail hung bottom up, and blackened outside to promote radiation, would also answer the purpose very well. The top of the flame should be about level with the bottom of the radiator. If the radiator is too low the flame will smoke and deposit soot on the inside of the radiator, impairing its efficiency and being liable to soil anything under it.

SOME PLUMBING DETAILS IN THE SAN CARLO HOTEL, NEW YORK.

When this hotel was finished, about a year ago, it was intended to take all the house water supply from main tank A, Fig. 1, on the ninth floor, but as it was afterwards decided to place servants' rooms, etc., on the ninth floor, the supplementary tank B was built on the roof above and arranged to furnish cold water to ninth floor fixtures, and to supply the boiler for hot water throughout the house. All water is, therefore, pumped through the 1½ riser C, and, after filling tank B, the surplus overflows through the 3-inch pipe D into the tank A, and may overflow from that tank to the roof through the 4-inch pipe E. F is a 1½-inch pipe to the basement boiler with branch G supplying cold water to the ninth floor only; H is a 1½-inch cold-water supply to all fixtures below the ninth floor; I is a 1-inch pipe through which tank A can be emptied to the roof gutter; J is a common bath tub valve by which tank B can be emptied, the water escaping through trough K to the roof gutter; L is a tell-tale to the drip sink in engine room; M M are ¾-inch vent pipes to admit atmospheric pressure to rising lines F and H, and facilitate their emptying after the upper valves are closed; N, N, etc., are relief pipes; O O and P P are copper floats that operate electric alarms in the pump room, the former for high and the latter for low water.

The details of the floats are shown in Fig. 2, where P and O are the copper balls fixed to ¼-inch brass rods A, and supported from shelf boards Q Q that are fastened to the tanks by bolts B B.

For the low water alarm, rod A is about as long as the tank is deep, and has a fixed collar C that prevents it from rising above the position shown by full lines where the buoyancy of the float usually maintains it; E E are copper springs, *not* in contact with the rod A. When the tank is nearly empty, the float falls to the position shown by dotted lines, and the button D, engaging the copper springs E E, completes through them the circuit between wires F and G., and rings the alarm gong in pump room. H H are insulating washers, and I is a metal base plate. The high water alarm float O operates similarly. Ordinarily it is in the position shown by full lines. When the tank is full it rises to the position shown by dotted lines, and the circuit is made as before described.

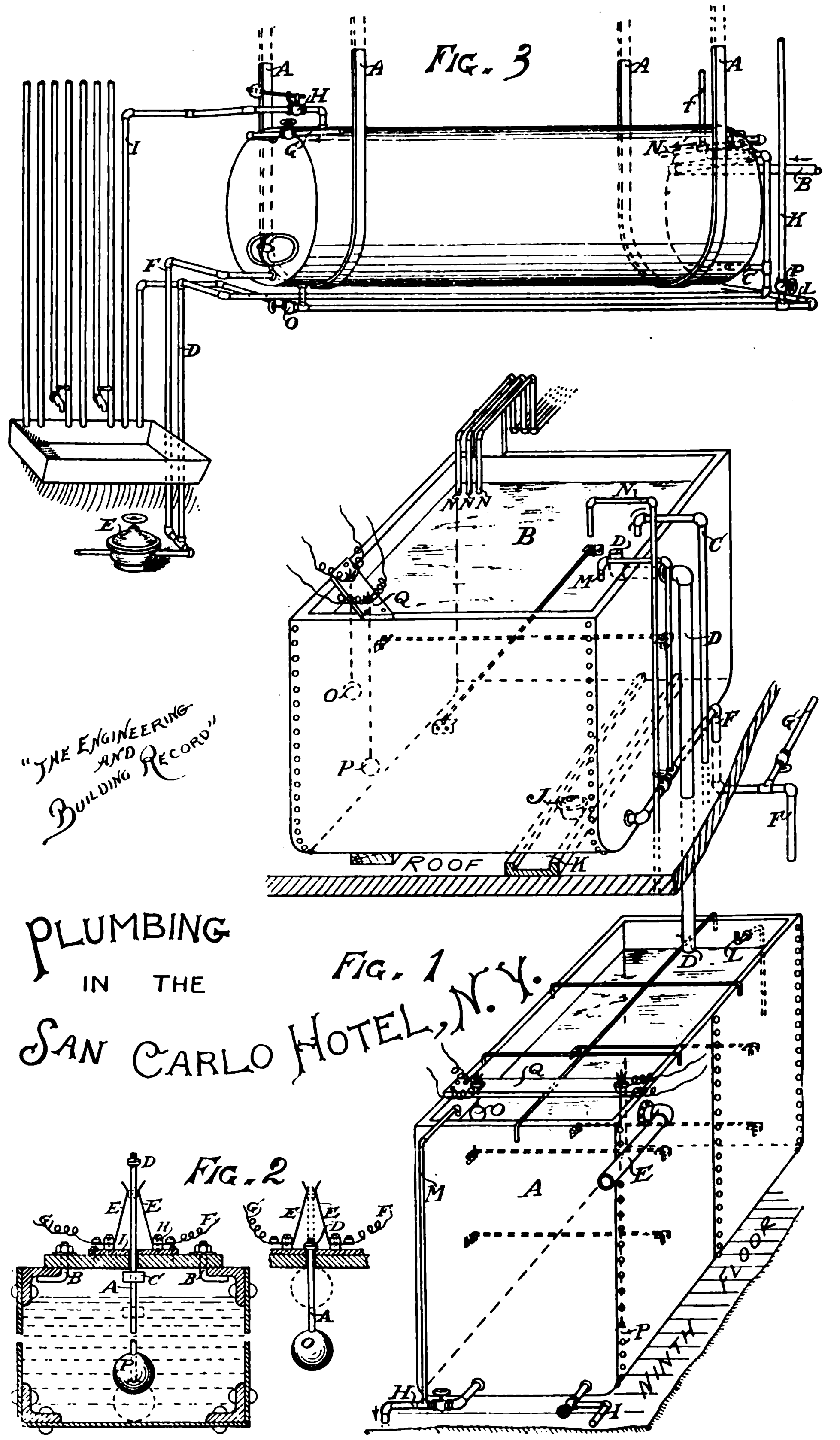

PLUMBING IN THE SAN CARLO HOTEL, N.Y.

FIG. 3

FIG. 1

FIG. 2

Figure 3 shows the basement boiler for furnishing hot water throughout the house. It is suspended from the iron floor by iron straps A A.

Exhaust steam is received through the 2½-inch pipe B, passes through an inside coil, and comes out at C, discharging through pipe D and trap E; F is a 1-inch drip pipe from the coil; G is a ¼ inch pipe through which live steam can be forced into the water; H is an ordinary safety valve with waste pipe I.

Cold water from roof tank B, Fig. 1, is supplied through 1½-inch pipe K; L is the ¼-inch hot water return circulation pipe. The valve P is usually open and O closed, but if thev are reversed the boiler can be emptied through 1-inch pipe M: N is the 1¼-inch hot supply which has valves in the pump room controlling its branches to different parts of the house; T is a thermometer. The boiler and steam pipes are jacketed with asbestos, which is not shown in the illustration, to avoid confusion.

The plumbing was executed by Mead & Rossman, of New York.

ACCORDING to Col. F. R. Hain, General Manager of the New York elevated railroads, the management is looking forward to the adoption of a storage battery system of electric traction for the different lines.

Novelties.

Devices are described under this head purely and strictly as news; because believed to be new and calculated to interest readers.

In no case is pay accepted, directly or indirectly, for publishing a novelty notice.

As the subjects are selected for their supposed novelty and interest merely, it will, of course be understood that the selection does not imply indorsement.

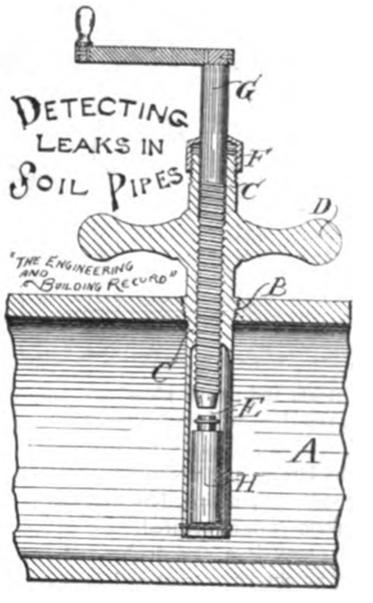
NEW FORM OF PIPE HANGER.

ERNEST V. CLEMENTS has assigned to the De La Vergne Refrigerating Machine Company, of New York, a patent for a new form of pipe hanger. The hanger consists of a lag bolt to be screwed into the ceiling beams, the bottom of the bolt being split, or formed into two horizontally projecting arms. The tops of these arms are rounded, and over them fits a stirrup or loop for supporting the pipe. The advantage of this construction is that the stirrup will swing and provide for the changes in length of the pipe through expansion and contraction.

DETECTING LEAKS IN SOIL PIPES.

THE device illustrated herewith is intended to facilitate the application of the well-known peppermint or other similar tests for discovering leaks in soil pipes.

Through the soil pipe A at a point near the bottom a hole B, preferably conical, is tapped and receives the screw plug C, which has an open cage or receptacle E at one end and a handle D at the other. The stem of the plug C is bored and tapped to receive the spindle G which works through a stuffing box F.


DETECTING LEAKS IN SOIL PIPES

In making the test a fragile bottle H, containing some pungent volatile liquid, is placed in the cage and the plug screwed into the soil pipe; then the spindle G is forced down on the bottle and breaks it, the liquid is released and its fumes penetrate the whole of the pipe and its branches, escaping through any openings. The presence of these is thus clearly indicated. The bottle H should be hermetically sealed, for which purpose a coat of varnish over cork and glass, is recommended.

R. T. Crane, Chicago, Ill., is the patentee, and claims that the method is more efficient than the ordinary peppermint test, because it prevents any possible smearing of the pungent liquid on the bands or outside of the pipe and avoids any chance of the odor's appearance, except through leaks from the interior of the pipe.

STEAM PIPE LAGGING FROM WASTE MATERIAL.

ACCORDING to the *Revue Industrielle*, some of the waste products resulting from the manufacture of paper furnish excellent material for cheap and efficient lagging for steam pipes. The waste products in question are chiefly those coming from the different cleaning and sorting machines, and which are of a fibrous nature. These, when dry, are to be mixed with potter's earth in the proportion of 4 to 1, enough water being afterward added to form a plastic compound. This is spread by hand over the surfaces to be protected, in thin successive layers. When dry, the coating is said to adhere firmly and is not easily broken. Its cost is practically no more than the cost of mixing and applying it.

Notes and Queries

on Domestic Engineering.

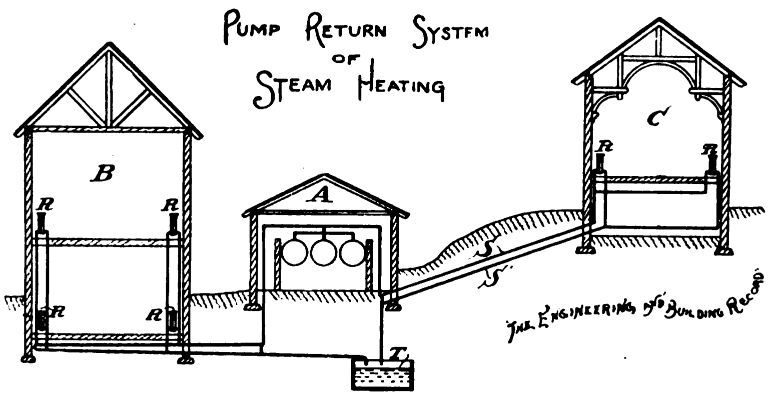
Communications relating to the practical details of plumbing, heating, lighting and ventilation will be welcomed in this column. The writer's true name and address must always be given, but an assumed name may be used for publication if preferred.

PUMP RETURN SYSTEM OF STEAM HEATING.

"ARCHITECT," of Providence, R. I., writes: "The accompanying plan is meant to show the arrangement of buildings to be heated by the low-pressure gravity system of steam heating. The pipes are all supposed to have proper pitch for drainage and to be of proper sizes, and the water of condensation will run back to tank, from which it will be pumped into the boiler. If the boiler-house had been below the lowest building, of course there would be no occasion for a pump.

(1) Will both buildings receive their supply of steam with the same facility and of equal dryness? (2) Will it be necessary to have any check or other valves except such as would be necessary to shut off steam, and will any traps be required? (3) Will it be possible, under any circumstances, to produce a vacuum by which the water can be drawn out of the boiler into the tank? (4) The radiators in the building on the low level will be about ten feet below the water line in the boilers."

[The accompanying sketch explains the arrangement of the buildings in question. A is the boiler-house; B, building with radiators below boilers; C, building above grade of boiler-house; T, tank low enough for water to return by gravity from lowest radiators; from this the water is to be pumped back to the boilers; S and S′ are steam and return mains, respectively.


PUMP RETURN SYSTEM OF STEAM HEATING
B
R
R
R
R
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C
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S′
T
THE ENGINEERING AND BUILDING RECORD

(1) If the steam and return pipes are sufficiently large and properly run there will be no difficulty in having equal dryness and nearly equal pressures at all parts of the apparatus. Absolutely equal pressures cannot be obtained through any system of piping, but differences below the limit of one pound can be secured.

(2) If your tank is a closed one, and your pipes are large enough, no checks or traps will be necessary, and a pump and pump governor will take the water from the tank to the boilers. If the tank is an open one traps will be required on each main return.

(3) If the pump is properly connected with the boilers no vacuum in the tank can draw the water from the boilers, any more than the pressure within the boiler can drive the water out through the check valves and pump.

(4) It matters not how much the radiators are below the water line of boilers in a system such as you propose, so long as they are sufficiently above the tank to allow the water to run to the same by gravitation.]

HEAT REQUIRED FOR DRYING LUMBER.

HENRY G. MORRIS, engineer and machinist, of Philadelphia, Pa., writes: "I find in the *Louisiana Planter and Sugar Manufacturer* a statement in regard to the amount of water which is removed from lumber in kiln drying, as follows:

When it is considered that there are many saw mills cutting as much as 100,000 feet of lumber per day, and drying the same, from 5,000 pounds per 1,000 feet to 2,700 pounds, with no other heat than exhaust steam from the mill engine, the practicability of putting this system to the concentrating of cane juice would seem assured.

What I desire to find is some actual data on the subject of lumber drying, and the amount of heat required to evaporate a definite quantity of water stated, either as units of heat or as quantity of water condensed when steam is used.

Any information that you can elicit upon this subject would be much appreciated."

[We have no actual data on the subject, and shall be pleased to obtain figures from the experience of any of our readers. The amount of steam to be condensed in drying, of course, in every case, will be practically equal to the amount of water removed from the lumber.]

ODORLESS EXCAVATING APPARATUS.

KING & DICKERSON, Peoria, Ill., write: "Will you please tell us, through your columns, what is the best pump or apparatus of any kind for pumping out cesspools or vaults? There is nothing of the kind here. The old way is followed of baling them out by hand. This is both slow and dangerous. We want to buy some kind of an outfit for this work. Can you post us as to the best make—something that you think you can recommend? We want something that will not necessitate sending a man down into the hole. If such an apparatus is not available, we will not risk this kind of work."

[For obvious reasons we can, in no case, undertake to specify which is the best of several pieces of apparatus. In the present instance, the Odorless Excavating Apparatus Company, of Baltimore, Md., are the only makers that we can call to mind of such outfits as our correspondents refer to.]

DIRECT PRESSURE WATER SUPPLY.*

IN the designing and operating of direct pressure systems of water supply for small towns some very interesting conditions frequently arise that are not to be met with elsewhere. In such a system we may meet with the following requirements. A domestic supply of 300 gallons per minute at 50 pounds pressure and a fire supply of 1,200 gallons per minute at 120 pounds pressure; the former to be maintained continuously, the latter not more than six hours per month.

These conditions are usually met by putting in an engine with variable cut-off, or else a compound pump arranged to admit live steam to the low pressure cylinders, thus acting as a non-expansive engine on fire service. This latter is a very satisfactory and economical arrangement for a small town, but it will readily be seen that it will make excessive demands upon the boiler plant at the outbreak of a fire. From the fact that the quantity of water required in case of fire is four times that required for domestic service it is evident that the piston speed will be increased four times, and hence, without considering increase of pressure, four times as much steam will be used.

As on domestic service the fires will be ordinarily banked, the result of an alarm of fire is generally a decided fall of boiler pressure, and hence it is that the live steam connection to the low pressure cylinder is considered so valuable; but this does not completely remedy the difficulty. Consider a pump whose cylinders are 10 inches and 16 inches in diameter. The low pressure cylinder area will then be 2.56 times that of the high pressure. The stroke being the same the volumes will be in the same ratio. A pair of such pumps if duplex will just about meet the requirements laid down above. On domestic service one alone would be run. On fire service both would be run and at double the speed on domestic service. Ordinarily in these pumps on fire service no work is done in the high pressure cylinder, as no separate exhaust is provided for it, so the amount of steam used per stroke on fire service will be 2.56 times that used on domestic service, and as there are four times as many strokes the steam required for fire service will be ten times that required for domestic service, approximately. Of course some diminution of pressure will generally be allowable, but it is safe to say that the fire service will require eight times as much steam as the domestic service. As this demand is one that must be met in a very short time, or the effectiveness of the fire service will be seriously impaired, some special device appears to be necessary in the way of a blower to produce a sudden increase of combustion. While a very high chimney may serve the purpose to some extent, there is at hand a much more effective means of accomplishing the desired result—viz., the exhaust steam. While ordinary fuel consumption varies from 10 to 20 pounds per square foot of grate, a combustion of 120 pounds may be produced by a steam blast. After using steam for heating the feed water and the pump room there is still enough of the exhaust remaining for a good steam blast, for less than one-fifth will be required for the feed water and not more than the same amount for heating any ordinary pump room; the rest would ordinarily go to waste. By utilizing the exhaust steam for a blast, by means of nozzles at the base of the stack, as in a locomotive, a smaller chimney and a smaller boiler plant will be sufficient, thus involving less initial cost; and while it may be argued that a steam blast is of low efficiency and detrimental to the life of the chimney, it seems to us that where it would be used so seldom, and where it would then use only steam that must otherwise be wasted, it could not be anything but a very effective and valuable addition to the plant, and the smaller chimney needed with it could be replaced at small expense when it should become necessary. It is also to be remembered that a good supply of water at the beginning of a fire may be infinitely more valuable than the same supply 20 minutes later, and any device that will assist in insuring such a supply should not be overlooked.

A very interesting point to be considered in direct pressure engines is the economical length of stroke. The stroke should be such that the losses due to condensation in the cylinder shall be reduced as much as possible. This requires that the ratio of volume to surface shall be a maximum. Then, also, the time that the steam occupies the cylinder is another element to be considered. While in a single cylinder engine it is not difficult to determine the best length of stroke to adopt, in a duplex compound pump, where both pistons act along the same piston rod, it becomes quite a complicated problem. Even in this case if the ratio of surface to volume and the time of occupancy of the cylinder by the steam were the only considerations, the solution of the problem would not involve very serious difficulties; but we have to consider the variable clearance, the variable service required of the pumps, and the relative disadvantages of condensation in each of the two cylinders. In an ordinary system of the sort considered, in a small town, as already pointed out, the domestic service will probably require less than one-half the capacity of the pump, and yet the pump must be of the greater capacity for the sake of a few hours' use in a month for fire service, hence a high piston speed cannot be maintained during the greater proportion of the time. So in determining the economical length of stroke we must consider the pump as working at its low piston speed, taking care to introduce no conditions that will be incompatible with the performance of the required fire service. In view of the fact that the sooner the steam can be made to do its work and be exhausted the less will be the condensation, we are inclined to favor short strokes. The condition of minimum surface for maximum volume in a single cylinder makes the length of stroke equal to the diameter of the piston so that we would certainly not make the stroke longer than the diameter of the low-pressure cylinder, and the economical length according with this condition alone would be somewhere intermediate between the diameters of the two cylinders, but condensation in the high-pressure cylinder will be more detrimental than in the low because in the former the water so produced must be carried on through the engine clogging the work in the low-pressure cylinder, while in the latter it is immediately exhausted without further detriment; so we will find it advantageous to favor the high-pressure cylinder as much as possible and make the stroke equal to the diameter of that cylinder. If the engine works at very slow speeds on domestic service it may be desirable to still further shorten the stroke, and the only limit that it appears necessary to impose is that the number of revolutions on fire service shall not be too great. It may be urged that the work expended in overcoming the inertia of the column of water in the mains would be an argument against many strokes and in favor of few, but in a duplex pump only the water in the cylinder comes to rest during the change of stroke, and the more frequent the stroke the less the fluctuation of pressure in the mains and the less energy used up in accelerating the water column, so that a short stroke will be likely to increase the duty of a duplex compound pump up to a certain limit. Just what this limit will be will depend upon the particular case in hand. While at first sight it may appear that the shortening of the stroke will have a detrimental effect by increasing the clearance, yet this is of comparatively small consequence, as the steam occupying the clearance space in the high pressure cylinder is passed over to the low pressure and does work there, so that all that is really wasted is that in the clearance spaces of the low-pressure cylinder, and this, from its highly expanded condition, will not amount to much. Therefore it seems to us that for such service as that here considered a short stroke is to be looked upon with favor.

ACCORDING to the *Elektro-technische Zeitschrift* the proper height at which electric arc lights should be placed is 0.7 of the radius of the area to be illuminated. While this rule apparently has not been followed in the larger number of installations, it is of interest to note that in more recent work there is a tendency to place the lights at greater heights.

THE Master Plumbers' Association, of Dallas, Tex., are to give a banquet to the delegates to the convention of the Association of Master Plumbers of Texas State, at Dallas, on Thursday, October 23, 1890. D. S. Sullivan is President, and M. F. Kavanaugh is Secretary of the Dallas Association.

THE Masonic Temple to be built at Chicago, will, it is claimed, be the largest building in the world. It will be 18 stories high and have 14 elevators. It is to be finished and ready for occupancy on May 1, 1892.

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* G. S. Williams in the *Technic*, the annual of the Engineering Society of the University of Michigan.

CONTRACTING NEWS DEPARTMENT.

A WEEKLY RECORD

OF SPECIAL INTEREST TO CONTRACTORS, BUILDERS AND MANUFACTURERS OF ENGINEERING AND BUILDING SUPPLIES.

CONTRACTING INTELLIGENCE

Our readers will oblige us by notes, clippings, or any information which will put us in the way of obtaining early and reliable news for our "Contracting Intelligence." *Information of importance sent to us exclusively, and not elsewhere published will be liberally paid for.*

Persons who make any use of the information they find in these columns we trust will not omit to mention THE ENGINEERING & BUILDING RECORD as the source

For works for which proposals are requested see also the "Proposal Columns," pages i-ii-321.

BUENA VISTA, VA., October 13, 1890.

THIS city is now putting in a system of sewerage, at a cost, when completed, from $25,000 to $35,000. We have fine water-works, and will, in a short while, expend from $20,000 to $50,000 enlarging same. Have ordered hose and hose wagon from Northwestern Rubber Company, and have organized fire department. Our city is 18 months old, and has a population of 2,500, and in 12 months will number 10,000.

C. BARGAMIN,
Superintendent Water-Works.

WATER.

For Additional Water Items see Proposal Columns.

NEW ALBANY, IND.—It is estimated that the reservoir about to be constructed by the water-works company on the Silver Hills will cost $30,000.

ROCKFORD, ILL.—The water-works will bore two or three more artesian wells, 1,300 feet deep, next season.

BABYLON, N. Y.—The people of this place voted to establish a system of water-works at an election held October 11. The matter is to be further considered at the next meeting of the Town Board.

ST. LOUIS, MO.—The contract for the 20,000,000-gallon high-duty vertical pumping engine has been awarded to H. R. Worthington, New York, at $299,500.

MADISON, N. J.—Concerning the water-works here, Samuel B. Leach, hydraulic engineer writes: "The works were designed by me, and are being constructed under my supervision and superintendence as engineer, by Moffett, Hodgkins & Clark as contractors, Mr. O'Geran having immediate charge of the work for the contractors."

WAYNE, NEB.—It is proposed to begin at once on the proposed system of water-works for this place, for which the sum of $18,000 has been appropriated.

DALLAS, TEX.—Press dispatches state that an abundant flow of pure artesian water has been struck at this place and that immediate efforts are to be made to utilize it.

WESTFIELD, PA.—J. H. Miller, of this place, writes: "A company, with a capital stock of $25 000, has been organized at this place, with myself as president, for the purpose of establishing a system of water-works. The company expects to complete arrangements during the winter, so as to begin operations as soon as spring opens."

EDDY, TEX.—The Town Clerk at this place writes: "The question of water-works has been entertained at this place, and proposals of different companies have been and are being made. The stock company has fixed a limit of capital stock at $2,000. As yet no contract has been negotiated, and may not be this fall."

ELWOOD, IND.—It is proposed to expend the sum of $20,000 on a system of water-works for this place.

NORTH BROOKFIELD, MASS.—At a meeting of the taxpayers of this place all were agreed that a supply of water should be introduced into town for fire and mechanical purposes, such water being first secured as could, if necessary, be used for domestic purposes. Fifty thousand dollars was agreed to be the limit of expense which should be incurred, to be paid by the town in the course of 10 years. The question is to be further considered at a meeting to be held October 21.

LEBANON CITY, MO.—The water-works franchise granted by the Lebanon City Council to the light and water company has been ratified at the polls.

BAY CITY, MICH.—The question of expending $50,000 on water-works improvements is to be decided by vote at the election in November.

FORT WAYNE, IND.—The sum of $22,000 is to be expended on new water mains for this place.

AUSTIN, GA.—It is stated that a quantity of iron pipe, iron tanks, plugs, etc., will soon be wanted at this place, and that W. J. Dobbs can furnish particulars.

PLAQUEMINE, LA.—The people of this place will hold a mass meeting in a few days to discuss the water-works question.

ESTHERVILLE, IOWA.—The water-works question at this place is to be settled by a public vote. For particulars address A. O. Peterson, Chairman of Fire and Water Committee, as above.

EXIRA, IOWA.—It is proposed to expend $3,000 on a system of water-works for this place.

SAN ANGELO, TEX.—City Clerk John Moorkens writes: "Contract for a new system of water works has been granted to J. L. Millspaugh, President San Angelo Water-Works Company, for 15 years."

FLATONIA, TEX.—City Secretary H. S. Palmer writes: "The City Council has authorized bonds to be issued, not to exceed $30,000, which are to be used in putting in water-works, or so much thereof as will be found necessary."

KIRKWOOD, MO.—H. W. Hough, Town Clerk, writes: "There have been no steps taken to establish water-works in this locality."

HOMESTEAD, PA.—The following report was submitted by the Water-Works Commissioners appointed to take action in regard to the construction of a water-works at this place. That the work be commenced in the spring of 1891, and completed by the fall of the same year. As the result of advertisements the following bids were received: Chester B. Davis, Chicago, Ill., 5 per cent, of cost of works; Julien Kennedy, Pittsburg, Pa., 5 per cent. of cost of works; Fred. T. Crane, East Orange, N. J., $600 for plans and specifications, $150 per month; Samuel B. Leach, Tarrytown, N. J., 3½ per cent. of cost of the works; J. Schinneller, Pittsburg, Pa., 4½ per cent. of cost of the works. The bid of engineer Schinneller was accepted, because he is a local resident, and it was believed that he could, therefore, give most satisfactory services, he was accordingly ordered to prepare plans and specifications. J. M. Hoover is Chairman of Water Committee.

LINCOLN, ILL.—City Clerk John H. Starkey writes: "We have a system of water-works here since 1886, which are very good. There has been some talk of a new company but no steps have been taken yet."

CINCINNATI, O.—At a meeting of the Board of Public Improvements, held October 14, Superintendent Tharp recommended the construction of a new 6,000,000-gallon pumping engine. The matter was referred to the Committee on Water-Works.

WATER-WORKS.—See our Proposal Columns for information regarding water-works and water-works furnishings at the following places: Toronto, Can.; Markham, Ont.; Carthage, O.; Keithsburg, Ill.; Belvidere, Ill.; Rushville, Ind.; Philadelphia, Pa.

BRIDGES AND IRON STRUCTURES.

For Additional Bridge Items see Proposal Columns.

LA FAYETTE, GA.—The following bids for the building of an iron bridge across West Amichee Creek, were received by R. N. Dickerson, October 7: George H. Crafts, Atlanta, Ga., $1,908; Southern Bridge Co., Birmingham, Ala., $2,100; King Iron Bridge and Mfg. Co., Cleveland, O., $1,895; The Berlin Iron Bridge Co., East Berlin, Conn., $2,150; W. H. Converse, Chattanooga, Tenn., $1,875; The Columbus Bridge Co., Columbus, O.,$2,076; Milwaukee Bridge and Iron Works, Milwaukee, Wis., $1,930; Pittsburg Bridge Co., Pittsburg, Pa., $1,958.

SAN ANTONIO, TEX.—The following bids for the construction of a through truss class "A" bridge on San Antonio River, were received by Mayor Bryan Callaghan. October 4: Wrought Iron Bridge Co., Canton, O., $17,581; Thomas Murray & Co., New York, $15,500; George E. King Bridge Co., Des Moines, Iowa, $17,980; Berlin Iron Bridge Co., Berlin, Conn., $13,000; Pittsburg Bridge Co., Oliver, Penn., $18,400; Penn Bridge Co., Beaver Falls, Pa., $17,190; Variety Bridge Co., Cleveland, O, $15,100; Milwaukee Bridge and Iron Works, Milwaukee, Wis., $16,000; Smith Bridge Co., Toledo, O., $18,300; Mt. Vernon Bridge Co., Mt. Vernon, O., Plan A, $13,500; Plan B, $15,000; Lane Bros. Bridge and Construction Co., Newark, O., $16,004; Missouri Valley Bridge and Iron Works, $15,000; Chicago Bridge and Iron Co., $17,000; Wisconsin Bridge and Iron Co., Milwaukee, Wis., Plan A, $14,700; Plan B, $14,300; Lane Bridge and Iron Works, Chicago, Ill., $16,809; King Iron Bridge Mfg. Co., Cleveland, O., $17,952.

CLEVELAND, O.—It is proposed to erect a new bridge in this city over the "Central Way." Address the City Engineer for particulars.

BOSTON, MASS.—Estimates and general plans are being made by the engineer's department for a bridge, etc., over the Providence Division of the Old Colony Railroad at Forest Hills, in order to abolish the present grade crossing. Exclusive of land damages, the cost will be about $52,000.

NAPA CITY, CAL.—City Engineer Buckman has been instructed to procure plans and estimates for a new bridge over the river at Third Street.

SAGINAW, MICH.—Repairs are to be made to the bridges at Mackinaw and Johnson Streets.

KANSAS CITY, MO.—The Board of County Commissioners has authorized the erection of a bridge on the Leavenworth County line, in Prairie Township.

SPOKANE FALLS, WASH.—The City Council has issued bonds in the sum of $25,000 for the purpose of constructing a bridge at this place.

WILLIMANSETT, MASS.—A new bridge is to be constructed here after plans, just finished, by Edward S. Shaw, of Boston, Mass.

LANCASTER, PA.—It is proposed to repair all the county bridges at once.

SAN FRANCISCO, CAL.—It is proposed to either repair the Second Street bridge or to replace it with a new structure. For particulars, address Superintendent Ashworth, of the Street Committee, as above.

MILWAUKEE, WIS.—The plans for the new bridge on North Avenue have been completed by the City Engineer. According to the specifications the structure will be 522 feet in length, exclusive of the abutments, and 30 feet above the surface of the water. The entire bridge, with the exception of the planking of the roadway, will be of iron and steel. The cost is estimated at about $30,000. The Whitefish Bay Railway Company will erect the bridge, but the city will reimburse it for one-half of the expense.

PHILADELPHIA, PA.—A petition has been presented to Councils for a bridge over the Pennsylvania Railroad on the line of Oxford Street. Particulars can be obtained by addressing Clifford Pemberton, Jr., of this city.

BAYONNE, N. J.—Two bridges are to be erected at this place by the Central Railroad of New Jersey.

VICKSBURG, MISS.—Assistant Engineer John Ewans, appointed to examine and report on the proposed site of the New Orleans and Northwestern Railroad bridge over Bœuf River near Rayville, reports favorably. The bridge will open 60 feet in the clear, and is situated two miles north of Rayville.

LITCHFIELD, CONN.—It is proposed to erect a new iron bridge at the East Mill.

NEW LONDON, CONN.—A new bridge is to be erected over Winthrop's Cove, this city.

AUSTIN, TEX.—It is proposed to establish a new iron bridge at this place.

ST. PAUL, MINN.—At a meeting of the Board of Public Works, held October 10, all the bids for the superstructure of the Sixth Street bridge were rejected. The following were the bidders: Keystone Bridge Company, $136,000; Chicago Forge and Bolt Company, $126,160; Milwaukee Bridge and Iron Works, $136,000; Chicago Bridge and Iron Company, $149,999; King Iron Bridge and Manufacturing Company, $141,000; New Jersey Steel and Iron Company, $133,400. The engineer's estimate of the cost of the work was $133,000. It is stated that the bid of the Chicago Forge and Bolt Company would have been accepted but for the fact that all the sureties offered were non-residents of Minnesota, and the law requires that such shall be residents.

SCRANTON, PA.—City Clerk M. T. Lawler writes: "At the election on November 4, the question of increasing the indebtedness of the city $250,000, for the purpose of constructing four bridges, will be voted on by the electors."

BALTIMORE, MD.—City Clerk A. E. Smyrk writes: "The only bridge work now contemplated by the city is an iron bridge over the Baltimore and Ohio Railroad, on line of Monroe Street."

CHATTANOOGA, TENN.—A terminal company has been organized in the city, and among the works contemplated is the erection of a double-track railroad bridge, with footways on each side, to span the Tennessee River. Work is to be commenced on the structure at once.

LITTLE BRITAIN, PA.—On the 23d of October a jury appointed by the Court will meet for the purpose of viewing a site for an inter-county bridge over the Octaroro, from this place to Lower Oxford.

CHICAGO, ILL.—The Chicago and Western Indiana Railway Company will build an iron bridge, to cost between $40,000 and $50,000, over the Little Calumet River near Dalton, Ill. S. H. Miller, civil engineer, will have charge of the work.

LOCKPORT, ILL.—R. D. Wheaton & Co., of Chicago, have been awarded the contract for the construction of an iron bridge at this point, at $9,595.

THE Editor of THE ENGINEERING AND BUILDING RECORD is always glad to receive items of news for the Contracting News Department. But such items are not considered news except when the prices and particulars of the award of a contract are given.

The announcement that ——— has sold ——— to ——— without giving the *prices* and particulars concerns only the buyer and seller. Such notices are always excluded, except in the case where a certain firm is stated to have taken a certain contract, the execution of which would require that they should buy certain materials. Such an item would be used if deemed of more than local interest, because it would suggest to some readers the possibility of their making a sale or securing a sub-contra

DAYTON, TENN.—Two iron bridges are to be erected by the Tennessee Industrial Land Company of this place.

CLINTON, ILL.—Reports say that the Chicago and Eastern Illinois Railroad Company will replace its present wooden bridge at this place with a steel one, and that next year iron and steel structures will replace every wooden bridge on its system.

PITTSBURG, PA.—A new bridge is to be erected over the Susquehanna River by the Erie and Wyoming Railroad Company.

ORANGE GROVE, FLA.—Reports say that it has been decided to expend the sum of $22,000 on a bridge to span the Patapsco River at this place.

PHILADELPHIA, PA.—Plans have been received by the Park Department for a $50,000 iron bridge over Lansdowne Ravine.

BRIDGES.—See our Proposal Columns for information regarding bridge construction at the following places: Dublin, Ga.; Augusta, Ga.; Atlanta, Ga.; St. Paul, Minn.; Philadelphia, Pa.; Greensburg, Pa.; Zanesville, O.

NEW DEPOTS.

MORRISTOWN, PA.—The Reading Railroad Company will erect a large depot at the corner of De Kalb and Washington Streets, in this city.

KANSAS CITY, MO.—Van Brunt & Howe, architects, of this city, with J. A. L. Waddell, as consulting engineer, have prepared plans for a new union depot at Sioux City, Iowa.

MANASQUAN, N. J.—A new depot is to be erected here by the New York and Long Branch Railroad Company.

DES MOINES, IOWA.—The Iowa Railroad Commissioners have issued an order directing the Chicago, Milwaukee and St. Paul Railroad to build at once a commodious freight and passenger depot, and furnish other facilities at the station of Denison, Iowa.

WILKENSBURG, PA.—It is reported that the Pennsylvania Railroad will erect a new freight depot at this place.

ERIE, PA.—According to reports, John Hanchett has been awarded the contract to erect a new depot at this place.

CHESTER, PA.—A new depot is to be erected at this place by the Pennsylvania Railroad Company.

THE CONTRACTING NEWS DEPARTMENT of **THE ENGINEERING AND BUILDING RECORD** is edited with a view of giving space to no item that does not indicate where professional services or supplies may be needed in the near future, the prices bid for work or supplies, and the correction of false or misleading reports in some papers, that may subject readers to needless trouble and expense in going after something that does not exist.

SEWERAGE.

For Additional Sewerage Items see Proposal Columns

ATLANTA, GA.—The Aldermanic Board has concurred in the action of the City Council authorizing ordinances to be drawn providing for the extension of the main sewers to the city limits. It is probable that the matter will come up at the next meeting of the Council, and acted on.

ROANOKE, VA.—Important sewer work is projected here.

SCRANTON, PA.—Operations will probably soon begin on the $75,000 sewer job at this place.

WASHINGTON, PA.—A committee of citizens has been appointed at this place to take steps towards establishing a system of sewers.

JAMESTOWN, N. Y.—The sum of $95,000 has been appropriated at this place for the purpose of establishing a system of sewers.

SAN FRANCISCO, CAL.—It is proposed to construct sewers in the district north of the park, in this city. For particulars, address the City Engineer, as above.

DAYTON, O.—The following proposals for the construction of sewers in this city were opened October 13 by the City Engineer:

BIDDERS.	PIPE LAID, PER LINEAL FOOT.							DRAIN TILE LAID, PER LINEAL FOOT.				BRICK SEWER, PER LINEAL FOOT.				EXCAVATION, PER LINEAL FOOT.								Repaving, each.	Manholes, each.	Lampholes, each.	Flush-tanks.	Iron Pipe, price in tons, each.	Embankment, Cubic yards each	Clay Puddle, Cubic yards, each.	Total Bids.
	18-inch.	15-inch.	12-inch.	10-inch.	8-inch.	6 inch.	5-inch.	6-inch.	5-inch.	4-inch.	3-inch.	42-inch	40-inch.	36-inch.	30-inch.	6 ft.	6-8 ft.	8-10 ft.	10-12 ft.	12-14 ft.	14-16 ft.	16-18 ft.	18-20 ft.								
(Est'd quantities)..	5,600	100	2,800	7,400	35 000	1,100	5,000	5,000	1,000	1,000	2,000	1,600	25	3,300	2,100	12,000	14,000	22,000	10,000	3,000	2,000	1,000	100	1 500	180	200	60	110	3,000	100	
Frank Whitley, Springfield, O..	$1.60	$1.25	$1.10	$1.00	$0.65	$0.55	$0.55	$0.04	$0.03	$0.02	$0.02	$3.90	$3 90	$3.80	$4.00	$0.10	$0.06	$0 06	$0.06	$0.20	$0.20	$0.20	$0.20	$0.25	$20.00	$3.00	$25.00	$60 00	$0.60	$1.50	$92,987.50
D. F. Minehan, Springfield, O..	.77	.52	.36	.30	.23	.13	.11	.08	.07	.06	.06	4.00	4.00	4.00	3 50	.23	.37	.39	.60	.90	.95	1.05	1.30	.45	34.00	5.00	21.00	55.00	.40	1 25	88,782.00
John Munger, Dayton, O......	.60	.50	.33	.26	.21	.14	.12	.05	.04	.03	023	2 39	2.34	2.05	1.70	.20	.35	.40	.60	1 10	1.20	2.00	2.50	.12	25.00	2.00	25.00	38.25	.30	2.00	71,069.00
Rob't J. Paul, Dayton, O.....	.67	.53	.43	.37	.24	.17	.14	.12	.095	.09	.09	2.90	2 90	2.55	2.20	.24	.40	.44	.59	.85	1.00	1.24	2.25	.70	34.00	9.00	85.00	57.00	.67	1.40	88,294.50
Bruno Ritty, Dayton, O......	.76	.52	.40	.33	23	.18	.16	.14	.12	.10	.08	2.78	2.41	2.25	2.05	.16	.20	.26	.37	.45	.63	.96	1.04	.15	25.10	9.35	23.00	50.00	.20	.50	66,175 25

SAGINAW, MICH.—The City Engineer has been instructed to prepare plans for numerous new sewers.

COLUMBUS, GA.—An election will be held in Columbus some time next month for the purpose of determining whether the city shall issue bonds to put in a separate system of sanitary sewerage. Plans and specifications for the new system of sewerage have been made, and the estimated cost is $125,000.

TROY, N. Y.—The Public Improvement Commissioners have authorized the construction of numerous sewer extensions.

LORIN, CAL.—The local improvement association is agitating the question of establishing a system of sewers at this place.

TORONTO, CAN.—City Engineer W. T. Jennings has recently been visiting Boston inspecting the system of sewerage of the latter city, having in view the introduction of a new system of intercepting sewers for Toronto.

NEW PHILADELPHIA, O.—This city contemplates establishing a system of sewers.

SEWERS.—See our Proposal Columns for information regarding sewer construction at the following places: Jersey City, N. J.; Avondale, O.; Detroit, Mich.; Albuquerque, N. M.

STREET-WORK AND PAVING.

AURORA, ILL.—This city has decided to pave its principal streets with cedar blocks.

ROCKFORD, ILL.—The principal streets will be paved next season. The City Engineer is D. C. Dunlap.

SAN FRANCISCO, CAL.—It has been decided to put all the streets along the water front of this city in good condition.

SCHENECTADY, N. Y.—Many of the streets of this place are to undergo extensive improvements.

CHESTER, PA.—Numerous streets of this place are to be repaved at an early date. Address the City Engineer for particulars.

ROANOKE, VA.—Extensive street improvements are to made at this place.

ST. PAUL, MINN.—The Board of Public Works will report favorably upon the paving of numerous streets of this city.

NEW PHILADELPHIA, PA.—Considerable street paving is to be done at this place.

CHATTANOOGA, TENN.—Several streets of this city are to be widened, repaved and extensively improved.

BROOKLYN, N. Y.—City Works Commissioner Adams has authorized that proposals be issued for paving, curbing and guttering, with Belgian block and bluestone, several streets of this city.

GAS AND ELECTRICITY.

CAIRO, ILL.—The Citizen's Electric Light and Power Company has accepted the ordinance granting it permission to erect its power house, poles, etc., and to suspend the necessary wires for furnishing the patrons of the company with electric light and power.

KEOKUK, IOWA.—The Gate City Electric Company has been incorporated at this place. Capital stock, $150,000. George D. Rand is at its head.

PLAQUEMINE, LA.—It is probable that an electric lighting system will be established at this place.

ALEXANDRIA, LA.—The City Council has made a contract with the Thomson-Houston Electric Company to furnish the town with electric lights.

NEWBURG, N. Y.—Extensions are to be made to the local electric light plant.

ST. PAUL, MINN.—The Continental Dynamo Company has been awarded the contract for the electric light plant for the High School, for $1,550.

JAMESTOWN, N. Y.—The people of this place have voted $30,000 for electric lights.

UPLAND, PA.—Reports say that when the present contract for public lighting expires at this place an effort will be made to introduce electric lights.

NEW ROCHELLE, N. Y.—For lighting the village streets the Trustees have recommended the payment of $125 per year for each arc light, $25 each for 100 incandescent lights, and $25 each for 100 gas lights.

KEOKUK, IOWA.—At a meeting of the City Council, held October 7, the bids for lighting the city were opened. The following were the bidders: Keokuk Electric Light and Power Company, Badger Electric Company, Gate City Electric Company, Keokuk Gas Light and Coke Company. The figures for electric lighting were made on a basis of furnishing 125 arc lights of 2,000 candle-power each, the Philadelphia system to prevail. The highest bid was that of the Badger Electric Company, whose bid was $72 per light per year, with conditional figures for more or less lights. The lowest bid was that of the Gate City Electric Company, which was $60 per light per year, with conditions the same as above. The Keokuk Electric Light and Power Company's bid was $68 per light. The bid of the Keokuk Gas Light and Coke Company was as follows: For furnishing 100 gas street lamps, under the Philadelphia schedule, $25 a year, with additional lamps at $22. The figures in detail of the lowest bidder were as follows: Gate City Electric Company, first, to furnish 125 arc lights on the Philadelphia schedule, at $60; additional lights at $60; 125 arc lights and additional arc lights at $60. Second, 125 arc lights every night up to 12 o'clock at $60; additional lights at $60; 125 lights and additional lights at $60. Third, 125 arc lights every night and all night at $75; additional lights at $75; 125 lights and additional lights at $75. Fourth, 100 arc lights on the Philadelphia schedule at $65; additional lights at $65. Fifth, 100 arc lights every night up to 12 o'clock at $65; additional lights at $65; 100 lights and additional lights at $65. Sixth, 100 arc lights every night and all night at $78; additional lights at $78; 100 lights and additional lights at $78. Seventh, 60 arc lights on the Philadelphia schedule at $75; additional lights at $75; 60 lights and additional lights at $75. Eighth, 60 arc lights every night up to 12 o'clock at $75; additional lights at $75; 60 lights and additional lights at $75. Ninth, 60 arc lights every night and all night at $84; additional lights at $84; 60 lights and additional lights at $84. The company further agrees that in case a contract is awarded to it for 125 arc lights, to be lighted under the Philadelphia schedule, it will furnish same on such moonlight nights as may be necessary by reason of cloudiness, without additional cost to the city.

ORANGE, N. J.—The Essex County Electric Light Company has decided to build an incandescent light system for houses.

NORTH PLAINFIELD, N. J.—A committee has been appointed to procure electric lighting for this place.

EAST AURORA, N. Y.—This place is soon to have electric lights.

TORONTO, CAN.—The Fire and Gas Committee has awarded the following contracts for public lighting: Toronto Electric Light Company, for the supply of from 800 to 1,200 arc electric lights for five years, at 29¾ cents each per night; Consumers' Gas Company, for the supply of a minimum of 1,000 lamps with 4-foot burners, on the present line of mains, in such localities as may be required by the city, at $21.50 each per annum; Lambeth lamps at $75 each per annum, and such lamps as may be required on new mains, a distance of 150 feet apart, at $23 each for lamps with 4-foot burners, and $75 each for Lambeth lamps.

PORT JERVIS, N. J.—The plant of the local gas light company is to be extended.

BELLAIRE, O.—The Gearing Fuel Gas Company has been incorporated at this place. J. M. Waring can furnish particulars.

ATLANTA, GA.—Reports say that an electric light plant is to be erected in this city by the Georgia Electric Light Company.

RED CLIFF, CAL.—The Fall Creek Electric Company is to establish an electric light plant at this place. Estimated outlay, $10,000. For details, address G. F. Brock, as above.

FAIRFIELD, IOWA.—This place is to have electric lights. For details, address C. D. Jones, as above.

MONTGOMERY, ALA.—The Ball Light and Power Company has been incorporated at this place, and an electric light plant will be established. For particulars, address P. B. Bibb, as above.

DERRY, PA.—A plant is to be established at this place by the Derry Electric Light Company, at an estimated cost of $5,000.

COHOES, N. Y.—Improvements are to be made to the local electric light plant.

Electric Railways.—New electric railways are to be constructed, and improvements are to be made to those already established at the following places: Worcester, Mass.; Roanoke, Va.; Springfield, Mass.; Knoxville, Tenn.; Cairo, Ill.; Media, Pa.; Chester, Pa.; Salem, Mass.; Lewiston, N. Y.; Reading, Pa.; San Francisco, Cal.; Hannibal, Mo.; Middletown, Conn.; Jersey City, N. J.; Wheeling, W. Va.; Lynn, Mass.; Paducah, Ill.

BIDS OPENED.

Kansas City, Mo.—All the bids for building the Masonic Temple have been rejected, as they were over the limit, and the work is to be re-advertised.

Flushing, L. I.—The contract for macadamizing the North Hempstead Turnpike has been awarded to Thomas F. Tuohy and Company, of this place, at $65,000.

New York.—William J. Baldwin, heating and ventilating engineer and contractor, has the contract for warming and ventilating the Sims Clinic in connection with the College of Physicians and Surgeons, New York. W. Wheeler Smith, architect.

Brooklyn, N. Y.—The contract for heating the new building of the Brooklyn Polytechnic Collegiate Institute, by hot-water circulation, has been awarded to G. C. Blackmore, Newark, N. J., at a total cost of $15,000. Four No. 9 perfect water heaters will be used, with 13,000 square feet radiation.

Duluth, Minn.—Wilford & Northway, of Minneapolis, have secured the contract for the machinery for the Duluth Milling Company's new flour mill, to be erected here at once. J. H. Malloy has secured the contract for the construction of the mill and accessories. The mill will be of brick and stone, to cost $225,000.

Peru, Ill.—The contract for heating and ventilating the new monastery here has been awarded to Robert Clark, steam heating engineer, of Peoria, Ill., for $11,000.

GOVERNMENT WORK.

Tompkinsville, N. Y.—Abstract of bids received by Major D. P. Heap, U. S. A. Engineer, Third Lighthouse District, October 11, for furnishing 500 tons rip-rap stone at Saybrook Breakwater Light Station, Conn: Wm. H. Molthrop, New London, Conn., granite, $1.65; Charles F. Stoll, New London, Conn., granite, $1.49; T. A. Scott, New London, Conn., granite, $1.75, brownstone, $1.35, Daniel Crowley, New London, Conn., granite, $1.19; James Scully, Groton, Conn., granite, $1.75; John Beattie, Leetes Island, Conn., granite, $1.25; Connecticut River Granite Company, Essex, Conn., granite, 93 cents; James V. Luce, Niantic, Conn., granite, $1.39, Telegram, less 5 cents per ton from the quoted price.

Washington, D. C.—The following proposals for the work specified were opened on the given dates by the Supervising Architect of the Treasury Department:

Williamsport, Pa. — Low-pressure steam heating and ventilating apparatus for the United States Court-House and Post-Office at this place. Opened October 10. Bidders: James & R. H. Walker, Elmira, N. Y., $7,300; John Lyon, Washington, D. C., $8,295; Crook, Horner & Co., Baltimore, Md., $8,398.15; Samuel I. Pope & Co., Chicago, Ill., $8,478; Blake & Williams, New York, $9,980; Q. N. Evans Construction Co., New York, $10,289; E. Keeler & Co., Williamsport, Pa., $10,800; Williamsport Steam Co., Williamsport, Pa., $11,610.

Charlotte, N. C.—Low-pressure heating and ventilating apparatus for the United States Court-House and Post-Office at this place. Opened October 15. Bidders: J. E. Tinsley, Charlotte, N. C., $5,934; John Lyon, Washington, D. C., $6,180; Crook, Horner & Co., Baltimore, Md , $6,699.78; Samuel I. Pope & Co., Chicago, Ill., $7,963; Blake & Williams, New York, $8,891.

Readers of **THE ENGINEERING AND BUILDING RECORD** interested in the Contracting News Department of that paper are respectfully requested to examine those columns every week, and advise the Editor of any item which they may find that, in their judgment, is of no value to any one other than the person mentioned.

INDUSTRIAL.

Toronto, Ont.—The City Commissioners' report, that tenders be advertised for for a crematory to consume 75 tons of garbage and 20 tons of night soil, has been adopted.

Boston, Mass.—The sum of $840,000 has been appropriated by the Finance Committee of the City Council for public improvements.

PROPOSALS.

(Continued from page ii.)

PROPOSALS FOR CONSTRUCTION.—U. S. Engineer Office, 89 Euclid Avenue, Cleveland, O., October 14, 1890.—Sealed proposals, in duplicate, will be received at this office until 12 o'clock M. on MONDAY, November 3, 1890, when they will be opened in presence of bidders, for constructing 450 lineal feet, more or less, of the structure of east **BREAKWATER** at CLEVELAND, O. All information can be obtained at this office. The United States reserves the right to reject any or all proposals. Preference will be given to materials and plant of domestic production or manufacture, conditions of quality and price (import duties included) being equal. The attention of bidders is invited to the Acts of Congress, approved February 26, 1885, and February 23, 1887, Vol. 23, page 332, and Vol. 24, page 414, Statutes-at-Large. L. COOPER OVERMAN, Major of Engineers. 22

PROPOSALS FOR DREDGING. — UNITED States Engineer Office, Cleveland, O., October 14, 1890.—Sealed proposals, in duplicate, will be received at this office until 12 o'clock M. on MONDAY, the 3d day of November, 1890, and then opened, for **EXCAVATING** 240,000 cubic yards, more or less, of material from SANDUSKY BAY along line of proposed straight channel for Sandusky Harbor, O. Preference will be given to materials and plant of domestic production or manufacture, conditions of quality and price (import duties included) being equal. The attention of bidders is invited to Acts of Congress approved February 24, 1885, and February 28, 1887, Vol. 23, page 332, and Vol. 24, page 414, Statutes at Large. All information can be obtained at this office. The United States reserves the right to reject any or all proposals. L. COOPER OVERMAN, Major of Engineers. 22

OCTOBER 14, 1800.

SEALED PROPOSALS WILL BE RECEIVED at the office of the Supervising Architect, Treasury Department, Washington, D. C., until 2 o'clock P. M. on the 3d day of November, 1890, for all the labor and materials required for the **PLUMBING** and gas-piping for the U. S. Post-Office building at DAYTON, O., in accordance with the drawings and specification, copies of which may be had on application at this office or the office of the Superintendent. Each bid must be accompanied by a certified check for $100. The Department will reject all bids received after the time herein stated for the opening of the same; also, bids which do not comply strictly with all the requirements of this invitation. Each proposals must be inclosed in an envelope, sealed and marked "Proposal for the Plumbing and Gas-Piping for the U. S. Post-Office, etc., at Dayton, O.," and addressed to JAS. H. WINDRIM, Supervising Architect. 21

HEADQUARTERS SOUTHERN BRANCH, National Home for D. V. Soldiers, Hampton, Va., October 14, 1890.—Sealed proposals, subject to the usual conditions, will be received at this office until twelve (12) o'clock, noon, THURSDAY the thirtieth (30) day of October, 1890, for **BREAKWATER** at the Southern Branch of the National Home for D. V. Soldiers, near Hampton, Va. The work to consist of Piling Revetment, Dredging, Embankment and Platform, etc. Specifications and drawings can be seen at this office and further information obtained from the Governor of the Home. WM. C. GUNNELL, Civil Engineer. 21

OCTOBER 16, 1890.

SEALED PROPOSALS WILL BE RECEIVED at the office of the Supervising Architect, Treasury Department, Washington, D. C., until 2 o'clock P. M. on the 11th day of November, 1800, for all the **LABOR AND MATERIALS** required for the approaches to the U. S. Court-House, Post-Office, etc., building at LOUISVILLE, KY., in accordance with the drawing and specification, copies of which may be had on application at this office or the office of the Superintendent. Each bid must be accompanied by a certified check for $500. The Department will reject all bids received after the time herein stated for the opening of the same; also, bids which do not comply strictly with all the requirements of this invitation. Proposals must be inclosed in an envelope, sealed and marked, "Proposal for the Approaches to the U. S. Court-House, Post-Office, etc., building at Louisville, Ky.," and addressed to JAS. H. WINDRIM, Supervising Architect. 21

BRIDGE WORK, Greensburg, Pa.—Proposals are wanted until October 27, for a new superstructure and repair to the masonry work of a low truss iron bridge at this place. Address John M. Young, Clerk to the Commissioners, as above.

STREET WORK, Norwood, O.—Proposals are wanted until November 5, for doing certain street work at this place. Address E. G. Balles, Village Clerk, as above.

PAVING, Rutledge, Pa.—Proposals are wanted until October 22, for doing certain paving at this place. Address William S. Maull, Town Clerk, as above.

ROAD WORK, Willowdale, Ont.—Proposals are wanted until October 31, for doing certain road work at this place. Address Peter S. Gibson, as above.

COURT HOUSE, Fort Payne, Ala.—Proposals are wanted until November 3, for the erection of a county court house at this place. Address L. L. Cochrane, Judge of Probate Court, as above.

PROPOSALS.

STEAM HEATING APPARATUS, Chicago, Ill.—Proposals for furnishing and putting in position steam heating apparatus for electric light stations at various streets, will be received until October 21. For further information, address W. J. Onahan, City Comptroller.

REMOVAL OF ROCKS, New York City.—Proposals are wanted until October 30, for removing Dettinger and Overslaugh rocks in the Hudson River, five miles below Albany. Address Lieut.-Col. G. L. Gillespie, U. S. A., as above.

WATER-WORKS, Markham, Ont.—Proposals are wanted until October 21, for the construction of a complete system of water-works at this place. Address John Galt, C. E., No. 53 King Street, East Toronto.

PAVING, St. Paul, Minn.—Proposals are wanted until October 21, for doing certain paving in this city. Address J. T. Kerker, Clerk of the Board of Public Works, as above.

LEVEES, Alexandria, La.—Proposals are wanted until October 22, for the construction of four levees. Address James H. Meeker, President Board of Levee Commissioners, as above.

BRIDGE SUPERSTRUCTURE, St. Paul, Minn. —Proposals are wanted until October 23, for constructing the superstructure of the bridge on Sixth Street. Address J. T. Kerker, Clerk of the Board of Public Works, as above.

WHARF, Quebec.—Proposals are wanted until October 21, for the construction of a wharf in St. Ambroise in St. Sauveur. Address Jer. Gallagher, W. W. Engineer, as above.

PAVING, Quebec.—Proposals are wanted until October 29, for such stone paving, water course and curb stone, as the Corporation may require during the fiscal year beginning May, 1891. Address W. D. Baillairge, Assistant City Inspector, as above.

WATER-WORKS, Belvidere, Ill.—Proposals are wanted until October 25, for the construction of a complete system of water-works at this place. Address A. E. Jemer, City Clerk, as above.

PUMPING STATION, Carthage, O—Proposals are wanted until October 22, for the erection of a brick pumping station. Address H. E. Siter, architect, United Bank Building, Cincinnati, O.

SEWERS, Avondale, O.—Proposals are wanted until October 23, for the construction of certain sewers at this place. Address W. Elwood Wynne, Corporation Clerk, as above

SEWERS, Detroit, Mich.—Proposals are wanted until October 27, for the construction of various sewers in this city. Address the Board of Public Works, as above.

DRY DOCK, Port Royal, S. C.—Proposals are wanted until November 1, for the construction of timber dry dock at Naval Station. Address N. H. Farquhar, Chief of Bureau of Yards and Docks.

REPAIRS TO BUILDINGS, Fort Trumbull, Conn.—Proposals are wanted until October 29, for making repairs to numerous public buildings at this Post. Address E. H. Catlin, First Lieutenant, Second Artillery, A. A. Q. M., as above.

CITY HALL, Keithsburg, Ill. — Proposals are wanted until October 23, for the completion of a city hall for said city. Address J. L. Noble, Mayor, as above.

BRIDGE, Zanesville, O.—Proposals are wanted until November 11, for the construction of a bridge across the Muskingum River. Address J. A. Knight, Auditor, as above.

RESERVOIR, Philadelphia, Pa.—Proposals are wanted until November 7, for the construction of a reservoir. Address Louis Wagner, 1321 Filbert Street, as above.

STREET WORK, Jersey City, N. J.—Proposals are wanted until October 20, for the improvement of Woodward Street. Address E. A. Dugan, Chairman of Streets and Sewers, as above.

SEWERS, Jersey City, N. J.—Proposals are wanted until October 20, for the construction of the Hopkins Street Sewer. Address E. A. Dugan, Chairman of Streets and Sewers, as above,

LAVATORY BUILDING, Boston, Mass.—Proposals are wanted until October 20, for building a woman's lavatory at Charlesbank. Address Park Commissioners at Boston, Mass.

HOSPITAL, Atlanta, Ga.—Proposals are wanted until October 20, for labor and material required in constructing the buildings for the Grady Hospital. Address Jacob Elsas, Chairman Building Committee of Grady Hospital, as above

SCHOOL, Canton, O —Proposals are wanted until October 29, for the erection of a brick school building, including the heating apparatus, at this place. Address Guy Tilden, architect, Odd Fellows' Temple, as above.

PUMPING ENGINES, Toronto, Can.—Proposals are wanted until October 20, for furnishing two duplex pumping engines, with a 10,000,000-gallon capacity, also the necessary boilers, etc., for the same. Address William J. Hill, Chairman Committee on Water-Works, as above.

POSITIONS WANTED.

TOO LATE FOR CLASSIFICATION.

A MECHANICAL ENGINEER, WITH 20 years' experience in shop and drawing room, especially in the design and construction of triplex, compound and marine engines, desires an engagement. First class references. Address TAMSEN, 186 Carlton Avenue, Brooklyn, N. Y.

Building Intelligence.

We solicit from each and every one of our readers information relating to projected buildings in their locality, and should be glad to receive newspaper clippings and other items of interest.

Abbreviations.—*b s*, brown stone; *br*, brick; *br st*, brick store; *b s dwell*, brown-stone dwelling; *apart house*, apartment-house; *ten*, tenement; *e*, each; *o*, owner; *a*, architect; *b*, builder; *fr*, frame.

NEW YORK.

336 W 51st st, br flat; cost, $18,000: o, P Costello; a, not given.

E s Morris av. 255 s Highbridge Road, 2 fr dwells; cost, $7,000 all; o, S A Lisk; a, S C Lisk.

N e cor 123d st and St Nicholas av, br storage; cost, $40,000; o, O'Rielly Bros; a, C O'Rielly.

95 to 99 Hudson st, br store; cost, $30,000; o, J T Williams; a, J B Snook & Son.

N e cor Lexington av and 112th st, br flat; cost, $36,000; o, W Lyman; a, E Wenz.

N s 35th st, 100 e 11th av, br shop; cost, $12,000; o, Thos Watson; a, J W Cole.

S w cor 59th st and 9th av, br hospital; cost, $175,000; o, Roosevelt Hospital; a, W W Smith.

S s 77th st, 325 w 8th av, br dwell; cost, $45,000; o, H Lavanburg; a, J H Duncan.

W s Wadsworth av, 200 s 187th st, 2 fr dwells; cost, $7,500 all; o, G Herbert, Jr; a, C Sidney.

N e cor 96th st and 5th av, br dwell; cost, $7,500; o, C K Maguire; a, A Spence.

S s 77th st, 100 w 3d av, br school; cost, $35,000; o, City of New York; a, G W Debevoise.

S s 141st st, 100 w 7th av, br church; cost, $20,000; o, Church St Charles Boromeo; a, B E Lowe.

S e cor 161st st and St Ann's av, br factory; cost, $20,000; o, Albany Brewing Co; a, J Kastner.

62 Essex st, br flat; cost, $24,000; o, Fay & Stacom; a, C Rentz.

211 E 86th st, br flat; cost, $20,000; o, F E Wise; a, G A Schellenger.

96th st, n s, 70 e Lexington av, 5 br flats; cost, $18,000 each; o, T Lowery; a, Ogden & Son.

101st st, n s, 300 w 9th av, s flat; cost, $22,000; o, G Boehm; a, F J Miller.

Grand Boulevard, n w cor 150th st, br, s and terra cotta asylum bldg; cost, $90,000; o, The Hebrew S G Society; a, J H Duncan; b, R B Lynd.

12th av, w s, 53 s 132d st, br market; cost, $10,000; lessee, D Katz; a, E T Angell.

508 Broome st, stone and terra cotta bldg; cost, $15,006; o, W Schneider: a, J E Terhune.

N s 73d st, 323 e Av A, br stable; cost, $10,000; o, McGee & Lawton; a, J I F Gavigan.

N s 92d st, 200 w Columbus av, 4 stone dwells; cost, $80,000 all; o, Ferriter & Rossell; a, G F Pelham.

325 East 10th st, 2 br dwells; cost, $30,000 all; o, M R Townsend; a, G E Harney.

N s 133d st, 250 e 7th av, br flat; cost, $20,000; o, C F Schultz; a, Cleverdon & Putzel.

S s Little 12th st, 35 e Washington st, br store; cost, $8,000; o, M Lawless; a, E D Homes.

941-47 Fifth av, br synagogue; cost, $210,000; o, Temple Beth El; a, Brunner & Fayon.

191-97 East Broadway, br industrial school; cost, $120,000; o, Educational Alliance; a, same as above.

11 Lexington av, br dwell; cost, $30,000; o, P C Hewitt; a, W B Bigelow.

S s 93d st, 325 e Amsterdam av, 5 br dwells; cost, $90,000 all; o and a, W P Anderson.

N e cor 116th st and Madison av, br flat; cost, $95,000; o, E S Smith; a, F Baylies.

Fulton av, about 324 n 167th st, br fire engine house; cost, $17,000: o, City of New York; a, Le Brun & Sons.

S w cor Boulevard and 72d st, br club house; cost, $250,000; o, Colonial Club; a, H F Kilburn.

N s 76th st, 275 e 10th av, 4 br dwells; cost, $10,000 all; o, D C McKinley; a, C True.

BUILDING INTELLIGENCE.

ALTERATIONS—NEW YORK.

Pier 45 (new number), North River, foot 10th st, 1-story extension; cost, $10,000; o, Oceanic S. N. Co; a, R B Staats

BROOKLYN.

E s Broadway, 20 n Cornelia st, br dwell; cost, $8,000; o, A Kaiser & Co; a, H Vollweiler.

N e cor Broadway and Cornelia st, br dwell; cost, $8,000; o and a as above.

S w cor Green and Hamburg st, fr dwell; cost, $15,000; o, G Covert; a, H Loeffler.

N s Madison st, 290 e Broadway, 6 fr dwells; cost, $38,000 all; o, Sperl & Koeher; a, Th Engelhardt.

N e cor Arlington and Hall avs, fr dwell; cost, $7,000; o, A Appelhaus, a, Danman & Fischer.

N s Van Voorhees st, 200 w Evergreen av, 4 fr dwells; cost, $14,000 all; o, Mary A McLaker; a, E J Biddell.

N s Macon st, 198 w Patchen av, 4 br dwells; cost, $24,000 all; o, Mary A Burrows; a, I D Reynolds & Son.

S s 19th st, 100 w 3d av, 2 fr dwells; cost, $7,600 all; o, M Halfeldt; a, I Queensbury.

N s Van Voorhees st, 100 w Evergreen av, 3 fr dwells; cost, $9,000 all; o, Mary A McLaker; a, E J Biddell.

S e cor 6th av and 11th st, fr dwell; cost, $18,000; o, G O Van Orden; a, W O Tait.

N s Ross st, 250 w Marcy av, fr dwell, cost, $8,500; o, J Dittman; a, H A Billard.

E s 6th av, 81 s 11th st, fr dwell; cost, $10,000; o, Geo O Van Orden; a, W O Tait.

S w cor Fulton and Saratoga av, 5 fr dwells; cost, $22,500 all; o, P Donlin; a, O E Hoffer.

S e cor Manhattan av and Ash st, fr dwells; cost, $7,000; o, W Kasper; a, Th Engelhardt.

W s Vanderbilt av, 28 s Bergen st, 6 br dwells; cost, $42,000 all; o, T H Robbins; a, H Vollweiler.

S s Quincy st. 60 w Patchen av, 2 br dwells; cost, $16,000 all; o, J McQuaid; a, Th Engelhardt.

N e cor 3d av and 33d st, 2 fr dwells; cost, $7,000 all; o, Evarard & Son; a, not given.

S s 33d st, 200 e 3d av, 5 fr dwells; cost, $20,000 all; o, J Stabler; a, not given

S w cor 3d av and 45th st, 2 fr dwells; cost, $23,000 all; o, A Waldran; a, not given.

N s Vermont st, 150 n Jamaica av, 2 fr dwells; cost, $7,500 all; o, L Pfeiffer; a, K F Schmidt.

W s Chestnut st, 325 n Atlantic av, br factory; cost, $20,000; o, Solidarity Watch Co; a, Danmar & Fischer.

N w cor 3d av and 13th st, 2 br dwells, cost, $20,000 all; o, M A McCormick; a, not given.

S s 4th st, 294 w 7th av, 6 br dwells; cost, $48,000 all; o, Moses & Fanton; a, R L Daus.

31 Moore st, fr dwell; cost, $8,000; o, M Rich; a, E Dennis.

N s Decatur st, 100 w Howard av, 10 br dwells; cost, $45,000 all; o, W B Cummings; a, J E Dwyer.

N s 14th st, 105 e 8th av, 5 fr dwells; cost, $18,500 all; o and a, W Hawkins.

W s Lewis av, 95 n Quincy st, 2 fr dwells; cost, $15,000 all; o, Thos Rice; a, S Harbison.

N e cor Atlantic av and Franklin av, 3 fr dwells; cost, $50,000 all; o, E G Blackford; a, G A Schillinger.

S s Halsey st, 165 w Stuyvesant av, fr stables; cost, $8,000; o, H McQuilkin; a, H Vollweiler.

22-26 Moore st, 3 fr tens; cost, $9,000 each; o, Paskus & Feldman; a, H Smith.

Macon st, n s, 196 e Reid av, 5 b s dwells; cost, $4,500 each; o, F C Swimm; a, A Hill & Son.

McDonough st, s s, 175 e Ralph av, 8 b and red s dwells; cost, $4,000 each; o and a, Thomas H Radcliffe; b, J Covert.

6th st, s s, 126 w 4th av, 4 br tens; cost, $8,500 each; o, M Blanthorn; a, G M Miller; b, C Trimble.

MISCELLANEOUS.

CHAMBERSBURG, PA.—Work will soon be begun on the new machine shops of the Cumberland Valley Railroad. The machine and erecting shops will each be 50x150 feet. The other building will be 50x200 feet. The material will be brick. The company will advertise for bids in a short time.

BUILDING INTELLIGENCE.

ALLEGHENY, PA.—Mulberry st, 4-story br building for workshop; cost, $10,000; o, Coffin Works; a, Alston & Heckert; b, W F Trimble.

CANAL DOVER, O.—The Reeves Iron Co, of this place, will erect a large pipe works, in connection with their rolling plant, the city having donated $30,000.

DENVER, COL.—Col. W. K. Gooch and W S. Alkire will build a $30,000 block.

DETROIT, MICH.—Michigan av, bet Harrison and National avs, 4 3-story br stores and flats; cost, $16,000; o, Jas H Pound; a, E A Walshe & Son; b, not let.

Ferry av, west of St Antoine st, 2½-story br res; cost, $8,500; o, R J Wilson; a and b, same as above.

Ferry av, bet Woodward av and John R sts, 2-story res; cost, $45,000; o, C L Freer; a, John Scott & Co; b, same as above.

Locust st, bet Trumbull and National avs, 5 2-story fr res; cost, $12,500; o and b, Fred Gibson.

Third av, bet Walter and Holden avs, 3-story br double res; cost, $9,000; o, H W Holcomb; a, Harry J Rill; b, not let.

DUQUESNE, PA.—The Catholic Slavonic Congregation will erect a $10,000 church at this place.

FOREST CITY, PA.—A large hotel is to be erected at this place by R W Taylor.

LANCASTER, PA.—Two school buildings; cost, $25,000 each; b, contract not let.

LANSING, MICH.—Washington av, 3-story br office bldg; cost, $10,000; o, Geo E Ranney, M D; a, E E Myers, Detroit.

LEOMINSTER, MASS.—Stone church; cost, $20,000; o, Baptist Society.

LITTLE ROCK, ARK.—Lincoln av, 3 br houses; cost, $15,000; o, Jas R Miller; a, Fred J H Rickon; b, not let.

LANCASTER, PA.—Several new school buildings are to be erected in this city.

MINNEAPOLIS, MINN.—A theater, to cost $75,000, is to be erected on 1st avenue, between Washington and 3d streets, by Ralph Rees.

1908 Portland av. fr dwell; cost, $10,000; o, J M Bartlett; a, Orff Bros.

MINNEAPOLIS, MINN.—2425 S Emerson av. fr dwell; cost, $8,000; o and b, J P Larson; a, F Hoover.

2538 Stevens av, br stores and flats; cost, $22,000; o, Andrew Haugan; a, W H Dennis.

Tyler st and 14th av N E, br linen mill; cost, $25,000; o, Minneapolis Linen Co; a, W H Hayes; b, H N Leighton & Co.

NEWARK, N. J.—The State Board of Education has approved the plans for the new Normal School building, drawn by L H Broome, of Jersey City, N. J.

Plans have been prepared for the new addition to the County Insane Asylum, by Staehlin & Steiger, architects, of this city. The cost is estimated at $20,000.

PHILADELPHIA, PA.—S s Yotk st, w Sedgeley st, machine shop; b, R Smedley.

S s Gasker st, w 21st st, 16 dwells; o, W McCarter.

N s Sansom st, w 6th st, bldg; o, W C McPherson & Son.

S w cor 63d and Hamilton sts, church; b, J R Wiggins.

W s Maschers st, 8 e Mutter st, 15 dwells; o, E J Develin.

N s Asylum Pike, e Olney st, club house; o, E K Welch.

E s Clinton st, n Baker st, 16 dwells; b, McLaughlin & Co.

W s 3d st, s Venango st, factory; o, Payne Varnish Co.

S s Ruay st, e Edward st, 16 dwells; b, W H Gelland.

Bridge st, nr Orchard st, factory; o, R O Moorhouse.

S e cor Shedwick st and Ginter av, library; b, Martin Hetzel.

N w cor Dock and Pear st, factory; b, Thos Little & Sons.

BUILDING INTELLIGENCE.

ROCKFORD, ILL.—P. G. Hollem will build a row of flats on 5th street.

READING. PA.—The congregation of the First Baptist Church of this place contemplate erecting a new church.

ROCKFORD, ILL.—The Catholics will build a school-house here, to cost about $10,000.

WARREN, O.—Corner of Franklin and Main, S W; 3-story br bldg; cost, $10,000; o, J W Biggers; a, J P Leach; b, not let.

BUILDINGS.—There is nothing over $7,000 in value to report at the following places · Cambridge, O.; Wilkes-Barre, Pa.; Montclair, N. J.; St. Paul, Minn.; Chester, Pa.; Geneva, N. Y.; Pottsville, Pa.; Wheeling, W. Va.; Ogdensburg, N. Y.; Charleston, S. C.; Clinton, Iowa; Braintree, Mass.; Poughkeepsie, N. Y.; Canton, O.; Cambridge, O.

THE THAMES RIVER BRIDGE,
A Description by
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I.—Introduction. Issue of November 27, 1886.

II., III., IV.—Erection of the Towers of St. Patrick's Cathedral in New York City. Seven Illustrations. Issues of December 4, 11, and 18, 1886.

V.—Improvements in Dredging Machinery. Thirteen Illustrations. Issue of December 25, 1886.

VI.—Dumping-Scows. Thirteen Illustrations. Issue of January 1, 1887.

VII., VIII., IX., X., XI.—The Equitable Building in New York City. Thirteen Illustrations. Issues of January 8, 22, 29, February 5 and 12, 1887.

XII.—Carson's Trench Machine. Four Illustrations. Issue of February 19, 1887.

XIII.—Raising the Old Court-House in Boston. Three Illustrations. Issue of March 5, 1887.

XIV.—Cram's Steam Pile-Hammer. Five Illustrations. Issue of March 12, 1887.

XV.—The Equitable Building, New York City. Three Illustrations. Special Hoisting Engine and Derrick. Issue of March 26, 1887.

XVI.—The Equitable Building, New York City. One Illustration. Shoring of Column. Issue of April 9, 1887.

XVII.—Bridge-Erecting and Hoisting-Engine used on the Suburban Elevated Railway, New York City. Three Illustrations. Issue of April 30, 1887.

XVIII.—Traveler for Erecting Columns and Transverse Girders, Kings County Elevated Railway, Brooklyn, N. Y. Four Illustrations. Issue of June 4, 1887.

XIX.—Excavating Apparatus used on the Tancarville Canal and Sewer, Havre, France. Three Illustrations. Issue of July 2, 1887.

XX.—Tipple Cars on the New Croton Aqueduct. Six Illustrations. Issue of August 13, 1887.

XXI.—Derrick, Foot Block and Sheaves at Shaft 14 on the New Croton Aqueduct. Two Illustrations. Issue of September, 17, 1887.

XXII.—The Potomac Flats Dredging Plant. Nine Illustrations. Issue of October 8, 1887.

XXIII.—The Tube-Riveting Machines at the Forth Bridge. Two Illustrations. Issue of October 22, 1887.

XXIV.—The Lockwood Dredge. Cape Cod Ship Canal. Eight Illustrations. Issue of November 5, 1887.

XXV.—Location of Plant at Shafts on the New Croton Aqueduct. Two Illustrations. Issue of November 12, 1887.

XXVI.—Material Lock used in the Pneumatic Caissons at the Forth Bridge. Illustrated. Issue of December 3, 1887.

XXVII.—Six-Ton Universal Traveling Crane for Elevated Railroad Erection. Illustrated. Issue of December 17, 1887.

XXVIII.—Head-House on the New Croton Aqueduct at Shaft 22. Illustrated. Issue of December 24, 1887.

XXIX.—The New Harlem River Bridge. Illustrated. Issue of January 21, 1888.

XXX.—Erection of Poughkeepsie Bridge, No I. Illustrated. Issue of March 3, 1888.

XXXI.—Oil Rivet Furnace at the Forth Bridge Works. Illustrated. Issue of April 21, 1888.

XXXII.—Erection of Poughkeepsie Bridge. No. 2. Masonry. Illustrated. Issue of May 5, 1888.

XXXIII.—Erection of Poughkeepsie Bridge. No. 3. False Work. Illustrated. Issue of May 12, 1888.

XXXIV.—Erection of Poughkeepsie Bridge. No. 4. Travelers. Illustrated. Issue of May 19, 1888.

XXXV.—Erection of Poughkeepsie Bridge. No. 5. Riveting Traveler, Derrick, and General Plant. Illustrated. Issue of May 26, 1888.

XXXVI.—Erecting Traveler on Kettle Creek Trestle. Illustrated. Issue of June 2, 1888.

XXXVII.—Erection of Central Viaduct, Draw Span, Cleveland, O. Illustrated. Issue of June 9, 1888.

XXXVIII.—The 70-foot Caissons at the Forth Bridge. Illustrated. Issue of June 9, 1888.

XXXIX.—Raising an Engine at Poughkeepsie Bridge erection. Illustrated. Issue of June 16, 1888.

XL.—The Hydraulic Spade at the Forth Bridge Works. Illustrated. Issue of June 30, 1888

XLI.-XLVI.—Harlem River Bridge Erection. No. 2. Masonry. Illustrated. Issue of July 7, 1888.—No. 3. Cement and Concrete. Illustrated. Issue of July 14, 1888.—No. 4. Hoisting Apparatus; Revolving Derrick. Illustrated. Issue of July 21, 1888.—No. 5. Hoisting Apparatus; Floor Travelers. Illustrated. Issue of July 28, 1888.—No. 6. Derrick Details and Shipping. Illustrated. Issue of August 11, 1888.—No. 7. Support of Segments, Field Riveting, etc. Illustrated. Issue of September 1, 1888.

XLVII.—Head-House on New Croton Aqueduct at Shafts Nos. 1. 2. Illustrated. Issue of September 8, 1888.

XLVIII.—Lever Truck for Handling Bridge Material. Illustrated. Issue of September 15, 1888.

XLIX.—Bismarck Bridge. Erecting Traveler. Illustrated. Issue of November 3, 1888.

L.—Details of Head House, New Croton Aqueduct. Illustrated. Issue of November 17, 1888.

LI.—Suspended Tipple for Dumping Cars on the New Croton Aqueduct, N. Y. Illustrated. Issue of December 15, 1888.

LII.—A Viaduct Erecting Traveler. Illustrated. Issue of December 22, 1888.

LIII.—Ropes and Tackle. Illustrated. Issue of December 29, 1888.

LIV.—Power used for Operating Plant on the New Croton Aqueduct. Issue of January 19, 1889.

LV.—Special Methods of Handling Material on the New Croton Aqueduct. Issue of February 16, 1889.

LVI. Railway Bridge Erection in Peru. Part I. The Erection of a 200-foot Span. Illustrated. Issue of February 23, 1889.

LVII.—Railroad Bridge Erection in Peru. Illustrated Issue of March 2, 1889.

LVIII.—Erection of Omaha Bridge. Part I. General Description and Erecting Travelers. Issue of March 9, 1889.

LIX.—Erection of Omaha Bridge. No. II False Work in Channel Span. Illustrated. Issue of March 16, 1889.

LX.—Building the Centre Pier of Railway Drawbridge. Illustrated. Issue of March 23, 1889.

LXI.—The Sugar River Bridge Erection. False Work. Illustrated. Issue of March 30, 1889.

LXII.—Erection of Canadian Pacific Railway Depot, Montreal, P. Q. Illustrated. Issue of April 20, 1889.

LXIII.—Erection of a Plate Girder Bridge. Illustrated Issue of May 18, 1889.

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LXVI.—Erection of Harvard Bridge, Boston, Mass. Illustrated. Issue of June 29, 1889.

LXVII.—False Work of St. Peter's Bridge over the Dadore. Illustrated. Issue of August 10, 1889.

LXVIII.—Methods of Timbering Shafts on the New Croton Aqueduct. Illustrated. Issue of August 17, 1889.

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LXXVI.—An Adjustable Pile Driver and Derrick. Illustrated. Issue of November 9, 1889.

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LXXVIII.—Erection of Buffalo Truss Viaduct. Illustrated. Issue of December 14, 1889.

LXXIX.—Construction of Arches on the New Croton Aqueduct. Illustrated. Issue of December 14, 1889.

LXXX.—Erection of St. Paul High Bridge. Part I. General Diagram and Viaduct Erecting Traveler. Illustrated. Issue of December 21, 1889.

LXXXI.—New Croton Aqueduct Compressed Air Plant. Illustrated. Issue of December 28, 1889.

LXXXII.—Erection of St. Paul High Bridge. Part II. False Work and Traveler for River Spans. Illustrated. Issue of December 28, 1889.

LXXXIII.—Lighting the Croton Aqueduct. Issue of January 11, 1890.

LXXXIV.—Erection National Gallery, Berlin. Illustrated. Issue of January 11, 1890.

LXXXV.—The Van Buren Bridge Piers. Part I. General Description of Location, Structure, Methods, Progress and Materials. Illustrated. Issue of January 11, 1890.

LXXXVI.—Ventilating Croton Aqueduct. Illustrated. Issue of January 25, 1890.

LXXXVII.—Van Buren Bridge Piers. Part II. Illustrated. Issue of February 8, 1890.

LXXXVIII.—Croton Aqueduct Pumps. Experiments relating to Hydraulics of Fire Streams. Issue of February 22, 1890.

LXXXIX.—European Bridge Erection. Illustrated. Issue of March 1, 1890.

XC.—Erection of Court Street Bridge at Binghamton, N. Y. Illustrated. Issue of March 8, 1890.

XCI.—Sidewalk Protection during Building Construction. Illustrated. Issue of March 15, 1890.

XCII.—House Builder's Derrick. Illustrated. Issue of April 5, 1890.

XCIII.—Drilling, Blasting and Timbering the Croton Aqueduct. Illustrated. Issue of May 17, 1890.

XCIV.—Raising a Block of Brick Houses. Illustrated Issue of May 31, 1890.

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THE SANITARY ENGINEER.

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THE ENGINEERING AND BUILDING RECORD,
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THE QUAKER BRIDGE DAM.

IT will be seen by the recent report of the Chief Engineer, A. Ftely, to the Croton Aqueduct Commissioners of New York, upon the subject of the Quaker Bridge Dam, published almost in full in our last number, that this project is at last likely to be abandoned, or, at least, that a dam of much less height, forming a reservoir of materially less storage capacity, will probably be substituted for it.

The matter is not yet positively settled, as the Commissioners have decided to give a hearing upon the subject on the 27th inst. But considering the persistent opposition that the project has met with from a few individuals, almost from its inception, resulting in the repeated postponement of the commencement of work upon it, and in view of the fact that the Chief Engineer has finally thrown the weight of his influence against it, there is little hope that the structure will be built.

The repeated postponement of any decision upon the Quaker Bridge Dam compelled the construction of other, subsidiary dams upon the upper branches of the Croton, in order to get enough immediate addition to the storage to make the new aqueduct of any use in obtaining the much-needed increase in New York's water supply. While the construction of some of these subsidiary dams might have been needed in the future, in order to secure the maximum supply from the Croton, they would not have been required for some time to come; and their construction now, per contra, renders less necessary, for a long time, at least, a reservoir on the lower part of the river of so large a capacity as would have been afforded by the proposed structure. A smaller one, as Mr. Ftely says, will answer, possibly, "for the whole extent to which the supply from the Croton watershed should be properly developed," although he admits that the drainage area would be diminished by about 6 per cent.

It is, unquestionably, the duty of an engineer to resist the temptation to build monumental structures which are not really necessary, however much they may add to his reputation. Considering that this would have been the highest and largest dam in the world, involving considerable difficulty from the depth of its foundations, it is all the more creditable, under the changed circumstances due to the erection of the smaller storage reservoirs, for the chief engineer to modify his previously expressed opinion in favor of the Quaker Bridge Dam, and propose for it a substitute of much less size, and which will cost considerably less money. He gives, as his opinion, that, if the proposed reservoirs on the upper water-shed are built, they, with the proposed substitute on the lower river, would suffice for at least twenty years to come, and that in that time the "accumulated interest on the sum which would be saved by building it at site number 2 would pay for its cost." This is certainly a strong argument for the change.

Since the construction of the smaller dams in the upper water shed had been begun, and the authority to begin work on the Quaker Bridge Dam had thereby been again indefinitely postponed, and the opposition to it being just as persistent, this proposition of Mr. Fteley must be regarded as the next best, and, under the circumstances, most available thing to do.

It is a matter of congratulation that the erection of so important a structure as is even this smaller dam is in such able hands, and that the Chief Engineer will have the co-operation and support of so capable a commission as the existing one. When the clamor about cement begins, charges of favoritism from disappointed contractors will have less weight with the public than they would at one time have had.

WATER-WORKS AND SEWERAGE FOR SMALL TOWNS AND VILLAGES.

AN interesting article on the above subject by Stephen E. Babcock, Chief Engineer of Little Falls Water-Works, is published in the "Fireman's Manual," Watertown, N. Y., 1890. Its object is to advocate the extension of systems of water-works and sewerage to small towns and villages—primarily on account of the advantages accruing to the health of the inhabitants from an abundant supply of pure water, and from having all household slops and fæcal matter removed promptly from the vicinity of dwellings to a suitable point of disposal; and, secondarily, from the increased fire protection obtained, and consequent reduction in rates of insurance. Mr. Babcock also undertakes to show that these great advantages can be obtained without a prohibitive cost, even in villages of a small number of inhabitants.

It is too apt to be the case in small towns, and even in some small cities, that water-works are built without any sewerage system whatever being provided for, or, perhaps, even contemplated, and the increased consumption of water, due to its greater abundance and to the convenience in drawing it, make it still more difficult to dispose of household wastes by the old-fashioned and primitive methods. Mr. Babcock computes the losses to a village from the direct expenditures caused by the greater number of deaths and funeral expenses, arising each year from the unsanitary condition due to the lack of sewers, and from the expenses and loss of time in cases of sickness not resulting in death, and claims that in 20 years' time these amounts, together with the increased fire insurance premiums paid on account of a lack of water supply for fire protection, would pay for the whole cost of both water-works and sewerage, if constructed at the same time, and the sewers and water pipes laid in the same trench.

His statements about the economy to be obtained by using a single trench for both sewers and water pipes, however, would seem to require some modification. The water pipes could not well be placed directly over the sewers on account of the manholes, if for no other reason; nor should they be laid on the filled-in material without its being very thoroughly rammed, as otherwise settlement would cause distortion and leakage, if not absolute rupture of the mains, especially where the contour of the surface of the streets causes considerable and sudden variation in the relative depths of the sewers and water pipes. If a trench be cut entirely on one side of the sewer trench, so as to support the water-pipe on solid ground, as seems to be indicated in Mr. Babcock's paper, it is hard to see how very much saving in earthwork would result—although doubtless there might be some economy in prosecuting both works simultaneously, as suggested.

Though the arguments in the article are forcible and commendable, some of the figures relative to capacity of stand-pipes and mains need revision.

SANITARY DISCUSSION IN TEXAS.

Some funny literature regarding the water supply of Tyler, Tex., was recently given in *The Daily Democrat and Reporter* of that town. One of the articles was in the shape of a report from the City Chemist on the water furnished by the water-works. He found that it contained "total solids, 12.2 grains per gallon, and chlorine, 1.5 grains per gallon," saying nothing about ammonia or albuminoid ammonia, and condemned the water.

This report was criticised by a druggist, who says that he is "perfectly bewildered to know what conclusion the analyzer himself has reached," and that "if our young chemist really wishes to find some water deleterious to health, let him examine some of the water from some of the wells in Tyler, and he will find them rich in albumoids, nitrites and chlorides, which he may search for in vain in the water-works water."

Thereupon the chemist arose in his wrath and said that he made the report as a matter of duty, and "now then, by that action arises an impromptu, presumptuous, small gentleman (at the instigation of the water company we all suppose), in an off-hand essay fires at the report (under a state of bewilderment—think of it), a conglomerated ball of words which have lost their fell purpose, if we closely observe the effects." There is a good deal of "fine writing" in the chemist's reply, of which the above is a sample.

The best comment is an editorial in the same paper—which editorial has no special reference to this controversy, but seems to fit it beautifully. It reads:

"When it comes to settling any very difficult municipal or political question, Tyler takes the confectionery. Friends, brothers, men, women, children, disagree, and yell, and whoop, and tear their shirts (at least the men do), and raise sand, and when at last the thing is settled they all get together in the 'middle of the road' and live happy and quiet until next election, or until another question arises for discussion. It just beats the world to see them rear. They make so much fuss it generally scares an outsider afraid: but the regular Tylerite never pays any attention to it, except to raise his *pro rata* of dust and whoop in chorus with the others. It's funny; but it's only our style, and we can't help it."

TELPHERAGE AT EDINBURGH.

The most recent improvements in telpherage are shown in the telpher line put up at the Edinburgh Exhibition by the Electrical Engineering Corporation, which is arranged so as to carry passengers as well as to demonstrate the advantages of the system for transport of goods. The system provides for the transport of a wide range of material, from minerals and heavy freight to light packages, and an overhead line is employed, with carrier suited for the employment of electricity in the transmission of the power required. The Edinburgh line consists of over a quarter of a mile of track, the flexible portions being constructed in spans of 50 feet and the rigid ends in spans of 15 feet. The ropes on which the locomotives and cars travel are of steel, and 1⅓ inches in diameter. These are tightened, so that with a full load on the line there is a sag of about 2 feet 4½ inches on the spans covered by the train. The working of the line is said to have given great satisfaction.

The principle of the telpherage system was outlined in The Engineering and Building Record of March 15, 1890.

THE PROPOSED EAST RIVER TUNNEL.

The New York Board of Aldermen will be called upon shortly to act finally upon the application for a franchise made several years ago by a company formed to build the underground New York and Long Island Railroad. The company was organized under the General Railroad act of 1850, and its amendments, which require that the consent of a majority of the property owners on the street under which the road is to run, and the assent of the city shall be obtained. The consent of the property owners was obtained a year ago, and all that is required now is the assent of the corporation. The plans of the tunnel were submitted to the Aldermen three years ago, but the matter has been put off from time to time. It is now believed that the work will soon be under way.

Its promoters say that the actual and pressing need of better facilities for the transportation of both passengers and freight across the river is too apparent to require discussion, and that the advantages that would follow the completion of such an underground railway cannot be overestimated. The city is taxed to its utmost already by its peculiar shape, and the surplus population must find living accommodations in either New Jersey or Long Island. This surplus is increasing rapidly. The Brooklyn Bridge provided an outlet for the overflow to a certain extent, but it is no longer equal to the demands made upon it. Neither are the ferries. In fact, the present facilities are entirely insufficient for handling the great increase in population. No provision has hitherto been made for the increased quantity of freight that results from the increase in the population.

The new company saw that to meet the requirements it must introduce a system that would work with the elevated railroads and be so planned as to form a part of any rapid transit system which may be ultimately constructed. Col. Oliver W. Barnes, the chief engineer of the company, had this fact in mind when he prepared the plans.

The proposed tunnel will extend from the Hudson River on the west side of New York, under Forty second Street, in a direct line across the East River to Long Island City. The idea of this is to establish a complete rail connection between the New York Central and Hudson River Railroad and the Long Island Railroad. From Tenth Avenue the tunnel descends on a grade of 68 feet to the mile, passes under the East River, and then ascends to the Long Island Railroad at a point one mile from the river. The average depth of the tunnel below the river bottom is 50 feet. The tunnel will be connected with the elevated roads by elevators. There will be stations at Sixth and Ninth Avenues, on the west side, and at Second and Third Avenues, on the east. The central part of each station will be 100 feet square. Platforms 150 feet long will run from the central parts, making the entire station 400 feet in length. Stairways will be built in addition to the elevator shafts.

A shaft will be sunk at each shore, from which the headings will be driven. These shafts will be 3,300 feet apart. The line across the river passes under Man-of-War rock, which is bare at low water. A coffer-dam, having an area of 3,000 square feet, will be constructed here, and a third shaft will be sunk to the level of the tunnel and connected with it, for the raising of such materials as can conveniently be brought to that point. This plan provides for the working of two additional headings, and also constitutes the first step for the removal of this rock by the Government in operations like those prosecuted at Flood Rock. The tunnel is to be five miles long.

NOTES.

There is some talk, at present, of an international engineering congress, to be held at Chicago during the World's Fair. Nothing definite, however, has yet been determined upon.

Measures have recently been taken by the Mexican Government with the view toward the adoption of the metric system as the only system of weights and measures to be used in the Mexican Republic.

A New Haven, Conn., ordinance, which is strictly enforced and ought to commend itself favorably to all cities, reads: "Be it ordained by the court of Common Council of the city of New Haven: No person shall distribute, throw, drop, or cause to be distributed or dropped, in any of the streets or public squares of said city, any posters, handbills, advertising cards, or other substance used for the purpose of advertising. Every person violating this provision shall pay a penalty of not more than twenty-five dollars for every such offense."

The committee on the celebration of the opening of the St. Clair River Tunnel at Port Huron, Mich., have agreed upon the outlines of a programme. A grand banquet will be held in the tunnel itself. The table is to be 1,000 feet long, and located so as to be 500 feet on each side of the international boundary. The chairman is to be seated exactly on the line. On the Canadian side of him will be the President of the United States, and on the American side the Governor-General of Canada, while Ministers of State and other notables from both countries will be judiciously disposed of. The tunnel will be brilliantly lighted by electricity.

PUBLICATIONS RECEIVED.

Local Boards of Health in the State of New York.

Toronto Water-Works. Annual Report of the Superintendent for the Year Ending December 31, 1889.

City and Guilds of London Institute for the Advancement of Technical Education. Programme of Technological Examinations.

Report of the City Surveyor on the Various Works Executed by the Road Department, City of Montreal, During the Year 1889.

MEETINGS OF ENGINEERING SOCIETIES.

The American Society of Civil Engineers holds its regular meetings on the first and third Wednesday in each month, at the House of the Society, 127 East Twenty-third Street, New York.

The Boston Society of Civil Engineers holds its regular meetings at the American House, Boston, at 7.30 P. M., on the third Wednesday in each month.

The Western Society of Engineers holds its regular meetings at No. 78 La Salle Street, Chicago, at 7.30 P. M., on the first Wednesday in each month.

The Engineers' Club of St. Louis holds regular meetings in the club's room, Laclede Building, corner Fourth and Olive Streets, St. Louis, on the first and third Wednesdays in each month.

The Engineers' Club of Philadelphia holds regular meetings at the House of the Club, 1122 Girard Street, Philadelphia.

The Engineers' Society of Western Pennsylvania holds regular meetings on the third Tuesday in each month, at 7.30 P. M., at its rooms in the Penn Building, Pittsburg, Pa.

The Engineers' Club of Cincinnati holds its regular meetings at 8 P. M. on the third Thursday of each month at the Club rooms, No. 24 West Fourth Street, Cincinnati.

The Civil Engineers' Club of Cleveland holds regular meetings on the second Tuesday of each month, at 8 P. M., in the Case Library Building, Cleveland. Semi-monthly meetings are held on the fourth Tuesday of the month.

The Engineers' Club of Kansas City meets in Room 200, Baird Building, Kansas City, Mo., on the second Monday in each month.

The Engineering Association of the Southwest holds regular meetings on the second Thursday evening of each month at 8 o'clock, at the Association headquarters, Nos. 63 and 64 Baxter Court, Nashville, Tenn.

The Civil Engineers' Society of St. Paul meets at St. Paul, Minn., on the first Monday in each month.

The Montana Society of Civil Engineers meets at Helena Mont., at 7.30 P. M., on the third Saturday in each month.

The Civil Engineers' Association of Kansas holds regular meetings on the first Wednesday in each month at Wichita, Kan.

The New England Water Works Association holds quarterly meetings in Boston at Young's Hotel.

The Canadian Society of Civil Engineers holds its regular meetings on each alternate Thursday, commencing with the 9th of October, at the House of the Society, 112 Mansfield Street, Montreal.

The Engineering Department of the Brooklyn Institute, Brooklyn, holds regular meetings, at 8 P. M., on the third Tuesday of each month. Until the Institute building is repaired, the meetings will be held in the rooms of the Young Men's Christian Association Building, 502 Fulton Street.

An application, now said to be before the Municipal Council of Paris, is for the purpose of securing permission to erect an electric central station in order to utilize the power of a new artesian well situated in the Herbert Place, La Chapelle. La Chapelle is the center of a large industrial population, and it is intended to use several turbines in driving the dynamos, which will supply current for light and power to the surrounding districts.

The regular meeting and dinner of the Architectural League will be held at the "Arena," No. 41 West Thirty-first Street, on Monday evening, November 3, at 6.30 o'clock. Mr. C. H. Blackall, of Boston, will read a paper on Portuguese Architecture.

According to a western paper, the great Bear River canal, in Utah, for the construction of which $2,000,000 has been provided, is expected to be one of the most extensive irrigation works in America.

PERSONAL.

At the annual meeting of the Board of Water Commissioners of Madison, Wis., John B. Heim was elected Superintendent for the ensuing year, and John F. Donovan, Secretary.

M. Henri Rousseau, of Paris, France, an engineer of the Bridge and Highway Department of France, is making a short visit to St. Louis, to inspect for his Government the river improvements that the United States Government is carrying on there. He has a letter from the Chief of Engineers of the United States Army, introducing him everywhere, and asking that everything possible be done to assist him in obtaining any information he may wish. He goes from St. Louis, to the other large cities on the Mississippi and Ohio Rivers.

OBITUARY.

Lotan K. Hunt, who was for many years prominently identified with the building trade of New York City, died on October 16.

A. B. Mullett, Supervising Architect of the Treasury Department during Grant's administration, committed suicide at Washington on the 20th inst.

Dr. John Farnham Boynton, credited with being the inventor of the Babcock fire extinguisher, died at Syracuse, N. Y., on October 20. He was born in 1811.

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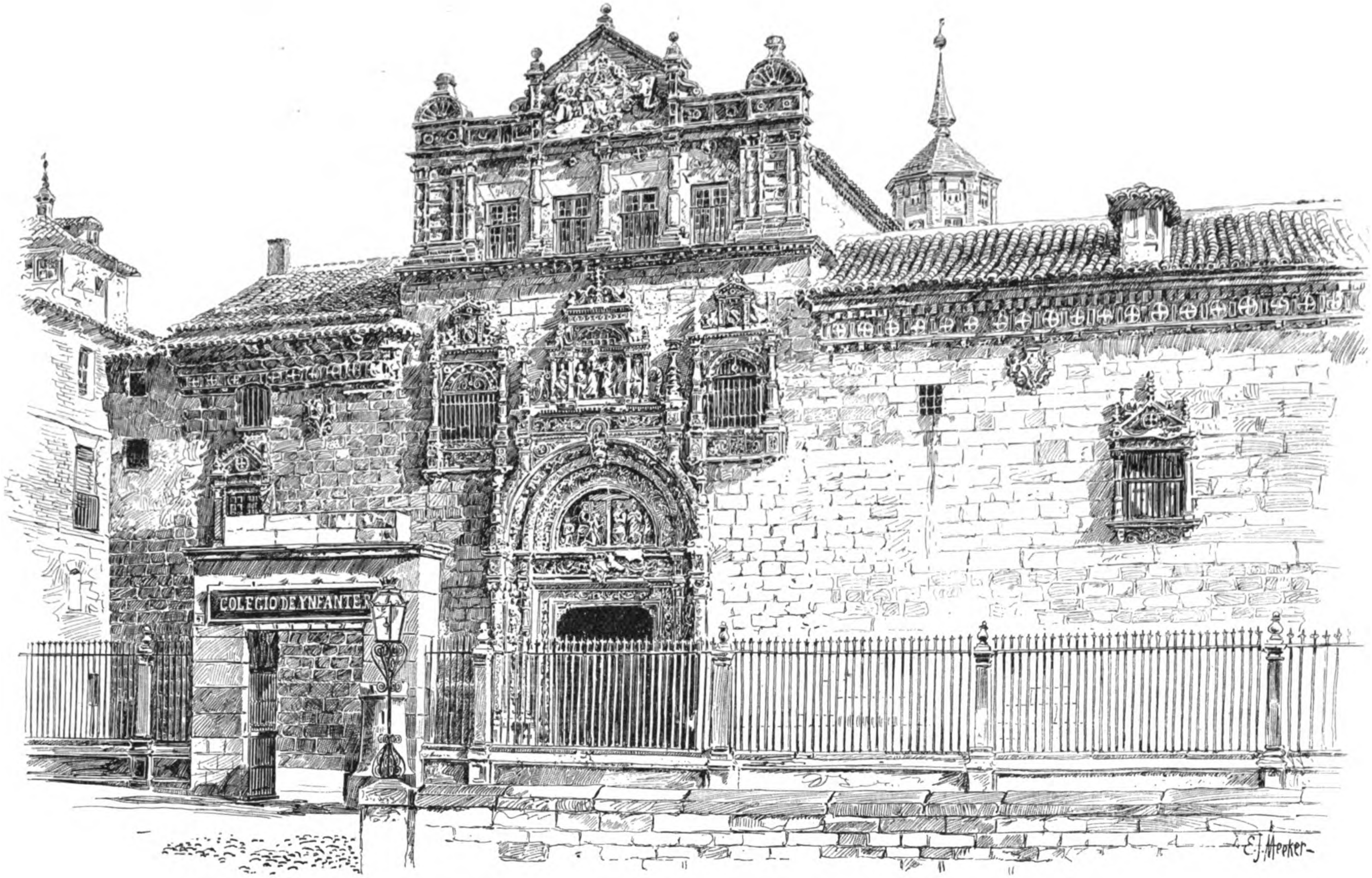
VIADUCT IN SPAIN.



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ENGINEERING SOCIETIES.

A REGULAR meeting of the Civil Engineers' Club of Cleveland, O., was held on Tuesday, October 14. Prof. Charles H. Benjamin and Mr. James W. Gallup were elected active members.

Mr. J. H. Sargent read a paper on "Railroads; Past and Prospective," giving an entertaining account of the development of the modern railroad from the stone tramway, as found in ancient ruins, noting especially the more rapid stages that he had personally observed since he began his professional career, and predicting that in the near future all trains will be moved by electricity.

The reading of the paper was followed by a discussion, in which a number of members described their personal experiences of a few years ago, showing the rapid progress that has taken place within their recollection.

Mr. Robison described a projected electric railroad between New York and Philadelphia, on which it is proposed to dispatch light trains every ten minutes from the terminals, and make the trip in 40 or 50 minutes.

Mr. J. B. Larned gave a description of the Grand Avenue Bridge at St. Louis, which is of the stiffened suspension type, with an upper tension chain of steel eyebars, and a lower chain, parallel to it, but made for compression, and triangular bracing between them.

This was followed by a brief description of the new cantilever bridge over the Ohio River between Cincinnati and Newport, now building.

NEW YORK ARCHITECTURAL LEAGUE COMPETITION.

THE fourth annual competition of the Architectural League of New York for the gold and silver medals of the League, in connection with the sixth annual exhibition, has been announced. The conditions are:

First.—The competitors must be residents of the United States, and under the age of 25. *Second.*—The drawings shall be made in conformity with the appended programme, and in all parts and portions entirely by the hand of the competitor. The drawings will be judged by the jury appointed for that purpose. The successful drawings, and such others as may be thought worthy, will be hung at the exhibition, the first and second prize drawings being so indicated, and these latter shall thereupon become the property of the League.

According to the programme an heroic statue of Zeus, standing 9 feet high, has been secured by an American citizen from one of the excavations now going on among the ruins of Greece, and presented to one of our large cities. The municipal government, appreciating the value of the gift, proposes erecting a loggia for its reception and protection. This pavilion is to be located upon a plot of ground formed by the conjunction of two avenues with a boulevard, the form and size of which are given. The structure should be of marble, and must be classic in treatment. Each contributor is required to exhibit two sheets of drawings: one to contain the front elevation, drawn to a scale of ¼ of an inch to the foot, and rendered at will; and the other to contain the ground plan, section, and such other drawings as may be necessary to explain the design and construction, and drawn to the most convenient scale for the purpose, and rendered at will. A small perspective sketch, rendered fully at will and taken from a designated point, can be shown upon either of the two sheets. Each sheet to be cut to the uniform size of 24x32 inches, and to be white card or Bristol board, or Whatman paper mounted on stretcher. No colored borders, frames or glazing will be allowed. Each sheet must be distinguished by a motto or cipher. A sealed envelope, bearing the same motto or cipher, must contain the name, full address, place and date of birth of the author, and must be mailed to the Medal Committee.

VIADUCT IN SPAIN.

EXCAVATORS OPERATED BY ELECTRIC MOTORS.

AN excavator operated by electric motors is now in use by the Bennett Amalgamator Company, of Denver, in connection with one of their amalgamators, working in gold-bearing gravel beds. There are two motors, one of 25 and one of 15 horse-power. In addition to these another 25 horse-power motor is mounted on the car and is employed in driving the conveyor and the amalgamator. The electric current is furnished by a 100 horse-power dynamo driven by water-power and located at a distance of about one and one-half miles from the mines where the shov [illegible] operation. The excavator was built by the [illegible] Company, of Albany, N. Y.

THE MAINTENANCE AND OPERATION OF WATER-WORKS BY PRIVATE COMPANIES.

(Continued from page 269.)

51. *Dividends.*—Charge this account, and credit "cash" with all sums paid as dividends on the capital stock of the company.

52. *Profit and Loss.*—At the end of each year, when the books are closed, carry the balances of the following accounts on to the opposite side of "profit and loss," and balance "profit and loss" account into "balance" account.

No. of Acct.	Name of Acct.	No. of Acct.	Name of Acct.
6	Public Hydrant Rental Accounts Receivable.	31	Boilers.
7	Private Hydrant Rental Accounts Receivable.	32	Pumps.
8	Water Accounts Receivable.	33	Fuel.
10	Services and Repairs Accounts Receivable and Payceivable.	34	Oil and Waste.
11	Miscellaneous Accounts Receivable.	35	Lighting.
19	Organization.	36	Stand-Pipe.
21	Real Estate.	37	Distributing Reservoir.
22	Water Supply.	39	Salaries.
23	Improvement of Water.	40	Legal Expenses.
24	Storage.	41	Superintendent.
25	Water Power	42	Engineering.
26	Conduits, etc.	43	Engine Men.
27	Distribution.	44	Office Expense.
28	Buildings.	45	Livery.
29	Foundations.	46	Interest.
30	Water Wheels.	47	Discount and Commission.
		48	Taxes.
		49	Insurance.
		50	General Expense.
		51	Dividends.

53. *Balance.*—At the end of each year, when the books are closed, carry the balances of the following accounts on to the opposite side of "balance."

When the books are opened for the next year, carry the amounts from this account on to the opposite sides of the new accounts.

No. of Acct.	Name of Acct.	No. of Acct.	Name of Acct.
1	Capital Stock.	15	Meter Rents.
2	Bonds.	16	Service and Repairs.
3	Bills Payable.	17	Miscellaneous Accounts.
4	Cash.	18	Bills Receivable.
5	Treasurer.	20	Construction.
12	Public Hydrant Rental	38	Meters.
13	Private Hydrant Rental.	52	Profit and Loss.
14	Water Rates.		

Whenever "Trial Balances" are made, the sum of the balances of the following accounts will show the earnings of the company for the current year to date:

No. of Acct.	Name of Acct.	No. of Acct.	Name of Acct,
6	Public Hydrant Rental Accounts Receivable.	10	Services and Repairs Accounts Receivable and Payable.
7	Private Hydrant Rental Accounts Receivable.	11	Miscellaneous Accounts Receivable.
8	Water Accounts Receivable.		
9	Meter Rents Accounts Receivable.		

While the sum of the balances of the following accounts will show the amount of uncollected earnings to date:

No. of Acct.	Name of Acct.	No. of Acct.	Name of Acct.
12	Public Hydrant Rental.	15	Meter Rents.
13	Private Hydrant Rental.	16	Services and Repairs.
14	Water Rates.	17	Miscellaneous Accounts.

BLANK BOOKS AND BOOKS OF RECORD.

Those regularly used are as follows:

No.	NAME.	Distinguishing Tint.	Record No.
1	Power of Attorney to sign Application	White.	906
2	Tap Order.	"	907
3	Service Pipe Order.	"	908
4	Plumbers' License	"	009
5	Plumber's Bond	"	910
6	Meter Order.	Primrose.	911
7	Inspection and Turn-on Order	Opaline.	912
8	Shut-off Order	Pink.	913
9	Shut-off Book	....	938
10	Repair Notice	Blue.	914
11	Record Book	... ...	934
12	Meter Book	.. ....	939
13	Meter Reading Book	....	935
14	Inspection Book	....	936
15	Complaint Book	....	937
16	Order Book	....	918
17	Bills, Fixture Rates	White.	915
18	Bills, Meter Rates	Primrose	916
19	Bills, Miscellaneous	Opaline.	917
20	Gate Book	... .	921
21	Hydrant Book	....	922
22	Street Plan Book	....	923
23	Maps	....	. .
24	Vouchers or Bill Covers	Lilac.	905
25	Trial Balance Sheets	Colors vary according to the company.	940-945, etc.

Lilac is "linen bond," made by Hampshire Paper Company. Other colors are "wove," made by Carew Company, weighing 24 pounds per ream, 17x22.

1. POWER OF ATTORNEY TO SIGN APPLICATION BOOK. Color, white. Record No. 906.

This form is to be used in cases mentioned in the general description of the Application Book. In too many cases in the past the Application Book has been signed by almost anybody, or not at all.

Every customer, every separate service connection, and every separate connection for private fire protection, must have a separate application. Whenever the owner cannot make application in person he must fill out, sign and send to the office one of these powers of attorney, authorizing some person to sign for him; or he may sign it, leaving the name of the attorney blank, send it to the office and the superintendent, or some one in the office may fill in their name, and then sign the application book.

These powers of attorney must then have the name of the applicant, the number of the application, and the stop number filled in on the back, and be filed away according to the application number.

2. TAP ORDER. Color, white. Record No. 907.

When an application is on the books and the tap ready to be made, fill out the Tap Order blank, giving the details called for by the blank spaces.

The foreman of the service department will then make the tap and return the blank to the office, properly signed and dated and with the tap number filled in. This tap number is always a consecutive one, and is kept by the foreman of this department, but is not a record number on any office book. On the diagram on the back of the blank should be filled out such dimensions and measurements as are necessary to locate the tap, and this should then be transferred by the office to the Record Book.

After the records are all transferred from this blank to the proper books, it should be filed away according to the application number.

3. SERVICE PIPE ORDER. Color, white. Record No. 908.

If arrangements have been made with the owner by which the company is to put in the service pipe and fittings from the main to the property line, or to and into the premises, this blank should be filled out and given to the foreman of the service department when the Tap Order is given him. If the company are only to put in the service pipe to the property line, then a duplicate should be filled out and given to the licensed plumber, who is to do the rest of the work. But, if a licensed plumber is to do all the work from the tap, then only one Service Pipe Order form is filled out, and that given to him.

Each form should have the application number filled out before it leaves the office, but the stop number is not given to it until after it is returned. The party doing the work must fill in the blanks on the face of the permit, giving the sizes and kinds of pipe and fixtures put in, and on the back make and fill out a diagram of the same.

When returned to the office, this information will be transferred to the Rate and Record Books, and this form filed away according to the stop number.

When any party desires additions to or changes made in their connections or fixtures, the party making such changes must obtain a permit from the office and fill out and return the same, giving the sizes, number, and location of all fixtures then in use, the same as though it was all new work. The necessary changes, additions, or corrections must then be made in the rate and record books, the permit numbered the same as, and filed away with, the original permit of the same stop number.

In case the company do a part of the work, and a licensed plumber the remainder, then both permits will bear the same stop number, and they will both be filed together.

4. PLUMBER'S LICENSE. Color, white. Record No. 910.

All plumbers who desire to do any service pipe or plumbing work in connection with the works of the company must have a license, duly signed and numbered; and all licenses will expire on the 1st of January in each year.

This gives the company opportunity to refuse to relicense any plumber who may not have done satisfactory work during the previous year.

When a license is renewed, it will bear the next consecutive number to the last one issued.

The superintendent cannot refuse a first license to any plumber without strong reasons, but can revoke one at any time, by written notice, if facts and circumstances warrant the same.

When a license has once been revoked, another may be issued to the same party if the superintendent thinks it best to do so.

A record of all licenses should be kept in some convenient book.

5. PLUMBER'S BOND. Color, white. Record No. 910.

Before any license is issued, the plumber must furnish a bond in the sum of $1,000, with two satisfactory sureties to idemnify the company and the customers for any loss or damage which may arise by reason of the negligence, carelessness, or incompetency of the plumber, all as stated in the bond.

When a bond is once given, accepted, and the license issued, no other bond need be given unless it is revoked by the sureties, which revocation is of no avail if action has been commenced under the bond; but, if no action has been commenced, then the revocation of the bond will warrant a revocation of the license until such time as a new bond is furnished.

In case of any loss or damage arising from the carelessness, negligence, or incompetency of the plumber, make out a full detailed statement of the same, and ask the plumber for immediate settlement. If he refuses, then place the matter in the hands of the company's attorney for action.

6. METER ORDER. Color, primrose. Record No. 911.

Whenever a meter is required on any surface, fill out the Meter Order blank, and give it to the foreman of the service department. No one but an authorized employee of the company must ever set a meter.

When the meter is set, the order must be returned to the office by the foreman, after first filling out such blanks as may be necessary, dating and signing the same. These orders will then be filed away according to the stop numbers.

7. INSPECTION AND "TURN-ON" ORDER. Color, opaline. Record No. 912.

When the Service Pipe Order is returned, the Inspection and Turn-on Order is filled out and handed to the inspector. He at once proceeds to inspect the premises; and if he finds the connections and fixtures satisfactory, and conforming to the rules and regulations in relation thereto, and agreeing with the plumber's return, he turns on the water, fills the pipes, reads the meter, if there is one, fills out his blank, dates it, signs it, and returns it to the office. If the connections or fixtures are not satisfactory, he so indicates on his report, returns the same, and makes written report to the office as to wherein they are unsatisfactory.

The office then notifies the owner and party who did the work, which must be made right before the water is turned on.

If more than the first inspection is required on account of poor, or otherwise unsatisfactory, work having been done by any licensed plumber, such plumber must pay the sum of $2 to the company for each inspection after the first, or, if he refuses, his license may be revoked.

When a plumber has been putting in any connections or fixtures or making any repairs or alterations on the same, he may turn on or off the water, at the sidewalk stop only, but he must always leave the stop in the same position he found it, whether "on" or "off," or be subject to a fine, to be paid the company, of $2 for each case or to have his license revoked, or both.

If water has been turned off for "penalty" or "vacancy" where there is no meter, it may be turned on again by any employee of the company under verbal orders from and reported to the office; but, if there is a meter, it must be done and reported by the Inspector.

Any person turning on or shutting off water except as indicated above will render himself subject to punishment or fine, or both, as may be provided for by Ordinances, or by Rules and Regulations.

After the Inspection Order is returned to the office, the necessary transfers will be made from it to the Rate Book and other books, and then be filed according to the stop number.

(TO BE CONTINUED.)

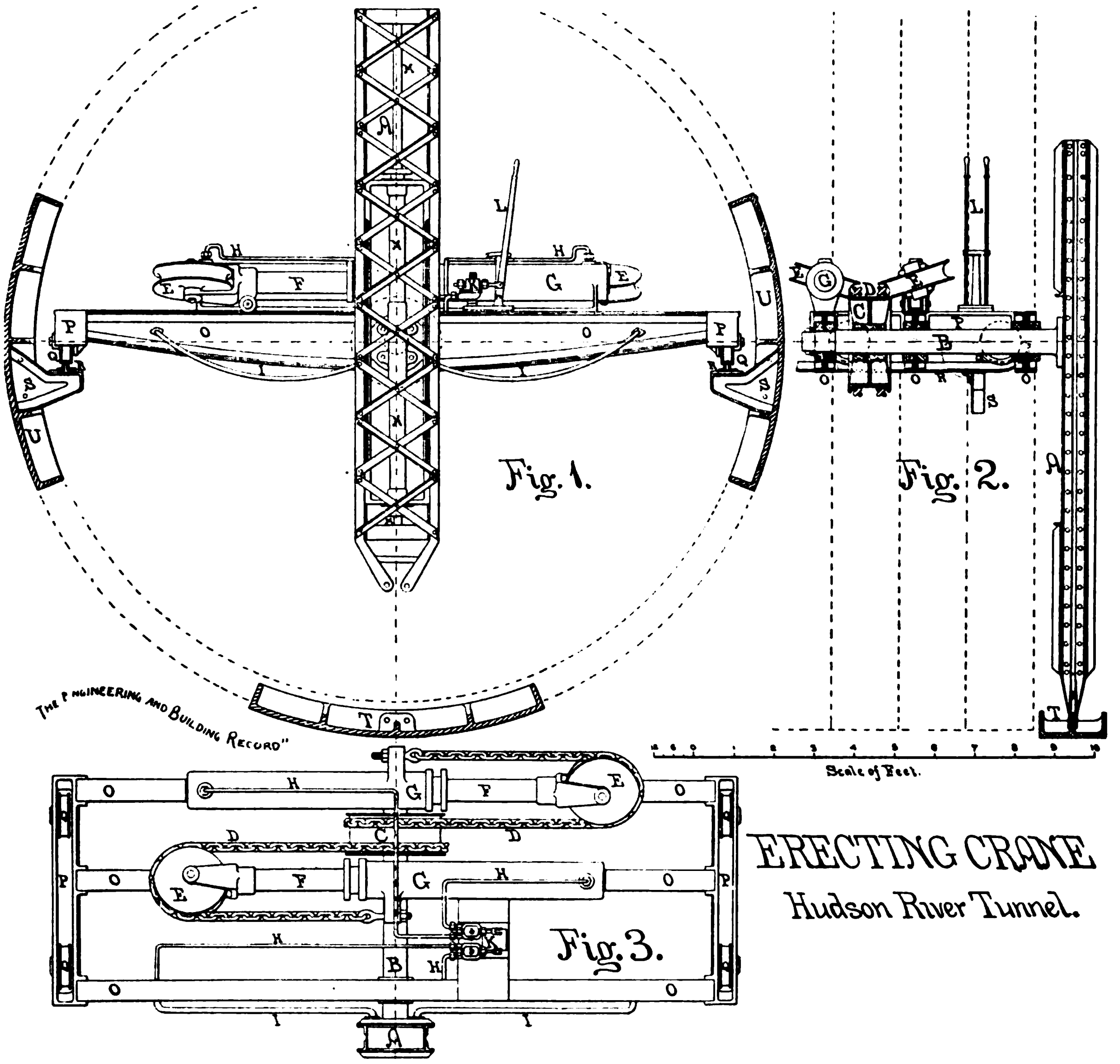
FIFTY feet of the dam at the dry dock in course of construction at Kingston, Ont., gave way recently, and the great excavation is now full of water. A new dam will have to be built, and the dock, it is said, cannot be pumped out before the spring. The loss is reported to be $10,000.

ERECTING CRANE USED IN THE HUDSON RIVER TUNNEL.

IN describing, on page 291 of Volume XXI., the recent fire at the New York end of the Hudson River Tunnel, mention was made of the proposed change in the plan of construction, whereby cast-iron plates were to be substituted for the brick lining which had so far been used, a method substantially the same as that adopted in the St. Clair Tunnel, described on page 227 of the same volume.

This plan has now been carried into effect, and the cast-iron cylinder is being built out from the New Jersey side at the rate of about one ring, some 20 inches in width, a day; a rate that will be much increased when certain improvements are made and the men become more familiar with this new mode of working.

The most striking feature of this method of construction is the erecting crane shown in the accompanying illustrations, by which the cast-iron plates, weighing 1,000 pounds each, are placed in position without manual labor. This apparatus was designed under the direction of E. W. Moir, who, as engineer for the contractors, S. Pearson & Son, of London, has immediate charge of the work.



ERECTING CRANE
Hudson River Tunnel.

Its construction and operation are as follows: A horizontal shaft or spindle B, whose axis is concentric with that of the tunnel, carries on its forward end a casting on which slides the arm A whose motion is controlled by the lifting rams M M working in cylinders N N, Fig. 1 The shaft B is supported by three bearings in as many transverse wrought iron girders O O O whose ends rest on cast iron frames P P. These in turn are carried by wheels Q Q, etc., running on rails R R supported by brackets S S bolted to some of the side plates U U of the cast iron rings, which are indicated by the dotted lines in Figs. 1 and 2.

On shaft B is keyed a drum C on which are wound in opposite directions the chains D D, and by which when actuated by the slewing rams F F carrying sheaves E E and working in cylinders G G, the shaft B may be rotated something more than a half circle in either direction.

The movement of these rams is controlled by water under a pressure of 1,000 pounds per square inch, which is admitted to them by valves at K operated by two levers L L, one for the lift and the other for the slewing rams. The water is conveyed to the slewing rams by ⅝-inch brass pipes H H and part way to the lifting rams by the same means, but in order to permit the rotation of the lifting arm, 1¼-inch rubber hose I I wrapped with steel wire is used for the rest of the way. The force and waste pipes which convey the water to and from the crane are not shown, and for convenience all pipes have been omitted from Fig. 2, and the working chains are not shown in Fig. 1.

In Fig. 1 arm A is shown with its working end down and run in or lifted to its highest point. Immediately under it is a plate T ready to be put in place. To do this arm A will be lowered until the bolt holes at its lower end coincide with those in the casting T as shown in Fig. 2. The two will then be bolted together, arm A will be raised so that the plate on its end will clear the plates already in position and revolved until plate T is opposite its proper place when arm A will be again extended and the plate finally put where it belongs. When the plate has been secured arm A will be unbolted and withdrawn ready to repeat the series of operations.

The rams have been so proportioned that though of ample power to perform their legitimate work the crane cannot be used to force ill-fitting plates into position with the risk of straining or breaking the crane or of displacing work already in place.

Although the crane has only been in use a very short time its performance is said to be very satisfactory, and it will doubtless very materially expedite the progress of the work in the tunnel.

Official information recently received at Washington, is said to furnish ground for confidence that the Nicaragua Canal will be completed within the next six or seven years. There are now more than 1,000 men at work on the line and six surveying parties are in the field under the direction of Chief-Engineer Menocal, making details and estimates upon which to base contracts with private corporations for the necessary dams, locks and excavations.

ACCORDING to a Deadwood, S. D., report the tunnel of the Fremont, Elkhorn and Missouri Valley, 2,079 feet in length, including approaches, was practically opened on the 10th inst.

IMPROVING THE MISSISSIPPI'S CHANNEL.

THE importance centered in Mississippi River improvements lends special interest to the following account published in *Harpers' Weekly* a short time ago :

"There are three theories for the improvement of the Mississippi, as widely different as any three could be. The one which has been adopted is that the water should be restricted within certain boundaries in the course of its flow, so that by its own force and velocity it shall keep its own bed scoured out, and maintain a navigable depth throughout its course. There are few great rivers swifter in running than the Mississippi, and it is urged that if its course be properly directed, so that it shall not spread out into lakes, and so lose its rapidity for a distance, the water will not only carry off the sediment with which it is charged when it reaches the valley, but will carry with it some portion also of the soft mud of the bottom already deposited there by the water that has passed before.

"Practically, it is doubtful whether this theory has entirely vindicated itself. Captain Eads did, it is true, establish a channel from New Orleans to the sea, and he had adopted this theory, but the water did not perform the work expected of it. A great stream was flowing through the South pass, and it was thought that if this stream should be made narrower, it would, by its own force, become deeper, so the jetties were built. The primary result was the exact opposite to what had been expected. The water, finding its old path narrowed, followed its confirmed habit of seeking the line of least resistance, and in a short time it was found that the obstructions in the South pass were actually improving the channel in the Southwest pass. This might have been considered a partial demonstration of the correctness of the theory, unexpected as it was in the way of a result, but it was by no means gratifying to Captain Eads. Several million dollars remained contingent upon the improvement of the South pass, and he treated the wayward river with both coercion and coaxing. He put a submerged dam across the neck of the Southwest pass, that the water should not thus get away from him, and he got the most powerful dredging machines ever built, and began clearing out the mud of the South pass, which the water would not carry away for him. This dredging was continued for some years, until the channel was really established. The dredging has now been discontinued for some time, and the channel seems to be maintaining itself.

"It is claimed, however, by the believers in the second theory that this appearance is deceptive. The outlet theory, as it is called, has many strenuous advocates, who urge that the only thing to be done with safety to the Mississippi River is to remove obstructions, and to provide new outlets here and there through which the surplus waters of the periodical floods shall find their way easily to the ocean. They argue that anything in the way of an obstruction tends to retard the flow of the water; that even a narrowing of the river bed at any given point is practically an obstruction, and instead of increasing the scour, really increases the amount of deposit made by the water as it flows, and so tends to choke the river up instead of keeping the channel clear. It is certain that the water of the lower Mississippi is almost a saturated solution of mud and that if the water is really retarded, its inevitable tendency is to drop its sediment. These theorists ridicule the alleged success of Captain Eads' work, and declare that the real result of it has been to raise the bed of the river above it. This assertion was boldly made in the recent discussion of the River and Harbor Bill in Congress, but it does not appear to be supported by any actual demonstration of the fact, if it be a fact. The conclusion reached by this school of thinkers is that the entire plan of work of the Mississippi River Commission is radically wrong, and the only result to be looked for from their labors is serious mischief.

"The third theory has never been strenuously urged, though it has the sanction of ancient usage in China. It has been conceived possible to hold back the waters which in wet seasons make the floods, and by confining them in great basins or reservoirs to regulate the flow from season to season, rendering droughts and floods, extreme high water and extreme low water in the channel alike impossible. Theoretically speaking, this can be done, and it is even pointed out that nature has provided just such a reservoir in one place at least, where, with the aid of comparatively little artificial construction, it would be possible to confine an enormous volume of water for an indefinite period. This is in the St. Francis basin or valley, often called the Sunken Land of Arkansas. Here, in consequence of earthquakes that occurred early in the present century, the surface of the ground was lowered—it is said more than 10 feet. Very probably this is an excessive estimate, for no accurate surveys were recorded. At all events the basin is there, abounding in lakes and streams, which find their outlet through the St. Francis River into the Mississippi, and there nature herself practices in a wild way this very reservoir theory whenever the floods are remarkably high ; for the waters at the juncture of the Ohio and the Mississippi not infrequently break away to the westward and flood the entire sunken district."

A MOVEMENT is on foot in New York City to have the Forty-second Street Reservoir removed. It is claimed to answer its purpose as a storage reservoir only inadequately and to be a menace to health, owing to its leaky condition and the consequent dampness of houses in the adjoining streets.

BUILDERS' AND CONTRACTORS' ENGINEERING AND PLANT.

No. CI.

(Continued from page 278.)

ERECTION OF THE HOOGHLY JUBILEE BRIDGE, INDIA.*

PART II.—ERECTION OF THE SUPERSTRUCTURE.†

The superstructure of the bridge is divided into three sections, as shown by Fig. 7, spanned by girders of the triangular type, with curved top booms and straight bottom booms of the ordinary box or trough section. The vertical struts are composed of four angle bars, back to back, and inclined ties of double flat bars, both stiffened by cross bracing. The roadway for the double line of railway is carried between the main girders on four longitudinal plate beams or girders, supported by cross girders, riveted to the bottom booms of the main girders at intervals of 30 feet, which is the length of the panels or bays of the main girders. The girders are strengthened by horizontal diagonal bracing at roadway. The whole of the cantilever and the ends of the side spans have deck-plated roadway platforms and overhead transverse diagonal bracing.

Figure 7 is a general elevation of the bridge, with one side span S in transit. The central, or cantilever, span was erected from the timber false work (two pairs of trusses) on the piers that are shown in solid black, and whose principal pieces were strengthened by double-headed rails partially let into the sides of the timbers, Fig. 6, which also covered the butt joints of the timbers. The cantilever material was sent out from England partially riveted. The total invoice weight of materials in the cantilevers is 1,465 tons. The several sections, in which the materials were sent from England, were floated from the shore on the iron punts and raised by derricks into position and temporarily connected by drifts and service-bolts until the work was sufficiently advanced for riveting. At the points of support on the river piers, inclined struts *o o*, Fig. 5, page 277, fixed at the base to the top of the steel standards, and riveted at the apex to the main uprights of the girders, are provided to resist the pressure of the wind in cyclones. The derricks used were Oregon spars 70 to 90 feet in length; they were guyed from buoys moored in the river and from the pontoons, which were moored on the down-stream side of the river piers, and formed a convenient working platform. The derricks were shifted from place to place on the cantilever platform as required.

Erection of the Main Side Spans.—In the meantime the erection of the girders of the main side spans was in progress. These girders are 420 feet each in length, 30 feet 8 inches apart from center to center, and 47 feet deep over all in the middle. The invoice weight of each span was 1,000 tons. The outer, or cantilever, end of the girders was formed with a step or rebate which rests on a corresponding bench at the ends of the cantilever girders. The inner or shore ends of the girders of the main side spans terminate in castings, A., Fig. 8, bolted to the sides of the end vertical plates with semicircular bearings, which rest upon steel pins B, passing through holes at the bottom of a pair of pendulum links C, suspended on corresponding pins D, carried in holes at the apex of triangular saddle castings E, 9 feet 2 inches high. These castings rest upon and are bolted to cast-iron bed-plates F, 10 feet long by 5 feet wide by 1 foot 10 inches deep, bedded in Portland cement on the brickwork of the abutment, to which they are anchor-bolted. This arrangement provides for the free expansion and contraction of the girders of the side spans and cantilever, from the center of the river pier to the end bearing on the abutment, a length of 540 feet.

The nature of the river bed, the great strength of the floods and tides, and the crowded navigation, made it impossible to provide a fixed staging for the erection of the girders of the main side spans, and they were therefore built on the approach viaducts. On the launching ways, shown in section in Fig. 10, the rails were secured to the timber by coach-screws, the joints of the rails were fished and were further supported by a 5-inch by 5-inch by ⅝-inch plate, let in flush with the surface of transverse pine planks. At the abutment the rails were laid on the cast-iron bed-plate direct, and prolonged to project 3 feet beyond the face of the abutment to carry forward the ends of the launching trollies when the rear ends of the girders reached the center of the abutment. The launching railway on the Hooghly side was level for a distance of 240 feet from the center of the bed-plates; thence it was laid with an incline of 1 in 120 (falling towards the abutment) for a length of 90 feet, beyond which to the rear end of the girders it was level. On the Naihati side the incline was longer but not so steep. The camber blocks on which the main girders were put together were laid on the rails of the launching ways. The whole of the material was raised from the ground and put in place by derricks.

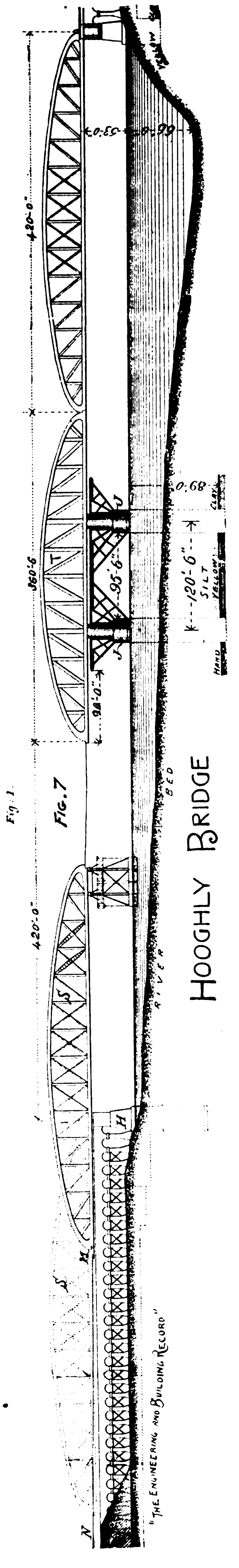


FIG. 7

As erected, the forward or outer end of the girders was 15 feet behind the center of the cast-iron bed-plate, which is 9 feet from the face of the abutment, and consequently the girders had to be pushed out or protruded 75 feet in order that the outer ends might overhang the face of the abutment sufficiently (51 feet) for the pontoons to be berthed beneath for floating them out. For this purpose it was necessary to support the forward ends of the girders at point J, Fig. 9, on a roller platform. In the overhanging portion of the girder, J to H, the inclined tension bars had to be stiffened to prevent them from buckling under the compressive strain to which they were temporarily subjected. The total weight to be carried during protrusion and until launching at point J was about 612 tons, and it became necessary temporarily to strengthen the girders by counter struts J E and K D which were made of old rails and secured to special castings bolted to the gusset plates at J, K, E and D. The struts were formed spindle-shaped. Each pair of rails was connected by ⅞-inch cross bolts at intervals of 4 feet, so that the ends of the struts having been firmly bolted to the cast-iron abutments, they could be expanded to take their share of the weight simply by tightening the cross bolts. To prevent buckling inwards, wooden cross struts, cut to fit, were inserted at each connecting bolt after the latter had been tightened; and, to preserve them truly in line, they were guyed by chains and stretching screws to the top and bottom booms and vertical struts of the main girders. The struts at J E consisted of six pairs of rails; At K D four pairs of rails only were required.

Roller Bearing.—During protrusion, the main girders were supported at point J on a bearing, or sledge, of hard wood cross timbers the full width of the bottom plates of the girders, and extending 5 feet on each side of point J. The bottom box of each girder was stiffened by the insertion of an additional transverse diaphragm 4 feet on either side of J. The underside of the cross timbers, which were dressed to a plane surface and connected together by bar irons let into the ends, rested upon seven parallel, inverted, flat-footed rails 10 feet long, with ends slightly rounded to facilitate the entry of the turned bar-iron rollers, 3¼ inches in diameter, on which the forward ends of the main girders were carried during protrusion. The inverted rails were secured to the hard wood bearing by coach screws. From point J in the original position of the main girders to the ends of the launching ways there were six rails under each main girder to give bearing surface for the bar-iron rollers, which were spaced 8 inches apart.

The weight at the inner or rear end of the main girders during protrusion was 438 tons, and during launching, when their outer ends were supported on the pontoons, 500 tons. It was originally intended to carry the rear ends of the girders during launching on the pendulum links, resting horizontally on 3-foot wheels revolving on the 15-inch pins, and central holes were made in these links accordingly. This would have brought a weight of 270 tons on each side of the viaduct on a wheel-base of 7 feet only. Some doubts arose as to the sufficiency of the foundations to sustain such a concentrated load, and it was thought advisable to provide special trollies to distribute the load over 22 feet of the launching railway. These trollies are shown by Figs. 10, 11 and 12, and were constructed at the works of plate and bar iron. They were inserted between the side plates of the end boxes of the main girders after the temporary removal of a portion of the end bottom plate of the main girders, and of two transverse stiffeners or diaphragms. The end of the main girder was supported on the trolly by the pins B, which were inserted through holes at the center of the main side beams I I of the trolly; these beams were supported on two 7-inch pins G G, passing through holes at the centers of two pairs of smaller inner beams H H, etc., which were carried by the 5-inch axles J J, etc., of four solid cast-iron wheels K K, etc. The bearing of the axles J J, etc., was 4¾ inches broad, and special provision was made for lubrication during protrusion and launching. The side plates of all the trolly beams were double, with solid forged bushes or rings riveted between them at all pin-holes. The top and bottom members of these beams consisted of 5-inch flat-iron bars on edge riveted between the side plates. It will be seen that by this arrangement an equal share of the weight was, under all circumstances, transmitted to each of the eight cast-iron wheels, and the total weight of the girder ends was equally distributed over 22 feet of viaduct instead of over 7 feet only, as would have been the case had the pendulum links been used as originally intended. The two trollies as constructed weighed, with the cast-iron wheels complete, 38 tons the pair.

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* Condensed from a paper by Sir Bradford Leslie, K. C. I. E., M. Inst. C. E., published in the Excerpt Minutes of Proceedings of the Institution of Civil Engineers, Vol. xcii.

† Part I.—Piers, Caissons, Abutments and Viaduct, was published October 4, 1890.

The trollies having been inserted at the rear ends, the main girders were lifted at the outer end for removal of the camber blocks, and for transferring their weight to the roller bearing at point J. This was effected by hydraulic jacks operating under the step or rebate at the outer ends of the girders. The girders, then supported only on the trollies at the rear and the roller bearings, were ready to be protruded.

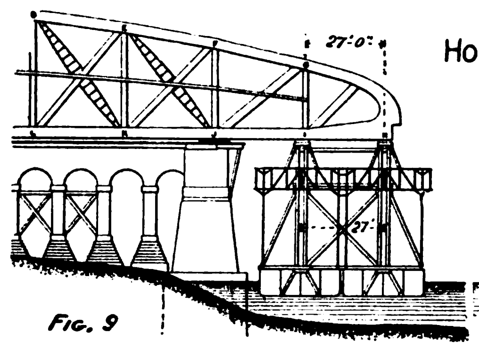


FIG. 9

HOOGHLY BRIDGE

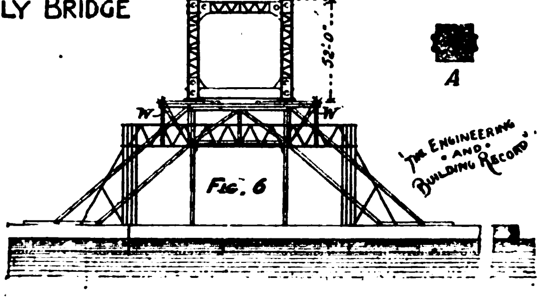


FIG. 6

HOOGHLY BRIDGE

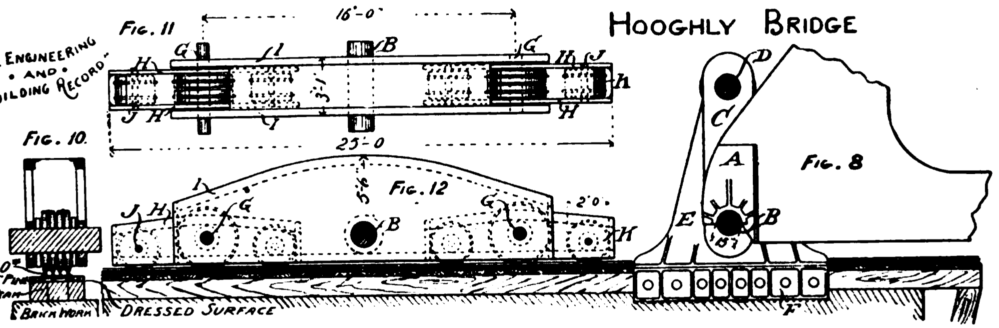


FIG. 11 FIG. 10 FIG. 8

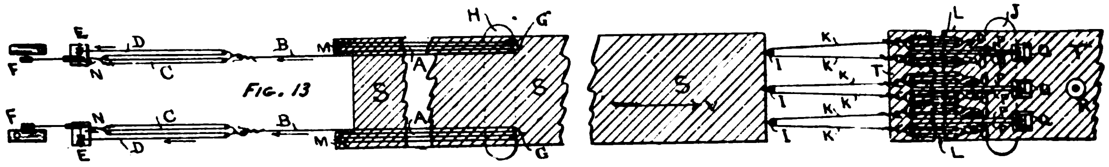


FIG. 13

The tackle for protruding and launching the span is shown in Fig. 13, which a diagram, not to scale and for clearness, shows the pulleys horizontal and somewhat separated, instead of in blocks and in vertical planes, as was the case.

Two sets of 1-inch chain tackles A A (see also Fig. 7), were each made fast to the pier H, at G, and to the rear of span S at M. Their fall lines B, were led to one end of the 4½-inch manilla rope tackles C, the other end of which was made fast at N, and its fall line D, led to the spool of hoisting engine E, driven by a rope from steam engine F. At the forward end of span S three 28-inch sheaves I I I, were attached to the cross beam, and single 4-inch steel wire ropes K K, etc., were rove around them, and each had each end attached to one end of a 6-inch manilla rope tackle L, whose other end was made fast at O to the pier J, and whose tall line P, was led to the spool of a hoisting engine Q, supplied with steam from 20 horse-power boiler R on the floor of the cantilever span T. The operation of all these tackles in the direction indicated by the small arrows, propelled span S in direction V, and it was found that the luff tackles A and C alone were almost adequate for that duty, although increased power had been contemplated in making fast, if necessary, one end of each rope K, and hauling on the other with two of the tackles L.

The protrusion of the girders 75 feet, to position for the final operation of launching or floating was a slow operation owing to the care necessary to keep the 3¾-inch bar-iron rollers square, in other respects no difficulty was experienced.

For floating the forward ends of the main girders and depositing them in position on the recessed benches at the ends of the cantilevers, the pontoons provided for sinking the caissons were used. The central platform, the overhead girders of the rail staging, and the overhanging and central portions of the main trusses, as also the central portions of the auxiliary trusses, were removed, and the pontoons were brought together, as shown in Fig. 9. In this position the pontoons were firmly and rigidly connected together by the main trusses of the rail staging and auxiliary trusses. To carry the girders, a combined timber and rail staging was erected over the central longitudinal bulkhead of each pontoon. Each pair of uprights and rakers was stiffened by old double-headed rails partially let into the outsides of the timbers, Fig. 5, page 277, and each pair of timbers was connected by distance-pieces and through-bolts. Simple butt-joints were used, the rails imparting the necessary stiffness. The entire structure was firmly bolted and clamped together, and secured to the pontoon decks by bolts and strap bolts. Advantage was taken of the rail staging originally provided for the erection and sinking of the caissons, and by which the pontoons were connected transversely, to distribute a portion of the weight to the sides of the pontoons on which the upright supports of the main trusses of this staging were carried (Figs. 9 and 13). This was effected by means of the projecting ends of the top sills of the timber staging, transferring the weight by struts and chains to the overhead girders of the rail staging, the ends of the top sills of the timber staging being trussed by four 5-inch by 1-inch bar-irons W W passing under the lower cross-connecting timbers, and tightly strained by powerful iron wedges.

The height of the special staging for carrying the ends of the girders was regulated by the tides, the object being to secure the longest time available on a single tide for launching the girders, and for the Hooghly span was made 48 feet 9 inches above water level at the light draught, leaving a vertical space of 7 inches to be made good by movable packings. The girders of the Naihati span required a greater thickness of movable packings on the pontoon staging. At points H and I, where the girders were supported by the staging, the rivet heads are not countersunk, and hard-wood packings were fitted to the underside of the main girders to cover the rivet heads at these points. The packing at H was made thicker than that at I, so that the outer pontoon began to take the weight before the inner pontoon, the object being that at high water, when the forward ends of the main girders were considerably higher than the rear ends, the load on the inner pontoon should not be excessive. The draught of water of the pontoons with staging, etc., complete, was 2½ feet. To secure the depth of 1½ feet below datum it was necessary to float the pontoons close to the abutments at the lowest tides that might occur on the dates fixed for launching, and the river-bed was deepened by dredging near the abutments. The additional immersion of the pontoons caused by the weight on the forward ends of the main girders was 2 feet, making the total draught of water 4 feet 6 inches. To keep the forward ends of the girders in line during launching, three barges were moored about 200 yards above the bridge, and three the same distance below the bridge. The line of girders was adjusted by warps from these barges, which were taken to pontoon capstans, and hauled in or slackened as required. The warps were double, passing through sheaves fixed to barges, and the standing part was made fast to the pontoon bollards. The object of this was to insure sufficient strength in case, as was possible, a breeze from north or south might be blowing on the date of launching, which would tend to cause the girders to oscillate laterally and strain the rear launching trollies. The girders of the main side spans were successfully placed in position, with their forward ends resting on cantilevers, one of them in one and a half and the other in two hours, after which about six hours was in each case required for removing the pontoons.

After the main girders were placed in position, it was necessary to remove the launching trollies from the rear ends, and transfer the ends of the girders to the pendulum suspension links. This was effected by 100-ton jacks, assisted by specially constructed rail-levers, as two jacks were not powerful enough to raise the end of one girder weighing 250 tons. To remove the trollies, the jacks were placed directly under the projecting ends of the pins G at the after ends of the trollies; by lifting these pins about 3 inches, the girder ends were raised half that amount, and hard-wood packings were inserted beneath the vertical side plates of the end boxes; these packings were armed with 5-inch by 1-inch bar-irons on the top to facilitate the sliding of the girder ends under variations of temperature. The after ends of the trollies being then lowered, the pins B were removed from the semicircular bearings at the ends of the girders, and the trollies hauled back clear of the girders. The transverse diaphragms, temporarily removed from the end boxes of the girders to make room for the trollies, were replaced and riveted; the weight of the girders was then taken at a point near the first cross girder on a platform of rails bedded in Portland cement outside, and clear of the cast-iron bed-plates, by the 100-ton jacks, assisted by rail-levers; and the packings under the sides of the end boxes having been removed, the saddle castings with pendulum links were slid into place on the bed-plates, and the pins B having been inserted through the holes in the lower ends of the links, the semicircular bearings of the ends of the girders were lowered on to them, and the saddle castings finally bolted down to the bed-plates of the abutments.

The difference in the length of the superstructure of the bridge between 40 degrees, the lowest temperature in the cold season, and 140 degrees, the maximum temperature in the sun in the hot season, allowing for portions of the girders not being exposed to the sun's rays, may amount to 6 inches; the bridge being fixed in the center, this is equal to 3 inches at each end. To provide for this, the joints of about a dozen 23-foot rails, adjacent to the bridge at each end, have a play of one-half inch each, and the fish bolts are regulated to admit of the rails traveling to that extent. The daily expansion and contraction due to variations of temperature do not exceed 1½ inch at each end of the bridge. The total steel weight of the superstructure is 3,876 tons.

The cost of the bridge, including the approach viaducts, was £261,178.

Land for the works was acquired and preliminary work begun in 1882, but the actual bridge construction was begun with the launch of the first caisson on the 2d of March, 1884, and completed with the suspension of the girders of the Naihati main span to the saddle castings on the 22d of December, 1886.

WORK has already been begun in changing the horse railroad in Broadway, New York, to a cable road. The contractor is John D. Crimmins, of New York. The cable conduits will be of steel plate with cast-iron yokes.

SLOW-BURNING CONSTRUCTION.

In a circular recently issued by the Boston Manufacturers' Mutual Fire Insurance Company the accompanying illustration is given, showing the section of a mill of the customary or standard type. Concerning it the following is taken from the circular:

Two floors are pictured, showing a section of the wall cut off at pilasters between the windows, the thickness of panels to be adjusted to the thickness designated in the drawing. If additional stories are required, the walls may be increased in thickness according to the number of stories added, after a computation of the loads which a standard factory may be called upon to sustain.

The window at the left represents what is known as the English type of window, such as it is customary to place in Great Britain in factories of four or five stories in height and not exceeding 126 feet in width, inside measurement—the lower sash being either fixed or swinging on hinges, the upper sash mounted like a transom, and opening inward for ventilation.

Attention is called to the rough plate, or what is now called "rolled cathedral glass," which is transulcent but not transparent, diffusing the light, making no hard shadows, and preventing the glare of sunlight to such an extent that window shades are seldom required.

It is assumed that no well-informed mill owner, engineer, or builder would fail to construct the stairways in towers or sections of the building, cut off by incombustible walls from all the rooms of the factory, the entrances to each room being guarded with standard fire-doors.

Elevators should either be placed in fire-proof shafts guarded by fire-doors and covered overhead by skylights, glazed with thin glass, protected underneath with wire netting; or else the hatchways in each floor should be well guarded by automatic or self-closing hatches.

In modern practice all belts or ropes which may be used for the transmission of power to the various rooms are also placed in incombustible, vertical belt chambers, from which the power is transmitted by shafts through the walls into the several rooms of the factory. There should be no unprotected or unguarded openings in the inner walls of this belt chamber. These belt chambers may also be covered in with skylights and netting in the manner prescribed for the fitting of the elevator well; the object in all cases being to provide an easy outlet for smoke, heat, and sparks, should a fire occur.

The most important feature in what is called slow-burning construction is to make each and every floor continuous, avoiding belt holes and open ways to the utmost possible extent, so that a fire originating in any one room may be confined to that room or story if possible.

In specially hazardous places ceilings may be protected by plastering of the ordinary kind laid on wire lathing nailed directly against the ceiling between the timbers. What is known as adamant plaster may also be applied directly against the plank without any intermediate space if put on to wooden laths cut in what is known as the "dove-tail" or "button" section. This plaster hardens immediately, and is not easily detached by the vibration of the machinery overhead.

Timbers, unless known to be absolutely and fully seasoned, should not be incased in any kind of air-proof plastering. They may be covered in with common lime mortar laid on wire lathing, provided no skim coat of lime putty is added. Ordinary plastering unskimmed is sufficiently porous to permit seasoning. As a rule timbers may be left unprotected, except in very dangerous places, since any fire which will seriously impair and destroy a heavy timber will already have done its work upon other parts of the structure.

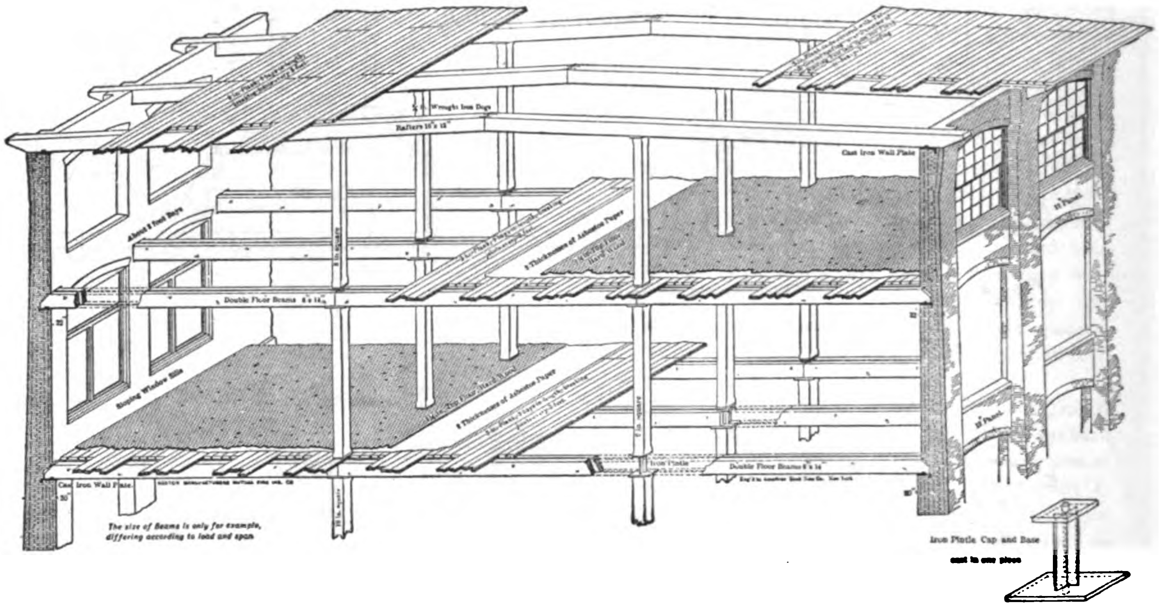
In many instances it may be preferable to substitute compound beams for single timbers, made by securing two or more beams or thick planks side by side; it being often easier to obtain well-seasoned lumber in smaller dimensions; such compound beams, of which the parts may be slightly separated by spaces for ventilation when put together, are less subject to decay.

Weaving mills can be made more rigid and more capable of resisting the vibration caused by the motion of looms by laying the top floor across the plank and parallel to the beams, nails being driven in diagonal rows. This may brace the floor as firmly as diagonal boarding, and it avoids the increased expense in construction and repairs which ensues from the adoption of that method.

The edges of the floor plank should be kept clear of the faces of the brick walls by about half an inch in order to obviate the danger of cracking the walls, which sometimes occurs from the swelling of the plank when laid close against them. These cracks must be covered by strips or battens both above and below.

Asphalte paper may be substituted for asbestos paper between the top floor and the plank whenever the building acts will permit. The asphalte paper is considered a better material, as it is a retardent to the flow of water as well as to the passage of fire.

Basement floors can be laid solid upon the natural soil, if it is dry, or upon rock or cinder filling by covering either with a suitable layer of coal tar concrete. Upon this concrete place an under floor of 2-inch chestnut plank. Then lay the top flooring across the plank and nail in the usual manner. Sills under the plank are not thought to be necessary to the preservation of the floor. They may be called for to sustain machinery which requires to be bolted more firmly than it can be upon a plank and board floor; but in such cases independent foundations of masonry will generally be preferred. A basement floor laid in the manner described upon a coal-tar concrete has been in service 24 years in a machine shop, which is in a rather damp location on the banks of a river, and as yet there is no indication of decay. Cement concretes may absorb moisture and promote the decay of timber or plank laid upon them.


Wrought Iron Dogs
Rafters 10"x 12"
About 8 foot Bays
3 Thicknesses of Asbestos Paper
Double Floor Beams 8 x 14
Sloping Window Sills
3 Thicknesses of Asbestos Paper
Cast Iron Wall Plate
The size of Beams is only for example, differing according to load and span
Cast Iron Wall Plate
Iron Pintle
Double Floor Beams 8 x 14
Iron Pintle Cap and Base
cast in one piece

SECTION OF SLOW BURNING MILL.

In view of the difficulties which have frequently occurred in preserving basement floors of the ordinary timber construction for lack of suitable ventilation underneath, and also in view of the rapid decay of timber and plank floors in bleacheries, dye works, print works and the like, where they quickly become saturated with moisture, reference may be made to the Guastavino cohesive tile construction, of which the representatives may be found at the offices of the Guastavino Fire-Proof Construction Company, in New York and Boston. It is claimed that on this method an indestructible floor can be laid near the ground, either in the original construction of the factory or works, or in substitution for a floor already decayed, at a very moderate cost. This mode of constructing floors may be observed in the interior construction of the Boston Public Library. We cannot give reference to any examples of this kind of floor in industrial works in this country. Reference will be made by the Guastavino Company to factories and works which have been constructed in Spain on this method.

We again repeat the following caution: Wherever and whenever solid beams or heavy timbers are made use of in the construction of a factory or a warehouse they should not be painted, varnished, oiled, filled or incased in impervious concrete, air-proof plastering, or metal for at least three years, lest fermentation should destroy them by what is called dry rot.

If the mill is to be heated by conveying steam through pipes, such pipes should be hung overhead. If the modern method, which is probably the best method, of conveying the heat through ducts in the pilastered walls should be adopted, provision will be made thereto in the construction of the mill wall.

The project of laying a telegraph line from Canada to Australia is at present under consideration.

NOVEL HYDRAULIC ENGINEERING.

The conversion of a pond of stagnant and offensive water into an agitated salt-water lake, was recently accomplished in an interesting manner, by James J. Powers, of Jamaica, L. I.

The scene of Mr. Powers' operations was at Princess Anne, Va., at what is known as Virginia Beach, just south of Cape Henry. At that point there is a sheet of water having an area of from 350 to 400 acres, known as Lake Holly, and in its immediate vicinity is the Princess Anne Hotel. The lake, which is about 3 feet above sea level at high water, was unsightly, and in seasons of drought evaporation would leave a muddy border. The question was, how to mitigate the annoyance. To draw the water off did not seem practicable. Mr. Powers was appealed to in the hope that he would devise some means of relief. The lake is situated about a quarter of a mile from the sea, and has an outlet through Linkhorn Creek into Linnhaven Bay. Holly Lake has a support of clay, and the space between the lake and the ocean, about a quarter of a mile, as stated, is largely made up of hills and woods. Mr. Powers' plan contemplated the construction of a flume connecting the ocean with the lake, the object being to convey the waters of the former through the latter, thus securing activity. In accomplishing this object, Mr. Powers relied solely upon giving natural forces full sway.

A contract for the construction of the system was entered into. The flume is a wooden structure, 60 feet wide and 11 feet deep, resting on piles about 4 feet apart. The timber, yellow pine, is bolted together, strength and durability being insured throughout. At the ocean end of this mammoth trough, which is just at the breaker line, is an "apron;" that is, an inclined plane adjusted at the end of the flume, and extending its entire width, reaching down to the ocean at an angle of 45 degrees, and extending 2 feet above the level of the flume. The breakers dash against it, leap upward and over it and fall to the floor of the flume. There the water is made captive, so far as retreat is concerned. There is no going backward, and forward dash the waves, the breakers coming over the top of the inclined plane at a rate which insures the passage into the lake of a large volume of water per hour. The whole surface of the lazy waters at once becomes energized, and the whole lake is set in motion. The presence of the salt water prevents the growth of the semi-tropical vegetation, which previously existed on the shores of the lake, and creates a sandy beach, convenient for salt-water bathing, as well as for promenades.

The work was begun in March last, and completed the early part of last month.

For 500 years the great Carl's bridge at Prague has withstood the buffeting of the risen river at various periods of its existence, only to fall in great part during the recent floods which did such vast damage throughout Bohemia and Austria. The bridge was the pride of Prague and of all Bohemia ever since its birthday, which is placed in the year 1358, about five centuries ago. Since then it has been looked upon as the great archæological treasure of the land. Emperor Carl IV, laid the foundation of the structure.

LAYING A TWENTY-INCH WATER MAIN.*

THE main in question was designed to increase the supply to the city of New London. It was five miles long, and laid generally parallel to a 16-inch cement-lined wrought iron pipe, and at a distance of from 8 to 200 feet therefrom.

The pipe was divided into two classes· Class A was used for heads of from 20 to 50 feet, was $\frac{68}{100}$ inches thick, and weighed 138 pounds to the foot. Class B, for heads of 50 to 160 feet, was $\frac{70}{100}$ inches thick, and weighed 154 pounds to the foot. It was necessary to cart the pipe over very rough roads from two to six miles, and these thicknesses were decided upon with due consideration of the effects of transportation, but were lighter than is generally used for work of this kind. The pipes were subjected to rigid inspection at the foundry, and of the total number cast 10 per cent. were rejected. Of the total number accepted at the foundry about 7 per cent. were broken in transportation or handling, or by blasting; a large majority of the breaks being checks running 2 or 3 inches from the spigot end. The percentage of cracked pipe was about the same for each class of pipe.

The bells were of a design similar to the Providence bell, being 3¾ inches deep, with ⅜-inch joint room, taking about 27 pounds of lead for each joint.

The pipe was laid on perfectly straight lines and nearly straight grades, all changes in direction being made with bends of 20 feet radius. Bends of three different lengths were used, and the angles in the line arranged to take one or a combination of two or more of these specials at each angle.

Before the pipe was covered it was tested by making a 2-inch connection with the old main, the open end of the pipe being stopped with a wooden plug bolted in. By this method any defect in calking was discovered and remedied at once, and it is thought that many small joint leaks that never would have shown above ground were thus prevented. It is believed that the little trouble and expense occasioned by the test were justified by a considerable saving in repairs, as but two small joint leaks and two cracked pipes were found in the final test, one of the pipes being cracked by a cave in of the bank during the filling of the trench.

DISCUSSION.

Mr. Jones: The first 20-inch pipe laid in Boston, when they knew but little about them, to be sure, weighed about 200 pounds to the foot, and was nearly seven-eighths of an inch thick—a little over three quarters. If a mistake was made it was made on the safe side. I can only speak in general terms about such things, but I think there are two things with regard to laying water pipes that are open to criticism; one is that they do not make them thick enough, and the other that they do not make them large enough. When the gentleman speaks about its being thick enough to stand the pressure, even if it were thinner than that, does he take into consideration the fact that the pipe is liable to decay, and does he take into consideration the question of water hammer?

Mr. Richards: The pipe in question was for a supply main without any taps off of it, and the water hammer on it would be comparatively small to what it would be in a distribution pipe in the city.

Mr. Jones: I cannot agree with the gentleman there, because the first 30-inch main in Boston burst with the water hammer from the fountain playing on the Common, and it was quite a serious break. Another break was on the top of the hill from the water hammer. The pressure then in Boston, I believe, was only about 50 pounds to the square inch.

Mr. Fuller: I would like to ask Mr. Richards if he couldn't have got his curves with straight pipe, if he had sufficient radius, without using specially cast pipe.

Mr. Richards: Yes, they could have been made with straight pipe, but the joint room, three-eighths of an inch, would have necessitated a very large radius.

Mr. Darling: You have the short bell, and you cannot make a curve in them; with a longer bell you could curve your pipe more.

The President (Mr. Dexter Brackett): I suppose there is no question but that the thickness of pipes in general use is larger than is necessary to withstand the static pressure; but the constant tendency at the present time is, I think, toward increase of pressure, on account of increased heights of buildings, and on account of the water hammer, due to the increased use of water elevators. The pressure on the pipes is in many cases increased very much beyond what they originally were designed to withstand. In Boston we have large sections of the city where the pipes laid in 1848, when there was a pressure of perhaps 40 pounds, are to-day, by the substitution of high service, withstanding a pressure of from 90 to 100 pounds, to say nothing of the additional pressure due to the water hammer. I think the increasing tendency in this direction must be considered by any one who is designing a system of water supply.

Mr. Darling: I think the greatest mistake that is made by a great many towns and cities to-day is that they try to economize too much in putting in not only light pipe, but in putting in small sized pipe. As our president has remarked, there is a constant tendency toward an increased use of the water. In the first place take the hydrant service. That is one of the greatest and most important features of any water-works, to say nothing about the family use. Then when you come to take on this new feature, which the insurance companies have brought up by the introduction of the automatic sprinklers, you have got to provide for that in addition. Then, too, there are the elevators, and a general increase in the use of water for all purposes, and you must have large pipes to get such a service as you want. So I say that the greatest mistake to-day is that cities and towns do not put in pipes large enough to provide for the growth there is sure to be in the years to come. They are too careful, too economical, too prudent. They should put in larger-sized pipes and pipes of good thickness. Now, when you speak of water-ram, you don't know what circumstances will produce it. There are to-day, with these new complications, ten chances that you will get a water-ram where there was not one years ago. With the elevators and sprinklers you do not know what minute you are going to be called upon to furnish an excessive supply of water at some particular point, and that is controlled by the parties themselves; and they do not stop to think whether they should not take time enough in shutting off the water, but they are liable to shut it off immediately; and if they do shut it off immediately you are going to get a water-ram—you cannot help it.

Mr. Jones: Our president neglected or forgot to mention something with regard to the decay of water-pipes in Boston. Boston, to be sure, is on the seaboard; fortunately not all water-works are so situated; and a good many pipes here are laid in ground that has been filled in from the docks with dock mud. In ten years after the water-works were laid here, 12-inch pipes, that were nearly five-eighths of an inch thick, were so damaged by this dock mud that you could cut them with a knife as you cut a lead-pencil; and they are taking them out every week now, I suppose, that you can cut in the same way. So, certainly, it is policy in Boston to use pipe large enough to resist, for a reasonable time, such influences. It may be that is something which does not have to be taken account of in the country, but, nevertheless, if I was to lay pipes again, I should try to make a mistake in the direction of laying large pipes.

Mr. Tidd: I believe, with the gentleman who has last spoken, that the thickness of pipe should be governed somewhat by where it is to be put. I have no doubt that in a soil such as he speaks of, a thicker pipe would be required than, perhaps, would be required in a different soil. But with the soils which we usually meet in building water-works through the country, my impression is we have been using unnecessarily thick pipe. My attention has been called to that particularly by reading the reports of tests at the Watertown Arsenal. The breaking strain of a 16-inch pipe, I think $\frac{44}{100}$ of an inch thick, was about 4,800 feet head. Now it seems to me we might get along with one half that, for probably the water-hammer never would come up to 25 per cent. of it. In the early stages of water-works construction it was customary to use very thick pipe, but I think the experience we have had lately will warrant us in using thinner pipe in many places. I have always believed in the principle of prevention of water ram wherever possible. I don't believe that shutting off a 4-inch pipe with a valve should ever be allowed. I think that will break any pipe. It seems to me, as I have said before, we have been wasting a great deal of iron. I agree with the gentleman who has last spoken as to the size of the pipes. I never knew a pipe too large, but I have seen lots of them too small.

ANCIENT AMERICAN TOOLS.

IN speaking of ancient American tools, Mr. H. F McLeod, of the Smithsonian Institute at Washington, recently said: "Aboriginal carpentry was the chief trade of our predecessors on this continent. The Indians and the mound builders had a very good idea of wood-working. You will see even now some very pretty joining done by Sioux Indians. Their tent poles make a fit which many a white carpenter would not like to try to better. The best carpenters, of course, were the Aztecs, who had arrived at quite a high stage of art, and whose tools, although they knew nothing of steel, are really excellent. We have a few of their tools at the Smithsonian, but the best collection is, of course, in the City of Mexico. The material used was almost wholly glass, especially for the finer parts of their wood-cutting. To chop trees they used flint axes, and for the rough hewing out of logs the same; but when it came to the accurate fitting in of the hewn timber, they handled glass knives, chisels and saws very deftly, and with beautiful results. There is a ceaba-wood post in Washington with hieroglyphics and faces cut upon it, all with glass. You can see bits of the original chisel still sticking in a corner of the wood, where it broke off three centuries ago under the hand of the workman. The Aztecs knew how to make a very good and manageable glass, and their best cutting blades, swords, daggers and spears, saws, chisels and axes were made of it. When the edge dulled they broke it from the end instead of sharpening it, and got a new cutting line. You can see a great deal of aboriginal carpentry still in use among the Moqui Indians of the United States. Of course they use our tools now, but they follow their old patterns."

Correspondence.

Communications giving information or opinions on matters of general interest to the engineer, the architect, the contractor, or the municipal officer, will be welcomed in this column. Fairness will suggest that when communications are sent simultaneously to this and other journals we should be informed of it at the time. Anonymous letters will not be noticed.

LARGE SIZE VITRIFIED PIPE FOR SEWERS.

ST. LOUIS, October 13, 1890.

To the Editor of THE ENGINEERING AND BUILDING RECORD:

SIR: The opinions of engineers concerning the value of vitrified pipe sewers of the larger diameters are of interest and value, and I have followed the recent communication in your columns on the subject.

Sewer pipe was not extensively used in St. Louis prior to 1878, because the material then in this market was of insufficient strength. Mr. Robert Moore, then Sewer Commissioner, adopted specifications requiring heavier pipe. This demand being responded to by the production of "double strength pipe," the local use rapidly extended, and no failure due to the pipe has since occurred. For several years sizes over 18 inches diameter were sparingly used, but as experience gave ground for confidence the use up to 24 inches diameter has extended. We now use it freely.

A late instance, in another city,* apparently to the discredit of 30-inch pipe, has come to my knowledge. The sewer failed by collapse under the following conditions. It was laid in a narrow trench, and the pipes were not properly bedded; a railway track was laid in the street, partly over the sewer, and used by dirt trains. Under such circumstances crushing of the pipe was but a natural result.

In the early days of sewer construction some single-ring brick sewer was built in this city. So far as strength alone is concerned it has answered its purpose, but such construction was long since abandoned. Where present cheapness of construction is a necessity, a single ring may be used, especially when, as is frequently the case, the town may be expected to outgrow its baby clothes. In other words, cheap sewers may answer until the questions of: How deep? and how large? are more definitely settled than is possible when the sanitary necessity for sewers first comes to the front. Under the hard service of large cities, particularly the industrial sections, whose sewers must receive everything and at times run under head, the double ring will repay manifold the additional cost, when good material and workmanship is required throughout.

ROBERT E. MCMATH, Civil Engineer,
Sewer Commissioner.

Questions and Answers.

All questions relating to building construction, paving, sewerage, water supply, or kindred subjects, will be welcomed in this column provided they relate to matters of general interest and are not such as should properly be referred to a consulting engineer. Answers will be carefully prepared and a proof of both question and answer mailed to the inquirer as early as proper consideration will permit. They will be published for the benefit of other readers as soon as convenient. The full name and address should be given, not necessarily for publication, but as a guarantee of good faith, and to facilitate further correspondence in case the question is not sufficiently explicit.

Inquiries of the Editor, in order to secure prompt attention, should *not be written on the same piece of paper as a communication* to the *Publishing Department.* Letters renewing subscriptions are sent to a clerk in the publishing office, and matter for the Editor, if in the same enclosure, is likely to be overlooked unless it is on a separate piece of paper, so that it may be promptly sent to the Editor.

LAYING WATER MAINS AROUND CURVES.

W. H. RICHARDS, Superintendent of the New London, Conn., Water-Works, writes:

"I notice in your paper of October 18 an inquiry regarding the maximum deflection allowable in laying water pipe around curves.

"The maximum *possible*, as you state, depends on the depth of bell and joint room, but the usual practice of making all but short curves with straight pipe seems to me to be wrong, in view of the increase in friction occasioned by the projection of the spigot end on the inside of the pipe. It will be readily seen that any considerable deflection throws the spigot against the inside of the bell on one side and out into the pipe on the other. If specials are used for all considerable changes in direction, and the pipes are laid on straight lines from special to special a less depth of bell and smaller joint room is possible, thereby effecting a considerable saving in weight of iron in the bell and lead in the joint and, on the larger mains at least, I suggest this as the best practice."

THE first electric car ever operated in Rochester, N. Y., was run over one of the street car lines on October 18. The overhead wire system is used.

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*From a paper read before the New England Water-Works Association by Walter H. Richards, Superintendent Water-Works, New London, Conn.

*This refers to East St. Louis, where a pipe collapsed.—ED.

DOMESTIC PLUMBING HEATING LIGHTING & VENTILATION ENGINEERING

ELECTRIC MOTORS.

(Continued from page 316.)

THE CROCKER-WHEELER MOTOR.

IN the motor built by the Crocker-Wheeler Electric Motor Company, 430-432 West 14th Street, New York, every attempt has been made to combine great durability and efficiency. The result has been a motor, which, in a comparatively short time, has come into extensive use. It is made for both arc and incandescent light circuits.

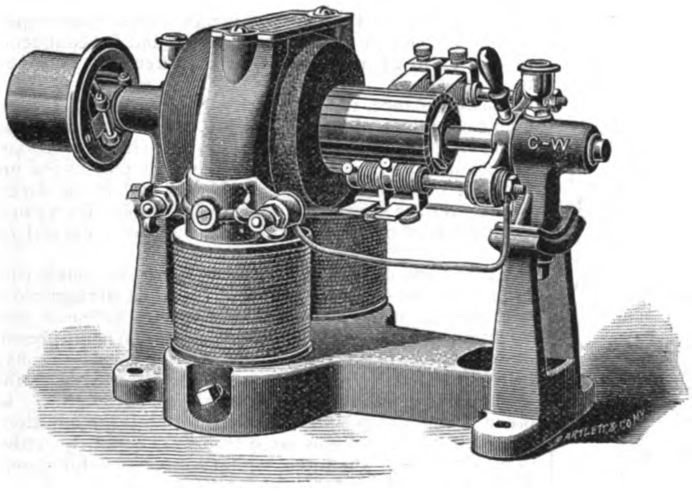


FIG. 13.—ONE-HALF H. P. ARC MOTOR.

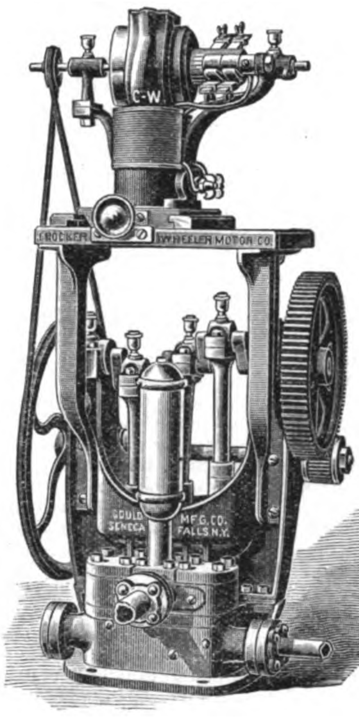

C-W
CROCKER-WHEELER MOTOR CO.
GOULDS MFG. CO. SENECA FALLS N.Y.

FIG. 14.—PUMP OUTFIT.

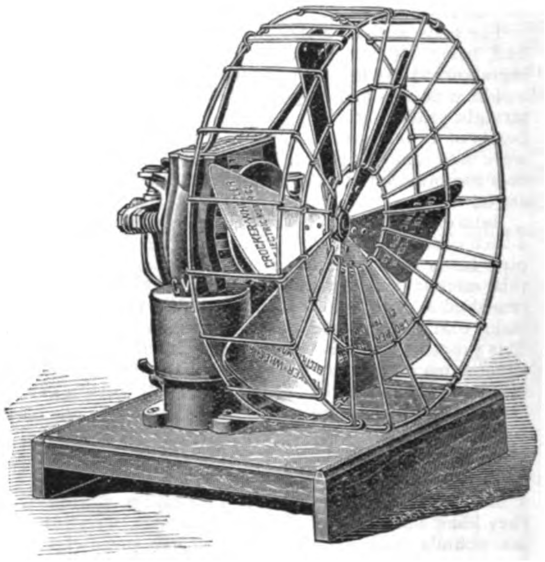


FIG. 15.—FAN OUTFIT.

THE CROCKER-WHEELER MOTOR, MADE BY THE CROCKER-WHEELER ELECTRIC MOTOR CO., NEW YORK.

Figure 13 shows a ½ horse-power arc circuit motor. The regulation of speed is produced entirely by a mechanical governor inclosed within the pulley. The action of this is simply to allow the armature to be thrown out of the field longitudinally by the attraction of the field for a second mass of iron placed behind the armature. There is no switch or electrical regulator of any kind on the motor. The regulating mechanism is entirely non-electrical and separated from the motor, and can be easily taken apart and adjusted by any machinist. Dimensions of ½ horse-power motor, 22½x12x12¾ inches; weight, 106 pounds; speed, 1,800. The larger sizes, both arc and incandescent, are made in the same style.

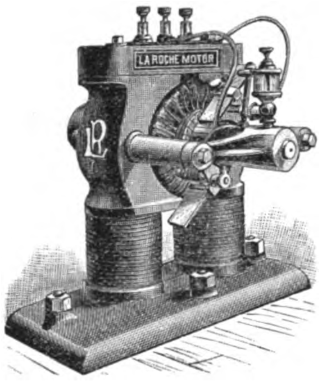


Fig. 16.—ONE H. P. MOTOR.

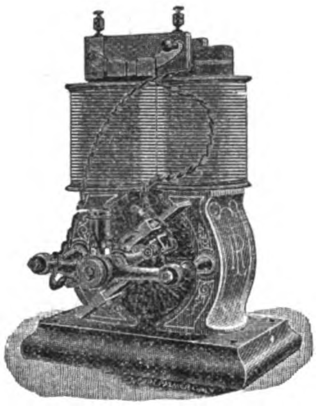


Fig. 17.—ONE-EIGHTH H. P. MOTOR.

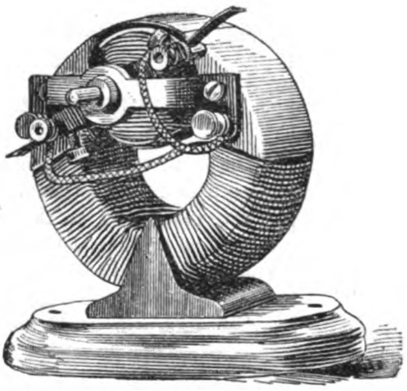


Fig. 18.—ONE-TWENTIETH H. P. MOTOR.

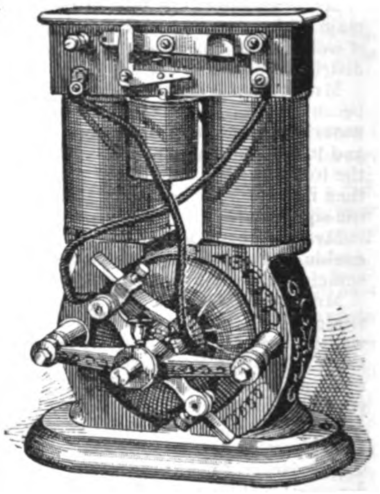


Fig. 19.—ARC MOTOR.

THE LA ROCHE MOTOR, MADE BY THE LA ROCHE ELECTRIC WORKS, PHILADELPHIA, PA.

Figures 14 and 15 show a pump outfit and a fan outfit, respectively, both having ⅛ horse-power motors. The pump is of the triplex type, made by the Goulds Manufacturing Company, of Seneca Falls, N. Y. The complete outfits, as shown, are, however, furnished by the Crocker-Wheeler Company. Similar outfits, fitted with ⅛ horse-power motors, are also available, and still larger pump outfits are made with ½, 1 and 5 horse-power motors. The motors are either belted or geared to the pumps.

The sizes in which the motors are ordinarily made range from ⅛ to 50 horse-power.

THE LA ROCHE MOTOR.

The La Roche Electric Works, 116 North Sixth Street, Philadelphia, Pa., make a motor designed for both arc and incandescent circuits, and illustrated in Figs. 16, 17, 18 and 19.

Figure 16 represents a motor made in sizes ranging from 1 to 5 horse-power; Fig. 17 shows a style varying from ⅛ to 1 horse-power; Fig. 18 shows a motor of $\frac{1}{20}$ horse-power designed for battery use, and Fig. 19 shows what the makers call their automatic constant-current (arc) motor. This, they explain, is so made that it cannot burn out or run away in case the belt should come off, and will cut itself out and close the circuit, avoiding danger or injury to the motor.

The commutators are made of tempered copper, and the motors are very highly finished. They all have improved carbon brushes and adjustable brush holders, and run at speeds ranging from 800 to 1,000 revolutions per minute.

(TO BE CONTINUED.)

NON-CONDUCTING COVERINGS FOR HOT-WATER PIPES AND RESERVOIRS.

IN the course of a series of articles on hot-water supply, published in the London *Builder*, the following particulars are given on covering pipes and reservoirs for saving heat:

"It is no exaggeration to say that very shortly no apparatus for hot water supply will be considered complete or finished if the whole system is not insulated, so to speak, so that almost every particle of heat absorbed by the water in the boiler will be obtainable from the taps, instead of nearly 50 per cent. of it being radiated from exposed surfaces, and worse than wasted.

"There are at this moment hundreds, if not thousands, of hot-water systems that, by being carefully covered, would be converted from miserably inefficient to highly satisfactory appliances—this in particular with the tank system, when the tank is so commonly fixed in a cold, draughty roof.

"An interesting instance of the success attending the covering of pipes occurred quite recently, in which a residence was fitted with a complete system of hot-water supply pipes on a scale sufficiently large for a good boiler in a 5-foot kitchen range, but owing to a delay experienced in obtaining the range in question, another of a smaller size, 3 feet, was fitted up and connected to the chimney and circulating pipes for temporary cooking and hot water supply. It was not supposed that this little range with its boiler would do much in the way of water heating, but to the astonishment of everyone it gave a really abundant supply of very hot water in every part of the house as quickly in the morning and altogether as satisfactorily as a larger range would be expected to do.

"This desirable result was wholly brought about by the pipes and cylinder being everywhere carefully covered with a sufficient thickness of felt. It really does seem opposed to all reasonable and workmanlike principles to allow such abundant opportunity for heat to be thrown away, while labor and fuel is being expended in the kitchen apparently for this object. The waste of heat is not always the only ill result experienced, as in many instances the warmed air is very objectionable, and if a hot-water pipe is carried alongside a soil pipe it is possible for a very unpleasant feature to introduce itself. It is a very customary practice for a hot-water fitter to carry his pipes up in the casing that is nearly always to be found passing from the bottom to the top of the house, this casing containing all the different pipes of the house, such as the cold service from the main, the cold service down from cistern, the water closet cold-water services, and, very commonly, the soil pipe. There is no objection to his making use of this casing if it is large enough to hold a few more pipes, and it is often used of necessity, as to carry pipes openly through well-decorated rooms is out of the question; but to carry hot-water pipes up this case without felting them is an exceedingly bad practice, as they are not only brought into contact with very cold surfaces (they have frequently been found wired on to cold pipes, four or five pipes in a bundle), but the heat radiated causes a draught or current of air to set in, as we find in a chimney.

"When a casing contains pipes that radiate heat, that casing, within a few moments after the heat is felt within it, is converted into a flue, as by applying heat to air it can be made to circulate to all intents and purposes like water. Air that is brought in contact with heated surfaces becomes heated and rarefied, and, being thus made lighter than the surrounding air, rises, and cold particles immediately flow in to take its place, they becoming heated and following the first particles, and so on, so that it resolves itself into a stream of warm air flowing out of the upper part of the casing, and cold air flowing in in corresponding volume below. This may be excellent in practice when hot-water pipes are used for effecting ventilation; but it is fatal to hot-water services which are particularly required to keep the heat within them; in many instances they are cooled at about the same speed as they would be if placed outdoors when a strong wind was blowing.

"It may be argued that if the casing is stopped off at its two extremities the trouble will be obviated; and so it would be if the casing was perfectly air-tight everywhere, and had no cold pipes within it. But this is never the case; there are always numbers of crevices and apertures which permit of a tolerably free ingress and egress of air.

"The best material for covering these pipes, and also the reservoirs, is hair felt; hair is a natural poor conductor of heat, and nothing surpasses it for this purpose, especially as it is so easy of application. This felt, which is readily obtainable in sheets, is usually cut up in strips for pipe work; the strips are wound upon the pipe spirally, being secured here and there with cord or wire, but where spiral winding is impossible it can be tied on in lengths, which answers equally well, but has not such a good appearance.

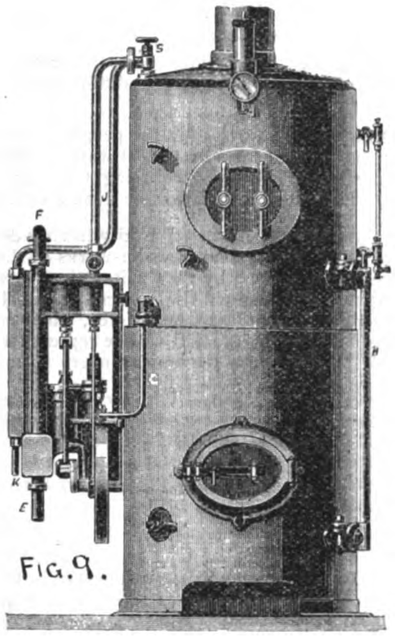


FIG. 9.

KIRKALDY'S SYSTEM OF HEATING BUILDINGS.

THE ENGINEERING AND BUILDING RECORD.

"The best and most complete arrangement for pipe work, but which entails a little greater expense, is to have the felt wound on spirally in one direction, say from left to right, and well secured with cord; then cover this with good canvas, also wound on, but in the opposite direction, and this secured with wire.

"It is most necessary, to secure the best results, to have the felt thick enough; hair-felt is sold in great quantities about $\frac{3}{16}$-inch thick, but this is not thick enough for good work. If possible, have it ½-inch thick, and a marked benefit will be had by using even thicker than this, or, say, two thicknesses of ⅜-inch.

"In felting cylinders, it is the best plan to take sufficient sheets of felt, and then sew the edges together to form one sheet large enough to go all round the reservoir. This sheet can then best be secured by bands of hoop iron or brass passed round at top and bottom, and around the middle; these bands being tightened up by having a bolt to draw the two ends together. After this circular pieces can be cut for top and bottom, these pieces being sewed on to the top and bottom edges of the large sheet. Tanks can be covered in exactly the same way.

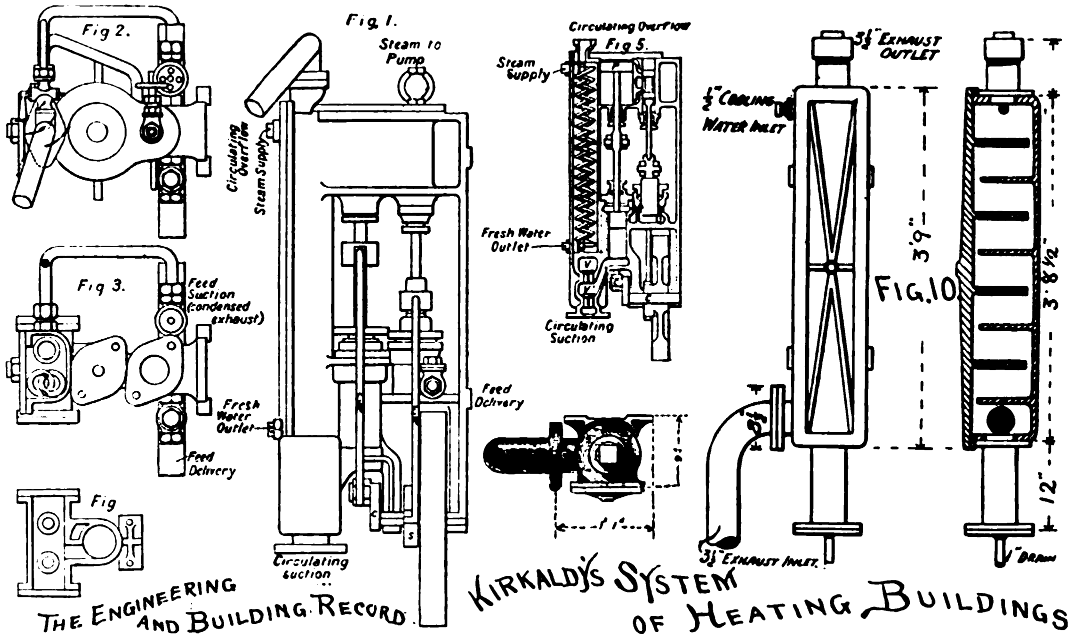
"Sometimes it is desired to encase the tank or cylinder with woodwork. This makes by far the neatest job, though more expensive, and it causes a little trouble should it be necessary to open the reservoir under some circumstances. If it is decided to have a casing it is very important that the space between the woodwork and the reservoir be well filled in with some poor conductor of heat, such as cow hair (plasterers' hair), slag wool, or even dry sawdust answers very well when the casing can be filled from the top. If the casing is not "packed" with something it would be much better to be without it, as it would have a current of cold air passing up through it the same as explained with the general pipe casing just referred to.

"If the hot water service pipes are carried up through the house without entering the general pipe casing mentioned, and it is proposed to incase them for the sake of appearance, this casing must also be packed for the reasons explained, but this is frequently neglected with the worst results, as the casing of pipes is frequently done for appearance sake only, the question of radiation not being considered.

"Occasionally it is found practically impossible to carry the pipes up inside the house, in which case it becomes necessary to carry them outside. This is very objectionable, but where it cannot possibly be avoided the objections do not avail, but they must be guarded against. In the first place, the pipes must be incased, and the casing ought to be of fair size, so that 1½ inch of packing can be filled in between the woodwork and any of the pipes. The packing must fill the case tightly, and it is imperative that the casing be well and tightly secured to the wall, as, should it get loose, the woodwork and the packing will come away from the pipes and leave them exposed.

"When pipes are carried outside the packing is not only needed to prevent great waste of heat, but there is a danger to be guarded against in cold weather when the pipes are liable to be frozen and an explosion possibly ensue, as the only outlet for any steam that may be generated in the boiler is at the upper extremity of the expansion pipe, unless a safety valve is provided."

THE Cambridge, Mass., water board, with invited guests, representing for the most part the members of the Cambridge city government, made its annual tour of inspection of Freshpond and Stonybrook on the 9th inst.



KIRKALDY'S SYSTEM OF HEATING BUILDINGS.

FROM a recent issue of the London *Engineer* we reproduce the accompanying illustrations of the apparatus made by Messrs. John Kirkaldy, London, for a new system of heating by means of hot water, and at the same time for supplying baths and other requirements.

All difficulties concerning circulation are avoided by the use of a small, constantly-working steam pump, the water circulated being heated by means of a steam heater, which utilizes the exhaust steam from the steam pump. The pump is of simple positive-action form, and may be used as a fire engine. The condenser is also as made for condensing the steam from electric light engines, and thus preventing the noise of exhaust and effecting a considerable economy.

Figure 9 shows the general arrangement, and the details of the condenser and steam pump, as employed for the heating apparatus at Epsom College, are shown in Figs. 1 to 6. Figures 1 to 4 give various views of the steam pump, and Figs. 5 to 6 show the condenser and heater and the connecting and eccentric rods of the pump. Figure 10 shows the jet condenser used with the apparatus. These engravings are so fully lettered that they are self-descriptive. In Fig. 9, which shows a complete set of apparatus, heater and pumps, but not the pipes, E represents water to be heated; F, water heated; and G, boiler feed, which includes the condensed steam. The heater and condenser may be placed underneath the pump In this case it would be horizontal, and would form the bed-plate for the pumps.

IT is anticipated that the St. Clair tunnel will be available for traffic next February.

INCREASING USE OF THE ELECTRIC MOTOR

THE rapidity with which the electric motor is forcing its way into all sorts of places, and notably into private houses, attracts more attention day by day.

An instance of the way in which the handy little machine insists on recognition is the case of a Brooklyn hotel, which, not long ago, ordered a small motor for running an exhaust fan. Soon after it was found expedient to use another small motor for running the knife-scouring machine. Following on this came an order for a four-horse power motor for washing dishes, and immediately after a ten-horse power motor was put in for the purpose of running the whole laundry of the hotel. The new machines were found so quiet in running, and so clean and effective in their work, that almost everything in the hotel that was formerly done by the steam engine is now done by electric motors.

NEW YORK STREET CLEANING STATISTICS.

THE report of the Street Cleaning Department for the quarter ending September 30 shows 314,179,228 square yards of streets swept and 355,461 cartloads of ashes and garbage collected, of which 19,850 loads were used to fill in city lots, the rest being dumped at sea. The amount paid to the city for the privilege of trimming scows was $13,886 60. Expenditures for all purposes aggregated $264,411.68, or $105,359 12 less than for the first quarter of the year and $83,111.95 less than for the second quarter.

Notes and Queries

on Domestic Engineering.

Communications relating to the practical details of plumbing, heating, lighting and ventilation will be welcomed in this column. The writer's true name and address must always be given, but an assumed name may be used for publication if preferred.

HOT-WATER HEATING IN AN APARTMENT HOUSE.

N. BARRY & SON, sanitary and heating engineers, Muscatine, Iowa, write:

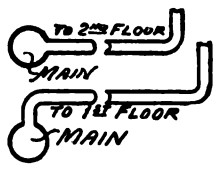
"Can you give us the address of parties making radiator shields or hoods?

"In your issue of October 11, showing hot water job in Brooklyn, the risers E, 2½-inch pipe, show connections to main with nipples looking down. Is this an error of draughtsman, or is it as actually put in? If so, would you kindly give your readers information. We have, in practice, put in nearly the same thing. When one large main acted as flow-pipe for two floors, the radiators not standing over each other in line, we have taken branches for second floor from side of main, and for first floor from top."

[We are not certain that we correctly understand the question regarding radiator shields. The Tuttle & Bailey Manufacturing Company and the Simonds Manufacturing Company of New York, and all other makers of registers, make coil screens. In the West the Crane Bros. Manufacturing Company, of Chicago, make screens for radiators and coils. The Gold Car Heating Company of New York make a hooded radiator with register in its top.

With regard to the second question, Mr. A. T. Rogers, with Messrs. Johnson & Co., of Catskill, N. Y., who executed the work, writes :

"Concerning the nipples looking downward in branch E, as shown in your illustration of our Brooklyn job in issue of 11th inst., we would say that the sketch is correctly drawn. As stated in your description, the ceiling of cellar is only about 6½ feet high, and in order to secure head room all branches were kept as near to the ceiling as possible. The 3-inch branches, supplying risers E and F, are placed side by side, and close to the ceiling for head room, and hence, at least one of branches E, must drop in order to pass the 3-inch pipe. Riser E supplies five radiators, averaging about 75 square feet each, one on each floor, and directly above each other, as shown in Fig, 4. Riser F supplies only one radiator, which contains about 90 square feet, and is in the main hall on the first floor, the second floor above the cellar, so that riser E has columns of hot and cold water three stories higher than riser F, which effectually counterbalance the retarding effect of the nipples looking downward as noted. Riser F has a straight run, which counterbalances the greater height of riser E."]



ANNUAL REPORTS.

ANNUAL REPORT OF THE CITY ENGINEER OF THE CITY OF PROVIDENCE, R. I., for the year 1889.

This report, by S. M. Gray, the City Engineer, opens with a detailed account of the expenses and operations of the City Engineer's department for the year. This is followed by an elaborate register of meteorological observations during the different months of the year. This gives thermometric and barometric readings, percentages of humidity, direction and velocity of wind, state of weather, etc., for every day of the year. Tables are also given of the amount of water pipe laid in different streets, the location and size of pipe, the monthly and annual and the average daily and monthly consumption of water during the year, location, sizes and lengths of sewers built during the year, etc. A special chapter is devoted to highways, giving details of paving and other street work. Parks and public buildings, bridges and harbor work are treated of in the concluding chapters.

ANNUAL REPORTS OF THE DEPARTMENT OF THE BOARD OF PUBLIC WORKS, CITY OF NEW HAVEN, CONN. for the year, 1889.

The first of the several reports in the pamphlet is by the Clerk of the Board, and briefly reviews the work of the year in the way of street improvement, bridge repairs, etc. The report of the City Engineer, Albert B. Hill, covers the same ground more in detail, and embraces also the report of the Superintendent of Sewers. Extensive tables are given, showing the prices of constructing the sewers and putting down and repairing pavements, and the cost of grading streets and repairing bridges.

TRADE PUBLICATIONS.

BATH TUBS.

AN attractive, eight-page circular has just been issued by the J. L. Mott Iron Works, 84–90 Beekman Street, New York, giving illustrations and particulars of a number of different styles of baths turned out by them. Dimensions and prices are furnished together with brief descriptions, though the latter are made almost unnecessary by the finely executed engravings, which tell their own story. An inclosed sheet directs attention to the firm's catalogue of fountains and drinking fountains, statuary, vases, stable fittings, etc.

STEAM REGULATING DEVICES.

A NEW illustrated catalogue, dated October 1, 1890, has been issued by the Mason Regulator Company, 10 Central Street, Boston, Mass. It is devoted to the various steam regulating devices made by them, and gives not only price lists and illustrations, but also intelligent descriptions of the apparatus. Steam engineers will find in it some interesting and profitable reading.

ORNAMENTAL METAL WORK.

THE Jackson Architectural Iron Works, 315 East Twenty-eighth Street, New York, have prepared a number of photographic reproductions of ornamental metal work manufactured by them. There are, in all, twelve finely executed plates showing aluminium bronze railings, wrought-iron balconies, lamps and scroll work, gates and stairs, giving a very good illustration of the capacity of the makers for work of that kind.

Novelties.

Devices are described under this head purely and strictly as news; because believed to be new and calculated to interest readers.

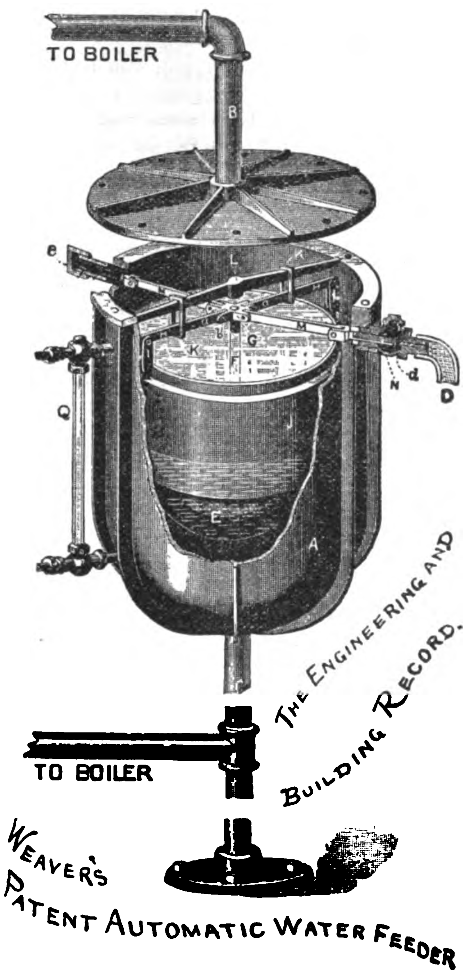
In no case is pay accepted, directly or indirectly, for publishing a novelty notice.

As the subjects are selected for their supposed novelty and interest merely, it will, of course, be understood that the selection does not imply indorsement.

AUTOMATIC WATER FEEDER FOR BOILERS.

THIS feeder consists essentially of a closed chamber A, freely communicating with the boiler by pipes B to the steam space, and C to the water space, and supplied with feed water through pipe D.

The water level is the same in chamber A as in the boiler; when it falls it operates a weight which admits feed water, and when the water level has become high enough the supply is again shut off. H H are two levers whose fulcrums K K are supported by cross-bar L. A solid annular weight, J is suspended from the outer ends of levers H H by links I I, and a cup E, full of water, is suspended by the rod F from the cross-head G. The latter unites the inner ends of H H. When the chamber A is partly full of water its buoyancy makes J overbalance E, thus raising the inner ends of levers H H, and operating the toggle joint composed of cross-head G and arms M M, so as to force valve N close up to its seat, as shown, and shut off the supply through D. As the water level falls in the chamber A, the cup E, ceasing to be buoyed up, overbalances the weight J, depresses the inner ends of levers H H, and the operation of the toggle joint withdraws valve N and admits water through D; *e* is an adjustable cap screwed up to compensate for the wear of rubber disk *d*; Q is a gauge glass.


TO BOILER
B
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TO BOILER
THE ENGINEERING AND BUILDING RECORD.
WEAVER'S PATENT AUTOMATIC WATER FEEDER

The device is patented and manufactured by James W. Weaver, Toronto, Ont.

BOOK NOTICES.

FIRE PROTECTION AND WATER SUPPLY for 1890; Published by *Fire and Water*, New York.

The purpose of this volume is to present to those interested complete statistics regarding the fire protection and water supply in the different cities and villages of the United States and Canada brought down to date. For readily apparent reasons statistics of this kind can scarcely be accepted as entirely reliable and complete, but the work of collecting them, we have no doubt, has been conducted with care, and the list thus probably represents the best available information on the combined subjects.

The cities and villages are classified by States, alphabetically, and in each case are given the population, character of mercantile and private buildings, the equipment of the Fire Department, and the main particulars of the water-works. The importance and value of the information thus offered in conveniently accessible shape will be at once appreciated.

CONTRACTING INTELLIGENCE

Our readers will oblige us by notes, clippings, or any information which will put us in the way of obtaining early and reliable news for our "Contracting Intelligence." *Information of importance sent to us exclusively, and not elsewhere published will be liberally paid for.*

Persons who make any use of the information they find in these columns we trust will not omit to mention THE ENGINEERING & BUILDING RECORD as the source

For works for which proposals are requested see also the "Proposal Columns," pages i-ii-338.

WATER.

For Additional Water Items see Proposal Columns.

EUFAULA, ALA.—The water-works question continues to be the principal topic of conversation with the officials and taxpayers of this place.

MONTGOMERY, MINN.—A special election held here has voted $5,000 for a system of water-works. Work will begin immediately on a deep well, pump-house and a large reservoir, with water mains and hydrants through the streets.

DEL NORTE, COL.—As the people of this place have voted for a system of water-works, the next step will be advertising for proposals, which, it is stated, will be done at once.

MONTGOMERY, ALA.—The city having decided to buy the system of water-works of this place, now operated by the Capitol City Water Company, has retained the services of J. H. Turner, of Mobile, Ala., as referee, while the Water Company's interests will be represented by M. M. Tidd, the Boston engineer.

HAVERHILL, MASS.—The city has decided to take control of the system of water-works of this place, now operated by the Haverhill Aqueduct Company, and has retained the services of M. M. Tidd, C. E., of Boston, as an expert.

FLORESVILLE, TEX.—Mayor A. D. Evans writes: "It is not contemplated by the City Council to establish public water-works in this place at present. Some private parties have had the matter under consideration with a view of establishing a stock company."

VANCOUVER, WASH.—The following bids for building and completing a water-work plant were received by O. M. Hidden, October 11: J. T. Goss, Vancouver, not guaranteed, $2,950; M. A. Cook, Portland, Ore., guaranteed, $3,886.

BELLEVILLE, ILL.—A shortage of the water supply of this place, which exists at present, will probably result in improvements being made to the plant.

DES MOINES, IA.—The City Council has ordered the laying of water-mains through numerous streets of this place.

MISHAWAKA, IND.—The taxpayers of this place voted in favor of establishing a water-works system, at a recent election.

KIRKWOOD, MO.—Reports say that John W. Andrews is at the head of a project to establish a system of water-works at this place.

EAST ST. LOUIS, ILL.—The Webster Grove Water Company has been incorporated at this place, with a cash capital of $25,000. J. S. Kendrick can furnish details.

MASON CITY, IOWA.—The sum of $20,000 is to be expended on a system of water-works for this place.

LEXINGTON, NEB.—The estimated cost of the water-works proposed for this place is $20,000.

PORTLAND, ORE.—It has been decided to add 9 miles of mains to the water-works system at this place.

AUSTIN, TEX.—The contract for the construction of a granite dam across the Colorado River has been awarded to Bernard Corrigan, of Kansas City, at $500,000, to be completed in two years. It will be 60 feet high and 1,200 feet long.

HALLETTSVILLE, TEX.—The following bids for the construction of a system of water-works were received by W. Blakeslee, City Clerk, October 6: G. Jaeger, Rich Hill, Mo., $14,685; J. W. Moore, Lampasses, Tex., $15,000.

CONTRACTING NEWS DEPARTMENT.

A WEEKLY RECORD

F SPECIAL INTEREST TO CONTRACTORS, BUILDERS AND MANUFACTURERS OF ENGINEERING AND BUILDING SUPPLIES.

HE ENGINEERING AND BUILDING RECORD,
277 Pearl Street, New York.

October 25, 1890.

WATER.

SIOUX CITY, IOWA.—The City Council has eceived a report from D. A. Decrow, a repreentative of the Holly Manufacturing ompany, calling attention to the necessity f adopting a plan looking to increase of vater supply, suggesting going to the Misouri River for a source, at a point three miles bove the city. The report suggests a pumpng plant of 10,000,000 gallons daily capacity or delivering water into the settling basins, nd a pumping engine of 6,000,000 or 8,000,00 gallons capacity for high service should be provided. The engines and boilers now in use could then be removed to the new station and serve as auxiliaries to the new high service pump. A storage reservoir, of at least 10,000,000 gallons capacity, should be built on the highest practical point between the proposed pumping station and the city.

MERIDEN, CONN.—At a special city meeting held here, for the purpose of taking action on the water-works question, choosing a new reservoir site, etc., it was first decided to construct the proposed system at Kensington, and then the following resolutions were adopted: "*Resolved*, That the sum of $200,000 be appropriated for the construction of water-works, to be expended under the direction of the Common Council, and said Common Council is authorized to borrow money, as it may be needed, to complete said water-works, not exceeding, in the aggregate, the above-named sum. *Resolved*, That the Common Council be authorized to take such legal steps as may be necessary to make application to the Legislature for permission to issue water bonds for a sum not exceeding $200,000." For complete particulars, address Mayor Page, as above.

KNOXVILLE, TENN.—The Knoxville Water Company is before the Council for permission to issue bonds to remodel and extend its system. The company contemplates a new suction main about three-quarter mile long, also remodeling the pipe lines and extending them several miles, also doubling the reservoir capacity.

ABERDEEN, WASH.—The question of expending the sum of $50,000 on a water-works system for this place is to be decided by the taxpayers at the approaching election.

PITTSBURGH, PA.—It is stated that the project to organize a new water company to supply the south side of the city with water is progressing, and that on November 6 an application will be made for the charter for the prospective company. Edward F. Hays, Thomas Miller, Charles G. Miller, and others, of this city, are interested.

HEBRON, NEB.—The City Clerk of this place advertises for bids for the construction of a system of water-works. For further particulars, see our Proposal Columns.

LOS ANGELES, CAL.—The Bear Valley and Alessandro Development Company, of this city, has decided to build a water storage reservoir, to hold water for irrigating 100,000 acres of land.

CHARLESTON, S C.—The supply of the local water-works system is to be increased.

ROCHESTER, N. Y.—The Common Council, October 21, authorized the special committee on additional water supply to enter into contracts with owners of water-power on Hemlock, Conesus, and Canadice Lakes, and their outlets, subject, however, to the approval of the Board, in order to ascertain the exact cost of procuring a supply of water from these sources. Alderman Kelly, of the committee, can furnish particulars.

MINNEAPOLIS, MINN.—One of the important improvements the water-works department will make next year is the laying of a 36-inch water main along Second Street to Fifth Avenue S, where it will connect with the old system of distribution from the West side pumping station. This main will be 10,107 feet long and will cost, when completed, in the neighborhood of $95,000.

ELWOOD, IND.—D. H. Hick writes from here as follows: "There have been no steps taken yet to establish water-works in Elwood. There is talk of water-works next season. Can't tell as yet what steps will be taken."

CHICAGO, ILL.—Two reports on the additional water supply for the Lake and Hyde Park districts have been submitted to the Council Finance Committee, one by Acting City Engineer Cheney, and the other by his assistant, Bernard Feind. It is reported that Mr. Cheney's plan involves an expenditure of $400,000 to $500,000, while that of Mr. Feind would cost from $700,000 to $880,000.

NORTH TORONTO, ONT.—The Water-works Committee has reported in favor of obtaining the town's water supply from Fox Creek. The report was adopted. The creek is about a mile distant, and the cost is estimated at $67,000.

WATER-WORKS.—See our Proposal Columns for information regarding water-works and water-works furnishings at the following places: Hebron, Neb.; Madison, Ind.; Van Wert, O.; Charleston, S. C.; Rushville, Ind.; Philadelphia, Pa.; San Antonio, Tex.; Galt, Ont.; Columbus, O.; Chamberlin, S D.; Huron, S. D.; Chambersburgh, Pa,

SEWERAGE.

For Additional Sewerage Items see Proposal Columns

LA GRANGE, ILL.—The authorities here will establish a system of drainage, at a total cost of $250,000. A large ditch will be constructed running three miles to the Des Plaines River, having a fall of over 50 feet.

LOWELL, MASS.—The Board of Aldermen have authorized the construction of numerous additional sewers at this place.

ROCHESTER, N. Y.—The Common Council, on October 21, decided to adopt the report of the East Side Sewer Committee, recommending at the instance of Mr. Emil Keuching, Engineer, the employment of a consulting engineer to examine and report upon Mr. Keuchling's plans and estimates for the east side trunk sewer, at an expense not to exceed $500.

SAN FRANCISCO, CAL.—Plans for the Point Lobos sewerage district have been approved, and proposals for doing the work will soon be wanted.

DAYTON, O.—The contract for sewering this city has been awarded to Bruno Ritty, of this city, at $66,175.20. The complete table of all the bidders was published in these columns last week.

ROCHESTER, N. Y.—The contract for constructing the sewer on East Main Street has been let by the Executive Board to William H. Jones & Sons, the lowest bidders, for $26,259.50. The next lowest bid was by N. L. Brayer, for $31,227.70.

ALBANY, N. Y.—The City Engineer has been instructed by the Board of Contract and Apportionment to prepare plans and specifications for numerous additional sewers.

JOLIET, ILL—A. Comstock, City Engineer, recently began the improvement of what is known as the "slew drain," by building a substantial wall and using concrete for the bottom. About $10,000 has been spent already, the entire cost of which will be about $40,000. The work will be continued next season.

WALTHAM, MASS.—It is stated that the Sewerage Commission recently organized here is about ready to report a detailed scheme for local sewerage, and that within the next 30 days the Aldermen will have the report before them and an order asking the necessary appropriation. The entire system will be constructed under contract.

FLATBUSH, L. I.—At a meeting of the Board of Street and Sewer Commissioners, held last week, Engineer McElroy, of the Board, was directed to prepare plans and specifications for the sewering of the principal streets of Windsor Terrace.

QUINCY, MASS.—C. W. Spear, Clerk of the Council, at this place, writes: "The Committee on Sewerage have reported a bill to the Council, if it is accepted, the Legislature will be asked to authorize the city to build in accordance therewith."

MONMOUTH, ILL.—This city is now being surveyed by J. E. Miller, C. E., under direction of Corthell & Wallace, civil engineers, of Chicago, preparatory to preparation of plans by them for a sewerage system.

CHARLESTON, S. C.—At a meeting of the City Council, held October 14, the joint committee on sewerage submitted a report recommending that an expert engineer be engaged to make a survey of the city with a view of establishing a system of sewerage. The report was adopted and steps will be taken at once to carry out the project. Alderman J. Fred. Lilienthal or the City Engineer can furnish particulars.

TRENTON, N. J.—Additional sewers are to be established in this city. Alderman Kulp can furnish information.

LANCASTER, PA. — Street Commissioner Smeltz has been directed to prepare plans for sewering certain streets of this place.

JERSEY CITY, N. J.—At a meeting of the Finance Commissioners, held October 21, a communication was read from James Moylan urging the immediate construction of the joint sewer between Jersey City and West Hoboken, which, according to the document submitted, will cost $67,850. The communication was referred to the Corporation Counsel for an immediate opinion as to the power of the Commissioners in the premises. Particulars can be obtained by addressing President Somers, of the Board of Financial Commissioners, as above.

KNOXVILLE, TENN.—The surveys for a sewer system for this city have been completed, and plans and estimates will soon be ready. The question of issuing bonds for construction will then be submitted to a vote of the people.

SEWERS.—See our Proposal Columns for information regarding sewer construction at the following places: Detroit, Mich; Buffalo, N. Y.; Des Moines, Iowa; Albuquerque, N. M.; Rothville, Mo.; Victoria, B. C.

BRIDGES AND IRON STRUCTURES.

For Additional Bridge Items see Proposals Columns.

ST. PAUL, MINN.—(By Telegraph.)—The Board of Public Works awarded contract for superstructure of Sixth Street bridge, to Chicago Forge and Bolt Company, at $128,875.

WEST BAY CITY, MICH.—The estimated cost of the bridge which it is proposed to erect over the Saginaw River, at this place, is $41,000. The plans for the structure are about completed.

COBURG, ORE.—A bridge is to be erected over the McKenzie River, at this place.

DETROIT, MICH.—Reports say that a high level bridge is to be constructed over the Detroit River, at this place.

SAVANNAH, GA.—The Macon and Atlantic Railroad contemplates constructing an iron bridge across the Savannah River just below this city. This bridge will be of iron, and will be used for traffic purposes as well as for railroad.

WEST BAY CITY, MICH.—The estimated cost of the proposed bridge to be erected over the Michigan Central tracks, at Washington Street, this city, is $82,567.76. The plans are now in the hands of the Board of Public Works.

BROOKLINE, MASS.—At a special meeting of the Selectmen of Brookline, the contract for building the abutments to the new bridge over the Boston and Albany Railroad, on Dean road, was awarded to D. H. Cram, for $8,331.

AUGUSTA, GA—At a meeting of the City Council, held October 16, a contract was awarded to G. H. Crafts, of Atlanta, to build an iron bridge over the Augusta canal, near the cotton factories. The contract is for $11,800.

LANCASTER, PA. — At a meeting of the Street Committee, held October 21, City Regulator Herr was directed to prepare plans and specifications for a bridge over the Conestoga at Reigart's Landing, and report at the Committee's next meeting.

BATH, ME.—The following proposals for a 60x16 iron bridge were opened October 20, by B. W. Huse, Town Clerk: Wrought Iron Bridge Company, Canton, O., $1,995; Pittsburg Bridge Company, Pittsburg, Pa., $2,011.

HARTLAND, ME.—This town will build an iron bridge at once. The Bridge Committee is E. J. Smith, S. M. Davis and A. Webber.

PITTSBURG, PA.—The plans for the temporary bridge connecting Forbes Street entrance with Shenley Park, this city, are about completed. The estimated cost of the structure is $20,000. For particulars address Chief Bigelow, as above.

OAKLAND, CAL.—L. J. Le Conte, Assistant Engineer in charge of the work on the Tidal Canal, between Oakland Harbor and San Leandro Bay, is working on the designs for the iron and steel draw-bridge across Park Street. As soon as they are finished, it is probable proposals for the construction will be wanted.

RICHMOND, VA.—It is probable that estimates will soon be wanted by the City Engineer for the construction of a viaduct which it is proposed to build in this city The estimated cost of the work contemplated is $200,000. Alderman W. M. Turpin can furnish particulars.

SALEM, MASS. — The following proposals for the construction of the Pow-Wow River bridge, at Amesbury, Mass., have been opened by the County Commissioners: Pittsburg Bridge Co., Pittsburg, Pa., $8,316; Smith Bridge Co., Toledo, O., $8,175; King Iron Bridge and Mfg. Co., Cleveland, O., $8,143; Wallis Iron Works, Jersey City, N. J., $8,050; Vermont Construction Co., St. Albans, Vt., $8,029; Wrought Iron Bridge Co., Canton, O., $7,296; Dean & Westbrook, New York City, $7,280; Berlin Iron Bridge Co., East Berlin, Conn., $7,795. The contract for the iron work has been awarded to the Boston Bridge Works, at $7,487. For the stone work to Joseph Ross, of Ipswich, Mass., at $11,900, and also the contract for the foot bridge to the same party, at $1,265. This work is to be carried on under the general supervision of the Engineer, C. A. Putnam, of Salem, Mass.

BRIDGES.—See our Proposal Columns for information regarding bridge construction at the following places: Philadelphia, Pa.; Greensburg, Pa.; Joliet, Ill.; Zanesville, O. Willimansette, Mass.

NEW DEPOTS.

CHATTANOOGA, TENN.—It is reported that the Chattanooga Southern Railroad Company is about to erect a large freight shed at this place.

STREET-WORK AND PAVING.

CHICAGO, ILL. — Acting City Engineer Cheney is preparing plans and estimates of the cost of changing the street grades and inclines for several streets, in accordance with the proposition made and profile presented by the Rock Island Road to elevate its tracks.

NORWALK, CONN.—The contract for macadamizing West avenue, has been closed with Connor Brothers & Co., of New Haven, at 74 cents per square yard for macadam and $3.50 for rock excavation. It is estimated that there will be about 19,000 yards of macadam.

CHATTANOOGA, TENN.—Numerous streets of this place are to be repaved at once.

GRAND RAPIDS, MICH.—At a meeting of the Aldermen, held October 20, a resolution was passed which authorizes the paving of all the business streets in the Second Ward of this city. For further particulars address Alderman Sproul, as above.

WASHINGTON, PA.—The Town Clerk at this place informs us that about 50,000 yards of paving is to be done here next season.

LANCASTER, PA. — Numerous streets of this place are to be improved. For particulars address Street Commissioner Smeltz, as above.

ALBANY, N. Y.—The Board of Contract and Apportionment has ordered the paving of numerous streets of this city, and the City Engineer is now preparing the specifications for the work.

SCHENECTADY, N. Y.—The Common Council has authorized the paving of numerous streets of this city. Alderman Holtzman can furnish particulars.

FOND DU LAC, WIS.—The paving of several streets has been authorized at this place.

POTTSVILLE, PA.—It has been decided to do considerable paving at this place.

OTTAWA, ONT.—The Council of this place have decided to do considerable street paving.

SARATOGA, N. Y.—The contract for doing certain street work at this place has been awarded to P. Calliman, of Albany, N. Y., at the following figures: Excavating streets named, 30c. per cubic yard; macadamizing, including stone, 45c. per square yard; same, village furnish stone, 25c. per square yard; paving gutters, 2c. per square yard; laying crosswalks, 4c. per lineal foot; 1,600 cubic yards of stoning, $1.55 per cubic yard.

SAGINAW, MICH.—At a meeting of the Common Council, held October 20, City Engineer A. W. Roberts recommended that a committee be appointed to investigate what, if any, material for pavement and what, if any, method of paving, other than that now used by the city, can be introduced at a saving to the city and without detriment to the condition of the streets.

STAPLETON, S. I.—The Supervisors of Richmond County met October 20, and awarded contracts amounting to about $50,000 for repairing 6½ miles of county roads and macadamizing them with Telford pavement. Estimates for the repair of 26 miles of roadways had been received, but all bids, except where awards were made, were considered excessive by the Board and rejected. The Board will readvertise for bids for the repair of 30 miles of road soon. The awards made Monday were as follows: P. Hart & Son, of New Brighton, $23,218; Bernard Mahon, of New York, $12,005.40, and D. Donavan, of Port Richmond, S. I., $15,208.40.

RAILROADS CANALS ETC.

CINCINNATI, O.—I. J. Miller has been granted a charter for a street railway called Route 23, going from the head of Elm Street through Clifton and adjoining suburbs.

GAS AND ELECTRICITY.

ST. JOHNS, QUEBEC.—The St. Johns Electric Light Company has been incorporated here, with a capital stock of $50,000.

MARION, PA.—Gas works are to be established at this place by M. C. Watson and others, who propose to expend the sum of $50,000 on the undertaking.

QUINCY, MASS.—Improvements are to be made to the plant of the Quincy Gas Light and Coke Company.

MOUNT CARMEL, PA.—Operations on the proposed electric light plant for this place are to begin at once, by the Edison Electric Illuminating Company.

BEDFORD, IND.—It is proposed to expend the sum of $20,000 on establishing an electric light plant at this place.

PHILADELPHIA, PA.—The Diamond Electric Light Company has been organized, for the purpose of supplying the outlaying wards with incandescent lights. It is proposed to put the wires underground. For particulars address William J. Latta, of the Pennsylvania Railroad.

HOWELL, MICH.—Operations are to begin at once on the construction of the electric light plant which is to be established at this place by the Howell Electric Light and Power Company.

WILTON, IOWA.—An electric light plant is to be established at this place at once.

ALEXANDER, LA.—The City Council of this place has contracted with the Thomson-Houston Company for an electric lighting plant.

DAWSON, GA.—Operations are to commence at once on the construction of an electric light plant for this place.

NORWICH, N. Y.—This place is to have an electric lighting plant.

KEOKUK, IOWA.—The Gate City Electric Lighting Company has been granted a franchise to establish and maintain an electric lighting business in this city for a term of 20 years.

HURON, S. D.—The South Dakota Gaslight and Heating Company is about to establish a plant at this place. It will be necessary to lay 5,000 feet of mains.

RICHMOND, PA.—It is proposed to expend the sum of $75,000 on the projected electric light plant for this place.

CHEROKEE, IOWA.—It is probable that the electric light plant projected for this place will be established at once by the Cherokee Electric Light and Power Company, which has obtained the exclusive right to erect and maintain a system throughout the city.

COVINGTON, KY.—At a special session of Council, October 20, a charter was granted the Rosendale Electric Railroad Company. The company is to build and operate an electric street railroad from Rosendale through Covington to Cincinnati. It will begin work at once.

DAVENPORT, IOWA.—At a meeting of the City Council, held October 21, the City Engineer was instructed to draw up proper specifications, and advertise for proposals for lighting the public streets for a term of 3, 5 or 7 years. For details address City Clerk Joe L. Herbert.

SEATTLE, WASH.—The following proposals for public lighting have been opened by the Street Lighting Committee: The Seattle General Electric Company—15 candle-power incandescent, $2.20; 30 candle-power incandescent, $3.50; 2,000 candle-power arc, $12. Home Electric Company—15 candle-power incandescent, $2.20; 30 candle-power incandescent, $3.45; 2,000 candle power arc, $12.50. The contract was awarded to the Seattle General Electric Company.

ELECTRIC RAILWAYS.—New electric railways are to be constructed, and improvements are to be made to those already established at the following places: Mahanoy City, Pa.; Springfield, Mass.; Newburyport, Mass.; Amesbury, Mass.; Anaconda, Mont.; Helena, Mont.; Rock Creek, Ill.; Bay City, Mich.; Rockland, Mass.; Buffalo, N. Y.; Alton, Ill.; Norwich, Conn.

NEW CORPORATIONS.

THE Hegeman Oliphant Filter Company have reorganized under the laws of New Jersey; capital, $500,000. President, Robt. Hay; Wm. Oliphant, vice-president; M. M. Moore, secretary and treasurer; directors: Chauncey M. Depew, Wm. Oliphant, Robt. Hay, R. B. Seymore, M. M. Moore.

SAN FRANCISCO, CAL.—The American Brewing Association, of San Francisco, has been incorporated, the objects of which are to conduct a brewery, also a bottling and cooperage establishment, etc. The capital stock is $3,000,000. Particulars can be obtained by addressing I. B. L. Brandt, Incorporation Attorney, as above.

INDUSTRIAL.

NASHVILLE, TENN.—A new race track and surroundings, to cost $40,000, will be constructed here.

NEW PHILADELPHIA, O.—Capitalists of this place will build a $50,000 works for the manufacture of tile and street brick. City Clerk can give information.

JERSEY CITY, N. J.—Plans submitted by Architect Broome, for the proposed new public school No. 24, have been accepted, and the clerk has been instructed to advertise for proposals.

WINNIPEG, MAN.—Local capitalists have made a proposition to construct a dam across the Assinniboine River, at Winnipeg, to utilize the stream for water power.

ST. THOMAS, ONT.—It is rumored that the M. C. R. intend constructing a tunnel under the Detroit River, between Courtright and St. Clair, and making the St. Clair branch the main line of the way.

BIDS OPENED.

NORWALK, CONN.—The bids received by the County Commissioners from contractors for the construction of the new County Home building, were all in excess of the appropriation. Nineteen bids were received, ranging in amount from $16,000 to $19,000. The appropriation was $15,000, and $2,700 of this amount has already been paid for the site. The commissioners have altered the plans, and have requested new proposals under the present arrangement, it being intended to construct a building, which, when completed, will cost about $12,000.

ST. LOUIS, MO.—The following proposals for work on the inshore tunnel, engine, etc., at the Chain of Rocks, were opened October 14, by the City Engineer:

	Quantities.	Wm. McCully, St. Louis, Mo.		Black & Davis, St. Louis, Mo.		McCormick Construction Co., St. Louis, Mo.		Hill & O'Meara, St. Louis, Mo.		Allen & Vieths, St. Louis, Mo		Fruin Bambrick Construction Co., St. Louis, Mo.	
		Price.	Amount.	Price.	Amount.	Price.	Amount.	Price.	Amount.	Price.	Amount.	Price.	Amount.
Earth excavation	40,000 cubic yards.	$0.75	$30,000.00	$0.64	$25,600.00	$1.00	$40,000.00	$0.35	$14,000.00	$0.70	$28,000.00	$0.30	$12,000.00
Excavation in soft or loose rock	2,500 "	1.00	2,500.00	0.75	1,875.00	1.00	2,500.00	1.00	2,500.00	2.50	6,250.00	0.75	1,875.00
Solid rock excavation in wet well and engine pits	12,000 "	1.25	15,000.00	1.25	15,000.00	3.00	36,000.00	3.00	36,000.00	2.75	33,000.00	2.00	24,000.00
" " in tunnels	2,000 "	7.00	14,000.00	6.00	12,000.00	5.00	10,000.00	8.00	16,000.00	8.00	16,000.00	7.00	14,000.00
Concrete, Class B	400 "	8.00	3,200.00	8.00	3,200.00	10.00	4,000.00	6.75	2,700.00	5.50	2,200.00	5.50	2,200.00
" " C	500 "	7.00	3,500.00	6.50	3,250.00	10.00	5,000.00	6.50	3,250.00	5.00	2,500.00	5.00	2,500.00
Brick masonry	1,100 "	13.00	14,300.00	16.00	17,600.00	15.00	16,500.00	11.00	12,100.00	14.00	15,400.00	12.00	13,200.00
Granite "	15 "	50.00	750.00	70.00	1,050.00	20.00	300.00	50.00	750.00	60.00	900.00	60.00	900.00
Stone masonry, Class X	275 "	50.00	13,750.00	45.00	12,375.00	10.00	2,750.00	43.00	11,825.00	40.00	11,000.00	30.00	8,250.00
" " " Y	1,400 "	15.00	21,000.00	19.50	27,300.00	10.00	14,000.00	18.00	25,200.00	16.00	22,400.00	20.00	28,000.00
" " " Z	6,600 "	12.00	79,200.00	12.00	79,200.00	10.00	66,000.00	11.00	72,600.00	10.90	71,940.00	12.00	79,200.00
" " " M	200 "	6.00	1,200.00	6.50	1,300.00	10.00	2,000.00	5.00	1,000.00	8.00	1,600.00	5.00	1,000.00
Lumber	15,000 feet B. M.	40.00	600.00	40.00	600.00	60.00	900.00	30.00	450.00	30.00	450.00	45.00	675.00
			$199,000.00		$200,350.00		$199,950.00		$198,375.00		$211,640.00		$187,800.00

BOSTON, MASS.—The Park Commissioners, October 21, opened proposals for building a woman's lavatory at Charlestown. W. H. Keyes & Co. bid $7,357 and John French $6,779. The Commissioners took the bids under advisement.

BROOKLYN, N. Y.—Commissioner Adams has rejected the bids submitted for the erection of new station houses in the Fifteenth and Twenty-second Precincts. Leonard Bros. were the lowest bidders, their figures being $41,260 for the first building, and $37,800 for the other. New bids will be called for. The Commissioner has awarded two contracts to John J. Cashman, as follows: For the erection of the Eighteenth Precinct station, at 4th avenue and 43d street, price, $49,366; Twentieth Precinct station, Clermont and Flushing avenues, $37,497.

OAKLAND, CAL.—The contract for furnishing the iron work for the construction of a wing to the Alameda County jail has been awarded to P. H. McGrew, of East Oakland, at $8,750. The bid of Bigelow & Little was $8,178.

AUSTIN, TEX.—The following bids for the construction of a dam across the Colorado River, and excavating a hydraulic canal near Austin, were received by John McDonald, Mayor, and opened October 15:

BIDDERS.	I	II.	III.	IV.	V.	VI.	VII.	VIII.	IX	X.	XI.	XII.	XIII.	XIV.	XV.	XVI.	Total for both faces and Capstones of granite.
	Bailing and Draining.	Earth excavation above low water. 66,000 cu. yds.	Earth excavation below low water. 10,000 cu yds.	Rock excavation at site of dam. 8,000 cu. yds.	Rock excavation in Canal and Gate House. 48,000 cu yds.	Limestone masonry. Upstream face of dam. 6,000 cu. yds.	Granite masonry. Upstream face of dam. 6,000 cu. yds.	Granite masonry. Downstream face of dam, 8,200 cu. yds	Limestone masonry. Downstream face of dam. 8,200 cu. yds.	Rubble masonry, limestone, paid for as excavation. 30,000 cu. yds.	Rubble masonry, limestone, not paid for as excavation. 40,000 cu. yds.	Granite rubble masonry. 70,000 cu. yds.	Granite cap-stones. 2,500 cu. yds.	Drilling bolt holes. 4,000 lineal feet.	Iron cramps and dowells. 30,000 pounds.	Excess for laying in Portland cement, 2,000 cu. yds.	
		Price per cu. yd.	Price per cu. yd.	Price per cu. yd.	Price per cu. yd.	Price per cu. yd.	Price per cu. yd.	Price per cu. yd	Price per cu. yd.	Price per cu. yd.	Price per cu. yd.	Price per cu. yd.	Price per cu. yd.	Price per lin. ft.	Price per pound.	Price per cu. yd.	
F. P Reynolds & Co.	$5,000	$0.18	$0.50	$1.25	$0.80	$11.00	$17.00	$16.00	$15.00	$4.00	$6.50	$9.50	$20.00	10c.	5c.	$0.40	$737,780
Bernard Corrigan	8,000	.14	.50	1.60	.80	8.00	11.00	11.25	8.50	7.90	3.50	6.00	15.00	24c.	10c.	.50	501,150
R. M. Hall & Co.	6,200	.15	.25	.90	.60	6.50	16.00	16.00	9.00	5.00	5.00	9.50	25.00	50c	5c.	....	697,800
F. H. Gaynor	9,000	.19	.65	1.35	.92	9.00	9.20	12.00	11.00	3.50	3.90	6.50	15.00	15c.	5c.	.50	538,200
Jas. Reilly & Co.	15,000	.25	1.00	1.00	1.00	9.50	13.00	13.00	9.50	3.70	3.90	10.00	22.00	30c.	10c	1.00	610,300
John P. Martin	21,700	.14	.55	1.75	.90	11.00	11.75	12.50	11.75	3.75	4.24	7.50	15.00	25c.	7c.	.50	590,740
Laing & Smoot	8,000	.18	.55	1.25	.90	12.50	18.00	16.00	14.00	3.80	4.10	7.50	25.00	40c.	6½c.	1.25	664,330

DEER ISLE, ME.—Messrs. Melvin and Shields, of Green's Landing, Deer Isle, have contracted to build a breakwater at Bar Harbor for $50,000.

COVINGTON, KY.—Conrad Smith, of this place, has been awarded the contract for the stonework of the new Baptist Church, at Ludlow, Ky., at his bid of $6,000.

GOVERNMENT WORK.

SAVANNAH, GA.—The following bids for constructing training walls in the Savannah River, were received by O. M. Carter, First Lieutenant, Corps of Engineers, U. S. A., October 20: Rittenhouse, Moore & Co., Mobile, Ala., $235,900; P Sanford Ross, Jersey City, N. J., $234,000; John F. Gaynor, Fayettsville, N. Y., $227,500.

WASHINGTON, D. C.—The following proposals for the work specified were opened on the given dates by the Supervising Architect of the Treasury Department:

Scranton, Pa.—Excavation, concrete foundation, stone and brickwork of the basement and area walls of the United States Post Office, etc., at this place. Opened October 17. Bidders: James Woolsley, Scranton, Pa., Bodwell granite, $28,688; blue hill granite, $27,188. E. O. Bell, Portland, Conn., Coon River granite $29,700; Mathew Stiff, Scranton, Pa., Banelt granite, $26,300; Conrad Schroeder, Bodwell, Bear or Woodstock granite, $23,961.

Bridgeport, Conn.—Plumbing fixtures, etc., for United States post-office building at this place. Opened October 21. Bidders: J. F. Dalton, Chicago, Ill., $3,317.69; Crook, Horner & Co., Baltimore, Md., $3,348.75; Montgomery & Patterson, New York, $4,400; Donahue Brothers, Springfield, Mass., $2,943.

Ellis Island, N. Y.—Erection and completion of the main building and boiler house of the United States immigrant station. Opened October 21. Bidders: For the main building, F. Klingman, $118,875; William E. Eldred, $199,995; Henry Schiffer & Co., $121,256; Sheridan & Byrne, $115,205; Samuel Smyth, $121,565; R. H. Casey, $120,786, and Mahoney Brothers, $121,000. For the boiler house, F. Klingman, $16,885; H. Schiffer & Co., $9 000; Sheridan & Byrne, $16,465; Samuel Smyth, $18,700; R. H. Casey, $17,338; and Mahoney Brothers, $16,900.

SAVANNAH, GA.—The following bids for dredging in the Savannah River were received by O. M. Carter, First Lieut. Corps of Engineers, U. S. A., October 15: P. Sanford Ross, Jersey City, N. J., 18 cents per cubic yard; Savannah Dredging Co., Savannah, Ga., 18¼ cents per cubic yard; American Dredging Co., 19½ cents per cubic yard.

Building Intelligence.

We solicit from each and every one of our readers information relating to projected buildings in their locality, and should be glad to receive newspaper clippings and other items of interest.

ABBREVIATIONS.—*b s*, brown stone; *br*, brick; *br st*, brick store; *b s dwell*, brown-stone dwelling; *apart house*, apartment-house; *ten*, tenement; *e*, each; *o*, owner; *a*, architect; *b*, builder; *fr*, frame.

NEW YORK.

87th st, s s, 62.2 w Madison av, 2 br and s flats; cost, $22.000 each; o, L Wirth; a, E Wenz.

105th st, n s, 280 w 4th av, 2 br flats; cost, $22,000 each; o, J O Connor: a, J Hauser.

119th st, s s, 250 e 2d av, br and s flat; cost, $20,000; o, E C Kerl; a, E Wenz.

105th st, s s, 142 10 e 9th av, br and s flat; cost, $22,000; o, J Renaud; a, Walgrove & Israels.

135th st, n s, 375 E Willis av, 2 br, s and terra-cotta flats; cost, $50,000; o, J Morrow; a, Cleverdon & Putzel.

187th st, s s, 25 e Arthur av, 3 br, s and fr dwells; cost, $2,800 each; o, O Toher; a, J J Vreeland.

600 St Ann's av, br and s flat; cost, $9,500; o, W Daell; a, A Olsson.

N s 52d st, 375 e 11th av, 3 br flats; cost, $54,000 all; o, J A Lowiscott; a, E L Angell.

S s 139d st, 41 e 8th av, 31 br dwells; cost, $248,000 all; o, D H King, Jr; a, Price & Luce.

S s 139th st, 19 e 8th av, 4 br dwells; cost, $40,000 all; o and a, same as above.

E s 8th av, 138th and 139th sts, 2 br flats; cost, $150,000 all; o and a, same as above.

N s 138th st, 41 e 8th av, 31 br flats; cost, $248,000 all; o and a, same as above.

N s 138th st, 19 e 8th av, 4 br dwells; cost, $40,000 all; o and a, same as above.

W s 7th av, 138th and 139th st, 4 br dwells; cost, $76,000 all; o and a, same as above.

W s 7th av, 20 n 138th st, 6 br dwells; cost, $60,000 all; o and a, same as above.

N s 141st st, 300 e Grand Boulevard, 4 br dwells; cost, $34,000 all; o, Carss & Hewlett; a, J A Hamilton.

S s 82d st, 100 e Amsterdam av, 2 br flats; cost, $40,000 all; o, Wessels & Bradley; a, G W Schillinger.

226 West 4th st, br flat; cost, $25,000; o, W H Crawford; a, F J Miller.

639-43 East 16th st, br factory; cost, $35,000; o, J G Gussler; a, W Schickel & Co.

N s 19th st, 312 w 7th av, br flat; cost, $26,000; o, W F Rohing; a, Kutzer & Ruhl.

S e cor Henry and Birmingham sts, br flat; cost, $23,000; o, H Fiskel; a, Buchman & Diesler.

N e cor Madison av and 88th st, br ten; cost, $96,000; o, W J Mathews; a, J C Burne.

ALTERATIONS.

6 and 8 E 20th st, br store; cost, $10,000; o, J A Roosevelt; a, S D Hatch.

227-229 E 56th st, br factory; cost, $10,000; o, T Hagan; a, W C Kornum.

ALLEGHENY, PA.—Pennsylvania av, 2 br and stone dwells; cost, $20,000; o, F E Moore; a, Alston & Heckert; b, Clark, Richmond & Co.

BIRMINGHAM, ALA.—Second av, bet 18th and 19th sts, br dwell; cost, $8,000; o, Thompson-Hutchinson Building Co.

22d st, bet 2d and 3d avs, br dwell; cost, $10,000; o, same as above.

8th av, bet 19th and 20th sts, br dwell; cost, $15,000; o, same as above.

Cor 6th av and 17th st, br school; cost, $40,000; o, same as above.

1st av and 21st st, br bldg; cost, $50,000; o, W A Walker; b, Woodson & Clark.

BOSTON, MASS.—Heath st nr Day st br brewery; cost, $60,000; o, American Brewing Co; a, F N Footman; b, not let.

19 Blossom st, br apart; cost, $9,000; o, P B Goodsell; a, Parker & Means; b, C F Palmer & Co.

Leland st nr Burgess st, 10 br dwells; cost, $45,000; o and b, E D Blackwell; a, S D Kelley.

25 Vale st, rear, br addn (mfg); cost, $12,000; o and b, Dennison Mfg Co.

Perch st, off Harrison av, 6 br dwells; cost, $20,000; o, N M Jewett; a and b, T Connelly.

BRIDGEPORT, CONN.—Cor of Main and Cannon, 5-story building, stores and offices, Ohio sandstone and buff brick; cost, $90,000; o, Henry Sanford; a and b, Longstaff & Hurd.

310 Broad st, double br flat; cost, $8,000; o, P Lesser; a, H A Lambert; b, Thomas Murray.

CINCINNATI O.—Beech and Locust st, Walnut Hills Congregational Church; cost, $8,500; a, E H Ketcham.

10 Kenton st, Walnut Hills, bldg; cost, $7,000; o, E M Costello; a, W W Franklin.

GRAND RAPIDS, MICH.—It is proposed to erect a poorhouse at this place, at a cost of $30,000.

HOLYOKE, MASS.—Cor Prospect and Maple sts, br Roman Catholic Church, 77x122; cost, $41,395; b, Joseph Hebert of Northampton.

LANCASTER, PA.—It is proposed to erect two new school buildings at this place, the cost of each to be $25,000, exclusive of heating apparatus.

MILWAUKEE, WIS.—10th st and Cold Spring av, smoke stack; cost, $20,000; o, Pabst Brewing Co; a, C Hoffman; b, F Stuewe.

34th and Wells sts, res; cost, $10,000; o, Jos Bub; a, F W Andree; b, O Fronner.

PINE BLUFF, ARK.—Ind av, Colored Masonic hall; cost, $25,000; a, E Cook; b, not let.

New jail to be built here. For particulars address the County Judge.

ROCHESTER, N. Y.—Struthalian Park, dwell; cost, $7,000; o, M J McMahon; a, Rogers, Sturgis & Sterne; b, F A Gleason.

SAN ANTONIO, TEX.—It is reported that a $2,000,000 company has been incorporated by Samuel, George, Albert and Mrs Mary Maverick, and Reagan Houston, to build a hotel, at this place.

SAVANNAH, GA.—Bull and York, brick stores; cost, $50,000; o, John Schwarz; a, A S Eichburg; b, John R Eason.

Bull and Bay, br stores; cost, $30,000; o, Est Waldburg; a, T O Brown; b, W S Walker.

Gwinnett & Whitaker, br dwell; cost, $15,000; o, J S Woods; a, A S Eichburg; b, John R Eason.

River st, con'd, cotton presses; cost, $75,000; o, Savannah Cotton Press Co; a, John W Howard; b, R K Bragdon.

State and Whitaker, brick stores; cost, $8,000; o, J R Sausny; a and b, W F Chaplin.

SCRANTON, PA.—Washington av, substructure of Federal bldg; cost, $40,000; o, U S Govt; a, Jas H Windrim; b, Conrad Schroeder.

SIOUX CITY, IOWA.—The proprietors of the Central Stock Yards, who are now completing an extensive plant here, announce their intention to put up a large packing house.

ST. LOUIS, MO.—Lindell and Grand avs, br dwell; cost, $8,800; o, F A Drew; b, J Barnes & Co.

Manchester and East roads, br factory; cost, $25,000; o, St Louis Lead & Oil Co; b, sublet.

S w cor Capitol av and Miami st, br brewery; cost, $15,000; o, Anheuser Busch Brewing Association; b, sublet.

Locust st and Channing av, br store and flats; cost, $7,000; o, Brennan Bros; b, sublet.

S w cor 20th and Penrose sts, br dwell; cost, $7,400; o, C H Behrens; b, P Tiemann.

Grand and St Louis avs, br church; cost, $8,600; o, Baptist Church; b, C A Dicke & Co.

ST. PAUL, MINN.—Albemarle nr Rose; 2-story br church and school; cost, $18,000; o, A Ogerline.

Ashland nr Grotto, 2-story fr dwell; cost, $8,000; o, J J Brennan.

WASHINGTON, D. C.—Woodley Road, 2-story br bldg; cost, $7,000; o, J G Hubward; a, J G Hill; b, W E Morrison.

2143 53 Va av, 8 2-story br bldgs; cost, $16,000; o, C W Simpson; a, G S Cooper; b, G W Lambden.

1355-57 D st n w, 2 3 story br bldgs; cost, $12,000; o, W Nailor; a, W C Brown.

1628 16th st, 4-story br bldg; cost, $20,000; o, F C Stevens; a, H L Page; b, Addison & Larcomb.

1307-09 H and 13 C st, 4 3-story br bldgs; cost, $21,000; o, F E Johnson; a, N T Haller; b, same as above.

324-6-8 E st, 3 3-story br bldgs; cost, $12,000; o, D B Graff.

527-29-31 18th st, 3 3-story br bldgs; cost, $11,000; o, J F Bradley; a, W B Gray; b, J F Bradley.

1624 I st, 5-story br bldg; cost, $40,000; o, A C Tyler; a, Barry, Simpson & Andrews; b, C A Langley.

1201-15 I st, 8 2-story br bldgs; cost, 15,000; o, E E Atkinson; a, N T Haller; b, W R Coon.

2005 O st n w, 3-story br bldg; cost, $10,000; o, W C Winlock; a, Hornblower & Marshall; b, Jno McGregor.

2014 P st n w, 3-story br bldg; cost, $10,000; o, J J Sheehey; a, E Waltz; b, John Hogan.

1017 M st, 3-story br bldg; cost, $8,000; o, R L Elliott.

1132-40 Florida av, 5 2-story br bldgs; cost, $15,000; o, Geo W Talbert; a, J H Ferris.

1708-10 16th st, 2 3-story br bldgs; cost, $15,000; o, Down & Harris; a, same as above.

812-16 B st, 3 2 story br bldgs; cost, $9,000; o, C Gessford; a, same as above.

838-48 8th st, 6 2-story br bldgs; cost, $18,000; o and a, same as above.

1912 G st, 3-story br bldg; cost, $10,000; o, J Moran; a, N T Holler; b, Jno Moran.

Cor 14th and K sts, 6 story br bldg; cost, $147,000; o, G W Cochran; a, Jno B Brady; b, F L Henry.

303 6th st, 3-story br bldg; cost, $9,000; o, G W Talbert; a, Isaac Beers.

1635 16th st, 3-story br bldg; cost, $25,000; o, G A Sheban; a, Bruce Gray; b, Jno McGregor.

1112 C st, 3-story br bldg; cost, $7,000; o, J J Hogan; a, Emmet & Heisley.

1330 G st, 3-story br bldg; cost, $15,000; o, J C Hawley; a, J W Towns.

1405-07 33d st 2 3-story br bldgs; cost, $14,000; o, C H Ficklin; a, F G Atkinson; b, T W Kim.

1-9 in Stones Alley, 5 2-story br bldg; cost, $7,000; o, McStone; a, E Nash.

1730-32 20th st, 2 3-story br bldg; cost, $23,000; o and b, T A Harding; a, G S Cooper.

365 permits less than $7,000 in value.

WOODSTOCK, VT.—Granite tomb; o, Town; a, F W Stickney, Lowell, Mass; b, not let.

WALTHAM, MASS.—River near Moody st, 3-story br cotton mill; o, Boston Manufacturing Co; b, S S Ordway.

Banks of Charles River, dancing pavilion and other buildings appurtenant to picnic grove; cost, $12,000; o, H P Bartlett; b, Robt Glancey.

WEST BAY CITY, MICH.—Kernan, Heisner & Co are preparing to erect a saw mill, with most approved machinery, to cost $100,000.

YOUNGSTOWN, O.—Architect A F Thompson has prepared plans for the erection of a brick planing mill and stock house for the Youngstown Lumber Co. The planing mill is to be 60 by 100 feet and two stories high and the stock house is 60 by 130 feet. Contracts not let yet.

BUILDINGS.—There is nothing over $7,000 in value to report at the following places: Harrisburg, Pa.; Wilkes Barre, Pa.; Pottstown, Pa.; Rochester, N. Y.; Poughkeepsie, N. Y.; Charlestown, S. C.; Worcester, Mass.; Allentown, Pa.; Geneva, N. Y.; Easton, Pa.; Baltimore, Md.; Canton, O.; Wheeling, W. Va.

POSITIONS WANTED.

TOO LATE FOR CLASSIFICATION.

A MECHANICAL ENGINEER OF 25 YEARS' experience in locomotive, marine and pipe work, desires an engagement. Address W. B. J, Box 72, this office. 22

A MECHANICAL AND TOPOGRAPHICAL draughtsman, desires position. Has had a varied experience, and makes good finished work. Address Straight Edge, Box 37, this office. 22

PROPOSALS.

(Continued from page ii.)

VIADUCT, Columbus, O.—*Proposals are wanted* until November 17, for the construction of a viaduct at this place. Address Frank J Reinhard, County Auditor, as above.

SRWERS, Buffalo, N. Y.—*Proposals are wanted* until October 27, for the construction of certain sewers in this city. Address George E. Mann, City Engineer, as above.

BRIDGE, Joliet, Ill.—*Proposals are wanted* until November 10, for the erection of an iron bridge at this place. Address Charles C. Wilson, City Clerk, as above.

DREDGING, Mare Island, Cal.—*Proposals are wanted* until October 28, for doing certain dredging at the navy yard at this place. Address N. H. Farquhar, Chief of Bureau, as above.

ARTESIAN WELL, Chamberlain, S. D.—*Proposals are wanted* until December 5, for the completion of the Pleasant Grove artesian well. Address A. E. Roberts, County Judge, as above.

BRIDGE, Rothville, Mo.—*Proposals are wanted* until November 5, for the erection of a bridge over Yellow Creek. Address John A. Lee, Clerk Chariton County Court, as above.

GRANITE, New York City.—*Proposals are wanted* until October 29, for furnishing granite stones for bulkhead or river wall and granite paving blocks for repairs to pavement. Address the Department of Docks, Pier A, North River, as above.

LIGHTING, Jersey City, N. J.—*Proposals are wanted* until December 1, for lighting the public streets of this place for one year from December 1. Address G. F. Robinson, Clerk of the Board of Police Commissioners, as above.

ARTESIAN WELL, Charleston, S. C.—*Proposals are wanted* until December 1, for sinking an artesian well. Address Zimmerman Davis, Secretary Water-Works Department, as above.

WATER-WORKS, Madison, Ind.—*Proposals are wanted* until October 27, for numerous water-works furnishings. Address John W. Hill, Consulting Engineer, Cincinnati, O.

WATER-WORKS, Hebron, Neb.—*Proposals are wanted* until October 27, for the construction of a system of water-works at this place. Address F. C. Hensel, City Clerk, as above.

SEWERS, Des Moines, Iowa.—*Proposals are wanted* until October 28, for constructing certain sewers in this city. Address R. S. Finkbine, of the Board of Public Works, as above.

SEWERS, Victoria, B. C.—*Proposals are wanted* until December 17, for the construction of certain sewers at this place. Address Wellington J. Dowler, as above.

ARTESIAN WELLS, Huron, S. D.—*Proposals are wanted*, no date specified, for sinking, etc., 10 artesian wells. Address Fred. B. F. Coffin, as above.

ORE DOCK, Arvon, Mich.—*Proposals are wanted* until November 1, for the construction of an ore dock on Huron Bay. Address Milo Davis, Chief Engineer, as above

WATER-WORKS, San Angelo, Tex.—*Proposals are wanted* until November 10, for furnishing a quantity of material for the Water-Works Department. Address J. V. Millspaugh, President San Angelo Water-Works Company, as above.

PROPOSALS.

WILLIMANSETTE BRIDGE MASONRY.

To Contractors.

SEALED PROPOSALS WILL BE RECEIVED by the Commissioners of Hampden County, Mass., until 10 A. M., WEDNESDAY, November 19th, 1890, for the masonry and foundations of a bridge over the Connecticut River, at WILLIMANSETTE, MASS.

All bids must be in accordance with plans and specifications, which will be mailed to Contractors upon application to Edward S. Shaw, Consulting Engineer, 146 Franklin Street, Boston, and which may be examined at the office of the County Clerk, Springfield.

The party to whom the contract may be awarded will be required to furnish a bond for a sum of not less than one-quarter nor more than one-half of the amount of the contract, with sureties satisfactory to the County Commissioners

The Commissioners reserve the right to reject any or all proposals.

LEONARD CLARK,
HARVEY D. BAGG,
LEWIS F. ROOT,
Board of Commissioners of Hampden Co.
Springfield, Mass., October 18, 1890.

Notice to Sewer Contractors.

SEALED PROPOSALS WILL BE RECEIVED at the office of the Recorder of Albuquerque, New Mexico, until 2 o'clock P. M. on the 1st day of November, 1890, for **CONSTRUCTING SEWERS** in the town of ALBUQUERQUE, BERNALILLO CO., NEW MEXICO. Forms of proposals, copies of specifications, and instructions to contractors may be obtained of the Recorder or of the Engineer, and the plans and profiles may be seen at the office of either of the above-named parties.

Each bid must be accompanied by a deposit of $1,000 (One Thousand Dollars) as a guarantee of the good faith of the bidder.

The Board of Trustees reserve the right to reject any or all bids. Address,

HENRY LOCKHART, Recorder,
Albuquerque, N. M.
W. KIERSTED, Engineer,
620 Keith and Perry Building,
Kansas City, Mo. 21

PROPOSALS FOR ROCK EXCAVATION and dredging, U. S. Engineer Office, Cleveland, O., October 14, 1890.—Sealed proposals, in duplicate, will be received at this office until 12 o'clock M., MONDAY, November 3, 1890, at which time they will be opened in presence of bidders, for **ROCK EXCAVATION** and **DREDGING** at ASHTABULA HARBOR, O. All information can be obtained at this office The United States reserves the right to reject any or all proposals. Preference will be given to materials and plant of domestic production or manufacture, conditions of quality and price (import duties included) being equal. The attention of bidders is invited to the Acts of Congress approved February 26, 1885, and February 23, 1887, Vol. 23, page 332, and Vol. 24, page 414, Statutes at Large. L. COOPER OVERMAN, Major of Engineers. 22

OCTOBER 17, 1890.

SEALED PROPOSALS WILL BE RECEIVED at the office of the Supervising Architect, Treasury Department, Washington, D. C., until 2 o'clock P. M., on the 14th day of November, 1890, for all the labor and materials required to do all the **DECORATIVE PAINTING**, etc., for the first, second, and attic stories and main stairway hall of the U. S. Post-Office, etc., building at SPRINGFIELD, O., in accordance with the specification and general plans of building, which may be had on application at this office or the office of the Superintendent. Each bid must be accompanied by a certified check for $100. The Department will reject all bids received after the time herein stated for opening the same; also, bids which do not comply strictly with all the requirements of this invitation. Bids must be inclosed in an envelope, sealed and marked, "Proposal for Decorative Painting, etc., for the U. S. Post Office, etc., building at Springfield. O.," and addressed to JAS. H. WINDRIM, Supervising Architect. 22

OCTOBER 15, 1890.

SEALED PROPOSALS WILL BE RECEIVED at the office of the Supervising Architect, Treasury Department, Washington, D. C., until 2 o'clock P. M., on the 12th day of November, 1890, for all the **LABOR AND MATERIALS** required for the superstructure and completion (except heating apparatus, elevator and approaches) of the U. S. Custom-House, Court-House and Post-Office building at EL PASO, TEX., in accordance with the drawings and specification, copies of which may be had on application at this office or the office of the Superintendent. Each bid must be accompanied by a certified check for $500. The Department will reject all bids received after the time herein stated for the opening of the same; also, bids which do not comply strictly with all the requirements of this invitation. Proposals must be inclosed in an envelope, sealed and marked, "Proposal for the Superstructure and Completion of the U. S. Custom-House, Court-House and Post-Office building at El Paso, Tex.," and addressed to JAS. H. WINDRIM, Supervising Architect. 21

PROPOSALS FOR DREDGING.—U. S. ENGINEER Office, 601 Eighteenth Street, N. W., Washington, D. C., October 17, 1890.—Sealed proposals, in triplicate, for **DREDGING** in the Potomac River at Washington, D. C., will be received at this office until 12 M. on TUESDAY, November 25, 1890. The attention of bidders is invited to the Acts of Congress approved February 26, 1885 and February 23, 1887, Vol. 23, page 332, and Vol. 24, page 414, Statutes-at-Large. For specifications, forms of bid and other information, apply at this office. PETER C. HAINS, Lieut.-Col. of Engineers. 24

PROPOSALS.

FORT RILEY, KAN., SEPTEMBER, 25, 1890.—Sealed proposals, in triplicate, subject to usual conditions, will be received here until 3 P. M. October 25, 1890, and then opened, for the **CONSTRUCTION OF A CAVALRY DRILL HALL**, 100 by 300 feet. Separate bids will be received for the combination truss roof. Plans and specifications can be seen at this office. The United States reserves the right to reject any or all bids. Envelopes containing proposals should be marked 'Proposals for Drill Hall,'' and addressed to Captain GEO. E. POND, Assistant Quartermaster, U. S. Army. 21

FORT RILEY, KAN., SEPTEMBER, 25, 1890.—Sealed proposals, in triplicate, subject to usual conditions, will be received here until 3 P. M. October 25, 1890, and then opened, for the **CONSTRUCTION OF A MAGAZINE** at this post. Plans and specifications can be seen at this office. The United States reserves the right to reject any or all bids. Envelopes containing proposals should be marked "Proposals for Magazine," and addressed to Captain GEO. E. POND, Assistant Quartermaster, U. S. Army. 21

PROPOSALS FOR CONSTRUCTION.—U. S. Engineer Office, 89 Euclid Avenue, Cleveland, O., October 14, 1890.—Sealed proposals, in duplicate, will be received at this office until 12 o'clock M. on MONDAY, November 3, 1890, when they will be opened in presence of bidders, for constructing 450 lineal feet, more or less, of the structure of east **BREAKWATER** at CLEVELAND, O. All information can be obtained at this office. The United States reserves the right to reject any or all proposals. Preference will be given to materials and plant of domestic production or manufacture, conditions of quality and price (import duties included) being equal. The attention of bidders is invited to the Acts of Congress, approved February 26, 1885, and February 23, 1887, Vol. 23, page 332, and Vol. 24, page 414, Statutes-at-Large. L. COOPER OVERMAN, Major of Engineers. 22

PROPOSALS FOR DREDGING. — UNITED States Engineer Office, Cleveland, O., October 14, 1890. - Sealed proposals, in duplicate, will be received at this office until 12 o'clock M. on MONDAY, the 3d day of November, 1890, and then opened, for **EXCAVATING** 240,000 cubic yards, more or less, of material from SANDUSKY BAY along line of proposed straight channel for Sandusky Harbor, O. Preference will be given to materials and plant of domestic production or manufacture, conditions of quality and price (import duties included) being equal. The attention of bidders is invited to Acts of Congress approved February 24, 1885, and February 28, 1887, Vol. 23, page 332, and Vol. 24, page 414, Statutes at Large. All information can be obtained at this office. The United States reserves the right to reject any or all proposals. L. COOPER OVERMAN, Major of Engineers. 22

OCTOBER 14, 1890.

SEALED PROPOSALS WILL BE RECEIVED at the office of the Supervising Architect, Treasury Department, Washington, D. C., until 2 o'clock P. M. on the 3d day of November, 1890, for all the labor and materials required for the **PLUMBING** and gas-piping for the U. S. Post-Office building at DAYTON, O., in accordance with the drawings and specification, copies of which may be had on application at this office or the office of the Superintendent. Each bid must be accompanied by a certified check for $100. The Department will reject all bids received after the time herein stated for the opening of the same; also, bids which do not comply strictly with all the requirements of this invitation. Each proposals must be inclosed in an envelope, sealed and marked "Proposal for the Plumbing and Gas-Piping for the U. S. Post-Office, etc., at Dayton, O.," and addressed to JAS. H. WINDRIM Supervising Architect. 21

U. S. ENGINEER OFFICE, ST. AUGUSTine, Florida, October 15, 1890. Sealed proposals, in triplicate, for furnishing materials and constructing **JETTIES** at the mouth of ST. JOHN'S RIVER, Fla., will be received at this office until 12 o'clock, noon, standard time, on November 15, 1890, and then be opened immediately. For all information apply to this office. The attention of bidders is invited to the Acts of Congress approved February 26, 1885, and February 23, 1887, Vol. 23, page 332, and Vol. 24, page 414, Statutes at Large. W. M. BLACK, Captain, Corps of Engineers, U. S. A. 23

U. S. ENGINEER OFFICE, CHARLESTON-Kanawha, W. Va., September 29, 1890.—Proposals for building the **FOUNDATIONS**, and the pier, abutment, etc., for a movable dam at lock No. 7 of the great KANAWHA RIVER improvement, will be received at this office until 3 P. M. of December 3, 1890 and then opened. The attention of bidders is called to the Acts of Congress approved February 26, 1885, and February 23, 1887, Vol. 23. page 332, and Vol. 24, page 414, Statutes at Large. Information can be obtained by application to ADDISON M. SCOTT, Resident Engineer. WM. P. CRAIGHILL, Colonel of Engineers, U. S. A. 23

U. S. ENGINEER OFFICE, 18 W. SARATOGA Street, Baltimore, Md., September 30, 1890.—Proposals for completing the **SHIP-CHANNEL** leading to the harbor at Baltimore, will be received until noon of December 2, 1890, and then opened. The attention of bidders is invited to the acts of Congress approved February 26, 1885, and February 23, 1887, vol. 23, page 332, and vol. 24, page 414, Statutes at Large. For information apply to WM. P. CRAIGHILL, Colonel Corps of Engineers, U. S. A. 22

U. S. ENGINEER OFFICE, BOSTON, MASS., October 15 1890.—Sealed proposals, in triplicate, will be received at this office until noon of November 22, 1890, for **DREDGING** from SCITUATE HARBOR, MASS., 30,000 cubic yards, more or less, of material. Attention is invited to the Acts of Congress approved February 26, 1885, and February 23, 1887, Vol. 23, page 332, and Vol. 24, page 414, Statutes at Large. For full information apply to S. M. MANSFIELD, Lieut.-Col. of Engineers. 23

PROPOSALS.

TREASURY DEPARTMENT, U. S. LIFE-Saving Service, Washington, D. C., October 22, 1890. Sealed proposals will be received at this office until 2 o'clock P. M. of WEDNESDAY, November 5, 1890, for the construction of two **LIFE-SAVING STATIONS**, one on FENWICK'S ISLAND, DELAWARE, one and a half miles north of the light, and one near OCEAN CITY, MARYLAND. Proposals will be received for one or both stations, and bidders proposing for both should state for what sum they will build each alone, and for what sum the two. Plans and specifications containing full information, and forms of proposals, can be obtained from the Collector of Customs, Wilmington, Delaware, Superintendent Fifth Life-Saving District, Onancock, Virginia; Superintendents of Construction, Life-Saving Stations 24 State Street, New York City, and upon application to this office. HORACE L. PIPER, Acting General Superintendent, D. T. J. 22

PROPOSALS FOR DREDGING.—UNITED States Engineer Office, Mobile, Ala., October 20, 1890.—Sealed proposals for **DREDGING** in MOBILE HARBOR, ALA.; BILOXI HARBOR, MISS., and PASCAGOULA RIVER, MISS., will be received at this office until 12 o'clock M., THURSDAY the 20th day of November, 1890, and opened immediately thereafter in presence of bidders. Specifications, general instructions to bidders, and blank forms of proposal will be furnished on application to this office. The attention of bidders is invited to the Acts of Congress approved February 26, 1885, and February 23, 1887, Vol. 23, page 332, and Vol. 24, page 414, Statutes at Large. A. N. DAMRELL, Major of Engineers, U. S. A. 23

OCTOBER 16, 1890.

SEALED PROPOSALS WILL BE RECEIVED at the office of the Supervising Architect, Treasury Department, Washington, D. C., until 2 o'clock P. M. on the 11th day of November, 1890, for all the **LABOR AND MATERIALS** required for the approaches to the U. S. Court-House, Post-Office, etc., building at LOUISVILLE, KY., in accordance with the drawing and specification, copies of which may be had on application at this office or the office of the Superintendent. Each bid must be accompanied by a certified check for $500. The Department will reject all bids received after the time herein stated for the opening of the same; also, bids which do not comply strictly with all the requirements of this invitation. Proposals must be inclosed in an envelope, sealed and marked, "Proposal for the Approaches to the U. S. Court-House, Post-Office, etc., building at Louisville, Ky.," and addressed to JAS. H. WINDRIM, Supervising Architect. 21

U. S. ENGINEER OFFICE, BOSTON, MASS., October 15, 1890.—Sealed proposals, in triplicate, will be received at this office until noon of November 21, 1890, for the delivery of 225,000 tons, more or less of **RUBBLE-STONE**, for the Harbor of Refuge, SANDY BAY, CAPE ANN, MASS. Attention is invited to the Acts of Congress approved February 26, 1885, and February 23, 1887, Vol. 23, page 332, and Vol. 24, page 414, Statutes at Large. For full information apply to S. M. MANSFIELD, Lieut.-Col. of Engineers. 23

U. S. ENGINEER OFFICE, ROOM 62, ARMY Building, New York, October 15, 1890.—Sealed proposals, in triplicate, will be received at this office until 12 o'clock, noon, WEDNESDAY, November 19, 1890, for the following work: I. For the construction of new DIKES; II., for rebuilding and repairing existing dikes; III., for dredging in the Hudson River between New Baltimore and Troy, N. Y. Amount available, $105,000. The attention of bidders is invited to Acts of Congress, approved February 26, 1885, and February 23, 1887, Vol. 23, page 332, and Vol. 24, page 414, Statutes-at-Large, and the River and Harbor Act of September 19, 1890, Sections 6 to 12. For specifications, blank forms, and all information, apply to the undersigned. G. L. GILLESPIE, Lieut.-Col. of Engineers. 24

U. S. ENGINEER OFFICE, BOSTON, MASS., October 15, 1890.—Sealed proposals, in triplicate, will be received at this office until noon of November 22, 1890, for **DREDGING** from PLYMOUTH HARBOR, MASS., 15,000 cubic yards, more or less, of material. Attention is invited to the Acts of Congress approved February 26, 1885, and February 23, 1887, Vol 23, page 332, and Vol. 24, page 414, Statutes at Large. For full information apply to S. M. MANSFIELD, Lieut.-Col. of Engineers. 23

U. S. ENGINEER OFFICE, BOSTON, MASS., October 15, 1890.—Sealed proposals, in triplicate, will be received at this office, until noon of November 21, 1890, for the delivery of 10,000 tons, more or less, of **RUBBLE-STONE** at NEWBURYPORT HARBOR, MASS. Attention is invited to the Acts of Congress, approved February 26, 1885, and February 23, 1887, Vol. 23, page 332, and Vol. 24, page 414, Statutes-at-Large. For full information apply to S. M. MANSFIELD, Lieut.-Col. of Engineers. 23

U. S. ENGINEER OFFICE. BOSTON, MASS., October 15, 1890.—Sealed proposals, in triplicate, will be received at this office until noon of November 21, 1890, for **DREDGING** from HINGHAM HARBOR, MASS., 20,000 cubic yards, more or less, of material. Attention is invited to the Acts of Congress approved February 26, 1885, and February 23, 1887, Vol. 23, page 332, and Vol. 24, page 414, Statutes at Large. For full information apply to S. M. MANSFIELD, Lieut.-Col. of Engineers. 23

U. S. ENGINEER OFFICE, BOSTON, MASS., October 15, 1890. Sealed proposals, in triplicate, will be received at this office until noon of November 21, 1890, for DREDGING, from WEYMOUTH RIVER, MASS., 25,000 cubic yards, more or less, of material. Attention is invited to the Acts of Congress approved February 26, 1885, and February 23, 1887, Vol. 23, page 332, and Vol. 24, page 414, Statutes-at-Large. For full information apply to S. M. MANSFIELD, Lieut. Col. of Engineers. 23

PROPOSALS.

SEA-WALL ON GOVERNOR'S ISLAND NEW YORK HARBOR. Engineer Office, U. S. Army, Room 74, Army Building, 39 Whitehall Street, New York, N. Y., October 1, 1890.—Sealed proposals, in triplicate, will be received at this office until twelve (12) o'clock noon, on FRIDAY, October 31, 1890, for the **CONSTRUCTION OF A SEA-WALL** on Governor's Island, New York Harbor. The attention of bidders is invited to Acts of Congress, approved February 26, 1885, and February 23, 1887, Vol. 23, page 332, and Vol 24, page 414, Statutes-at-Large. Further information can be obtained at this office. D. C. HOUSTON, Colonel of Engineers. 21

HEADQUARTERS SOUTHERN BRANCH, National Home for D. V. Soldiers, Hampton, Va., October 14, 1890.—Sealed proposals, subject to the usual conditions, will be received at this office until twelve (12) o'clock, noon, THURSDAY the thirtieth (30) day of October, 1890, for **BREAKWATER** at the Southern Branch of the National Home for D. V. Soldiers, near Hampton, Va. The work to consist of Piling Revetment, Dredging, Embankment and Platform, etc. Specifications and drawings can be seen at this office and further information obtained from the Governor of the Home. WM. C. GUNNELL, Civil Engineer. 21

U. S. ENGINEER OFFICE, BOSTON, MASS., October 15, 1890.—Sealed proposals, in triplicate, will be received at this office, until noon of November 22, 1890, for **DREDGING** from MANCHESTER HARBOR, MASS., 20,000 cubic yards, more or less, of material. Attention is invited to the Acts of Congress approved February 26, 1885, and February 23, 1887, Vol. 23, page 332, and Vol. 24, page 414, Statutes-at-Large. For full information apply to S. M. MANSFIELD, Lieut.-Col. of Engineers. 23

U. S. ENGINEER OFFICE, BOSTON, MASS., October 15, 1890.—Sealed proposals, in triplicate, will be received at this office, until noon of November 22, 1890, for **DREDGING** from GLOUCESTER HARBOR, MASS., 40,000 cubic yards, more or less, of material. Attention is invited to the Acts of Congress approved February 26, 1885, and February 23, 1887, Vol. 23, page 332, and Vol. 24, page 414, Statutes at-Large. For full information apply to S. M. MANSFIELD, Lieut.-Col. of Engineers. 23

U. S. ENGINEER OFFICE, BOSTON, MASS., October 15, 1890. Sealed proposals, in triplicate, will be received at this office, until noon of November 21, 1890, for DREDGING, from SALEM HARBOR, MASS., 45,000 cubic yards, more or less, of material. Attention is invited to the Acts of Congress approved February 26, 1885, and February 23, 1887, Vol. 23, page 332, and Vol. 24, page 414, Statutes-at-Large. For full information apply to S. M. MANSFIELD, Lieut.-Col. of Engineers. 23

U. S. ENGINEER OFFICE, BOSTON, MASS., October 15, 1890.—Sealed proposals, in triplicate, will be received at this office, until noon of November 21, 1890, for DREDGING from LYNN, HARBOR, MASS., 40,000 cubic yards, more or less, of material. Attention is invited to the Acts of Congress, approved February 26, 1885, and February 23, 1887, Vol. 23, page 332, and Vol. 24, page 414, Statutes-at-Large. For full information, apply to S. M. MANSFIELD, Lieut.-Col. of Engineers. 23

U. S. ENGINEER OFFICE, BOSTON, MASS., October 15, 1890.—Sealed proposals, in triplicate, will be received at this office, until noon of November 24, 1890, for **DREDGING**, from the west end of Brewster Spit, BOSTON HARBOR, MASS., 28,000 cubic yards, more or less, of material. Attention is invited to the Acts of Congress, approved February 26, 1885, and February 23, 1887, Vol. 23, page 332, and Vol. 24, page 414, Statutes-at-Large. For full information apply to S. M. MANSFIELD, Lieut.-Col. of Engineers. 23

U. S. ENGINEER OFFICE, BOSTON, MASS., October 15, 1890.—Sealed proposals, in triplicate, will be received at this office, until noon of November 21, 1890, for **DREDGING** from the channel leading to NANTASKET BEACH, BOSTON HARBOR, MASS., 20,000 cubic yards, more or less, of material. Attention is invited to the Acts of Congress approved February 26, 1885, and February 23, 1887, Vol. 23, page 332, and Vol. 24, page 414, Statutes-at-Large. For full information apply to S. M. MANSFIELD, Lieut.-Col. of Engineers. 23

U. S. ENGINEER OFFICE, BOSTON, MASS., October 15, 1890.—Sealed proposals, in triplicate, will be received at this office until noon of November 21, 1890, for **DREDGING** from WINTHROP HARBOR, MASS., 18,000 cubic yards, more or less, of material. Attention is invited to the Acts of Congress approved February 26, 1885, and February 23, 1887, Vol. 23, page 332, and Vol. 24, page 414, Statutes at Large. For full information apply to S. M. MANSFIELD, Lieut.-Col. of Engineers. 23

U. S. ENGINEER OFFICE. BOSTON, MASS., October 15, 1890 —Sealed proposals, in triplicate, will be received at this office until noon of November 24, 1890, for **DREDGING** in BOSTON HARBOR, MASS., 70,000 cubic yards of material, more or less. Attention is invited to the Acts of Congress approved February 26, 1885, and February 23, 1887, Vol. 23, page 332, and Vol. 24, page 414, Statutes at Large. For full information apply to S. M MANSFIELD, Lieut.-Col of Engineers. 23

BRIDGE, Zanesville, O.—Proposals are wanted until November 11, for the construction of a bridge across the Muskingum River. Address J. A. Knight, Auditor, as above.

RESERVOIR, Philadelphia, Pa.—Proposals are wanted until November 7, for the construction of a reservoir. Address Louis Wagner, 1321 Filbert Street, as above.

STREET WORK, Norwood, O.—Proposals are wanted until November 5, for doing certain street work at this place. Address E. G. Balles, Village Clerk, as above.

THE ENGINEERING & BUILDING RECORD

AND

THE SANITARY ENGINEER.

A JOURNAL FOR THE ARCHITECT, ENGINEER, MECHANIC, AND MUNICIPAL OFFICER.

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SPECIAL OFFERS.

DOUBTLESS many of our subscribers have a friend or friends who think of subscribing to THE ENGINEERING AND BUILDING RECORD for the coming year, and as every paper, however successful it may be, desires to increase the number of its subscribers, the following offers are made, to hold good during October, November and December, 1890:

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THE ENGINEERING AND BUILDING RECORD,
P. O. Box 3037. 277 Pearl Street, New York.

SEWERAGE AT HOBOKEN, N. J.

Two reports on a general sewerage plan for the city of Hoboken, N. J., recently submitted by Thomas H. McCann and Alphonse Fteley, seem to show that there is urgent need for improvement in the sewerage of that city.

Of the 720 acres included within the limits of the city, which occupies a long and rather narrow strip between the Palisade ridge and the Hudson River, 450 acres were marsh land. About one-third of this land has been reclaimed, most of it in the southern part of the city, and is occupied by tenement houses with a dense population. The streets built across this old swamp are only from one to five feet above high tide. About seven miles of sewers have been built in this low district, partly of brick, partly of wooden boxes, 3 feet by 4 feet in size, in most cases with no grade whatever, or a very slight one, and with their bottoms about one foot above mean low water. Two of the three outlet sewers, with a practically level grade, discharge into the Delaware and Hudson Canal, 3,000 feet from its connection with the river; and the third outlet, although connecting directly with the river, is also practically level. It is little wonder, therefore, that the death rate should be large in this low-lying tenement district.

In the system of sewerage recommended by Mr. McCann, with Mr. Fteley's approval, it is proposed to divide the low marshy district, which extends north and south between the Palisade ridge and a low ridge on the banks of the river, into two parts, the northern part being yet little occupied, and to treat each separately. For the southern district, two interceptors, with branches, will be provided, placed sufficiently deep not merely to drain the existing sewers, which are but little below the surface of the streets, but also to intercept new laterals and laterals which must be built in the future to replace the wooden and other defective ones now existing. These would be placed considerably deeper than the old ones in order to lower the subsoil water and drain cellars. These interceptors will discharge the sewage, including storm water, into a pump well near the southern limits of the city, from which it will be raised by centrifugal pumps, and discharged, through an iron outlet pipe, into the Hudson River at the pier line. A separate system for sewage and roof water was carefully considered, but the conclusion was arrived at that it would be preferable to provide for pumping the entire rainfall from the district, as well as the sewage, rather than to construct a double system of sewers. The pumps will have a capacity for disposing of six inches of rainfall in 24 hours on the above-mentioned area, and also on 50 acres draining from the Palisade ridge—336 acres in all. Overflows are to be provided for disposing of the storm water, through the old outlets, by gravity when it exceeds the capacity of the pumps.

The area of the Northern District contains 135 acres, of which 100 are marsh; 100 acres of the Palisade ridge, not within the limits of Hoboken, also drain into it. For this district the combined system, with pumps capable of handling 6 inches in 24 hours from the 235 acres, is also recommended; but as there are very few buildings now in the district, it will not be necessary to construct this portion of the system for some time to come. Meanwhile, temporary measures are suggested for draining the marshes, which are now cut up into several separate basins by the streets crossing them. It is expected that the 150 acres on the Palisade ridge, belonging to Jersey City and West Hoboken, will eventually be sewered, and will then intercept the sewage and rainfall now flowing into the low district of Hoboken, and relieve the pumps to that extent.

Proportioning laterals with a capacity for only half an inch of rainfall (reaching the sewers) per hour, seems hardly sufficient, with the present knowledge of the intensity of short rainfalls, especially over limited areas; and proposed grades which will give a velocity of only 2½ feet per second, with the sewers running full, will give undesirably light velocities, for sewage only, during a long dry spell. The situation of the ground may make it difficult to allow more, without considerable increase of cost from greater depth of sewers and greater lift for the pumps, and it is stated that provision may be made for flushing the sewers from the river, at high tide, when necessary. It is to be hoped, that, with the exceedingly bad conditions existing in Hoboken, the urgent need for an adequate system of sewerage will be recognized by the city authorities, and the work promptly commenced on the lines of the plans submitted. Unfortunately, no maps are published with the reports, making it difficult to understand some of the details without them.

CLERKS OF WORKS.

THE "Committee on the Employment of Clerks of Works and Superintendence," whose appointment was noticed in THE ENGINEERING AND BUILDING RECORD of February 1, of this year, has made its report to the American Institute of Architects, at the Annual Convention at Washington, last week. This report recognizes the importance of a constant and continuous supervision in the erection of buildings, especially in structures of importance, and strongly recommends the employment of Clerks of Works. It considers that the Institute can materially assist in hastening this very desirable result.

The first point needed is to make the employers and clients of the architect realize the necessity of this constant oversight of the contractors, and recognize, moreover, that the payment for it must be made by them. The salaries of the needed Clerks of Works cannot come out of the ordinary commissions of the architect, although many employers now seem to expect it. The report adds that in England few buildings of any importance are now erected without a Clerk of Works. Formerly he was often a builder's foreman or an architectural assistant seeking to acquire practical experience, but now "men specially trained for the duties, at regularly recognized salaries, have become so numerous that they have in successful operation a society of their own, the Clerk of Works Association of Great Britain."

THE ENGINEERING AND BUILDING RECORD has taken a strong stand in favor of constant supervision of all important buildings, during their construction, by Clerks of Works, and is glad to see from this report that there are hopes of this reform being more widely adopted. Whether a rate of $30 per week, however, for buildings costing from $20,000 to $200,000—particularly for those near the larger limit—is going to secure really capable superintendence, especially in the larger cities, is open to question, and it seems undesirable that the amount should be limited. The pay of United States Government Superintendents, or Clerks of Works, is generally from $6 to $9 per day ($42 to $63 per week)—occasionally, on small buildings, as low as $5 per day ($35 per week), but generally on such buildings not less than $6.

For large and important works a capable engineer would make the most desirable Clerk of Works, or assistant in charge of construction, being not only conversant with the work of construction, but also being more thoroughly posted in the necessary strength required in the details of the structure than are most architects at the present time. The statement, moreover, made in the report, that the architect is not responsible for the contractor's misdoings, seems a little too broad. He may not be pecuniarily responsible for the carelessness or rascality of the contractor, but he should be held responsible for the honest construction of his works in the same sense that a chief engineer is responsible for the proper construction of engineering works under his charge, especially if he has the assistance of Clerks of Works who have been appointed with his approval.

NOTES.

A break in a 12-inch water main, at Harrisburg, Pa., last week, caused considerable damage.

The stand-pipe of the water company at Temple, Tex., gave way on October 25, and considerable damage was done by the escaped water. The pipe was 20 feet in diameter, and 150 feet high.

At a recent meeting of the Albany Institute, at Albany, N. Y., pavements and irrigation were discussed in an interesting manner. London and Paris pavements and the irrigation system of Arizona were the chief topics.

The Philadelphia Natural Gas Company has decided to cut off all large manufacturing establishments supplied with gas by its lines, and devote itself entirely to private consumers, and claims it will then have an ample supply for everybody.

According to the Pittsburg, Pa., *Dispatch*, the Butler County oil producers have subscribed $150,000 toward the building of a pipe line, while the producers of Washington County raised a subscription to the same amount. Twenty or thirty producers of the Millerstown oil field subscribed a sufficient sum to build a pipe line to the railroad, where they will ship their product to the independent refiners of Cleveland.

St. Louis is awakening to the objections to overhead electric wires, and the question of putting all wires underground is occupying the attention of the press of that city. The experience of the fire department at a recent large fire has strengthened this movement, as the operations of the firemen were greatly hindered and the work made dangerous. The Bell Telephone Co. is before the Council with an ordinance asking a franchise to construct subways under streets and alleys.

The public hearing given by the New York Aqueduct Commissioners on October 27, on the subject of building a dam separate from the one proposed at Quaker bridge, resulted in a resolution to endorse the views of Chief Engineer Fteley, and the work will be begun at once. It is proposed to construct the dam of earth and masonry which would back up 16,000,000,000 gallons of water. The cost will be $746,000. The dam will be 105 feet high, 100 feet below the river bed, with a length between flow lines of 995 feet. It will be known as the New Croton Dam.

Eight suits have been begun in the Supreme Court, at New York, on behalf of English corporations and capitalists, against Dr. Gerardus H. Wynkoop and Theodore N. Vail, formerly President of the Boston Heating Company, and now President of the Consolidated Telegraph and Electrical Subway Company, to recover about $250,000 alleged to have been procured from them by misrepresentation. Among the plaintiffs are Sir John Penden, whose loss is placed at $50,000, and the Trustees', Executors' and Securities Insurance Corporation, the Bankers' Investment Trust Company, the United States and South American Trust Company, the Army and Navy Investment Company, and the Mercantile Trust Company, all of London.

Four hundred steam fitters and helpers stopped work at Chicago on October 27, and demanded higher wages. The strikers comprise about 90 per cent. of the steam fitters of Chicago. The strike was brought on by the refusal of the Master Steam and Hot Water Fitters' Association to comply with the demands of the Steam Fitters' Association.

PERSONAL.

M. S. Befreus has been appointed architect to the Quartermaster's Department, at San Antonio, Tex.

Fred. J. Amweg, C. E., has retired from the firm of R. C. Ballinger & Co., and opened offices in the Lucas Building, Philadelphia.

J. W. Beach, formerly with the Strong Locomotive Company, has opened an office as mechanical draughtsman at 45 Broadway, New York City.

James D. Lazell, M. E., formerly of Philadelphia, Pa., has accepted the position of Manager in the Southern office of F. J. Amweg, M. Am. Soc. C. E., at Roanoke, Va.

Minott W. Sewell, mechanical engineer, of New York, until recently with the Pneumatic Dynamite Gun Company, has opened an office at 71 Broadway, in that city.

Walter A. Fischer, architect, has opened an office at the corner of Fifty-fifth Street and Third Avenue, New York, and would be pleased to receive samples, catalogues, price-lists, etc., in the building and architectural line.

Mr. Emil Kuichling, City Engineer of Rochester, N. Y., in reporting on the east side sewer which is to be built, has suggested the desirability of having the proposed scheme submitted to consulting experts for further examination.

OBITUARY.

E. H. Cooper, a civil engineer of New York, was run down and killed by a train on the Niantic bridge, near East Lyme, Conn., on October 28.

James Suggett, credited with the invention of driven-wells, died at Cortland, N. Y., on October 23.

Contractor Nicholson was killed at Toronto, on October 21, by the caving in of a sewer trench.

Joseph Davis, one of the principal builders and best known citizens of Elizabeth, N. J., died on October 28, at the age of eighty. For a quarter of a century, in conjunction with his brother Jacob, now president of the First National Bank of Elizabeth, he carried on an extensive building business.

Brigadier-General Samuel Henry Roberts died at his home, at Brooklyn, N. Y., on October 27.

General Roberts was born in East Hartford, Conn., in 1820, and was educated in the public schools there. In 1839 he went to Michigan and engaged in the Indian Wars then going on in that region. He removed to New-York in 1850 and after being here five years crossed the river to Brooklyn. In September, 1862, he enlisted in the 139th Regiment, New-York Volunteers, and served through the war, being promoted several times for gallant action on the field, and retiring with the rank of Brigadier-General.

Oliver C. Bullard died suddenly in Bridgeport, on October 25. He was born in 1822, in Sutton, Mass. During the war he worked in the United States Sanitary Commission, and was with Butler and Banks at New Orleans. At the close of the civil contest Mr. Bullard saw the need of beautifying the breathing places of large cities, and with his friend and comrade, Frederick Law Olmstead, carried on the work of adorning Central Park, New York. He then went to Brooklyn, and much of the beauty for which Prospect Park is famous is due to his labors. His next great work was upon the Capitol grounds at Washington, and he also assisted in laying out the parks of Baltimore. Six years ago Mr. Bullard went to Bridgeport, and took charge of the parks.

OUR ARCHITECTURAL ILLUSTRATION.

HOUSE OF MARY OF BRAVA, SALAMANCA, SPAIN.

THE INTERNATIONAL ENGINEERING CONGRESS IN 1893.

A meeting was held at Chicago on October 14 and 15, 1890, to consider the establishment of an engineering headquarters and the holding of an International Engineering Congress during the World's Columbian Exposition, 1893.

The convention met at 10 A. M. in the rooms of the Western Society of Engineers, 78 La Salle Street, Chicago, Tuesday, October 14, 1890. The societies represented and the delegates present were as follows: The American Society of Civil Engineers, William P. Shinn (President), C. L. Strobel, A. E. Hunt; The American Society of Mechanical Engineers, William Forsyth, Jesse M. Smith: The American Institute of Mining Engineers, William P. Shinn, A. E. Hunt; Canadian Society of Civil Engineers, J. D. Barnett, O. Chanute; The American Institute of Electrical Engineers, E. M. Izard; The Engineers' Club of Philadelphia, H. W. Spangler, Wilfred T. Lewis, E. V. d'Invilliers; The Civil Engineers' Club of St. Louis, J. B. Johnson, E. D. Meier, Robert E. McMath; Civil Engineers' Club of St. Paul, L. W. Rundlett, W. W. Curtis, S. D. Mason (President); Wisconsin Electric Club, Warren S. Johnson; Engineering Association of the Southwest, E. L. Corthell; Civil Engineers Club of Cleveland, William T. Blunt, John Eisenmann; Engineers' Club of Minneapolis, William A. Pike, F. W. Cappelen; The Society of Civil Engineers, Paris, France, E. L. Corthell; The Engineers' Society of Western Pennsylvania, A. E. Hunt; The Western Society of Engineers, O. Chanute, D. J. Whittemore, E. L, Corthell, C. L. Strobel.

Mr. E. L. Corthell explained the object of the meeting. and several letters were read by the Secretary from officers of the Exposition, encouraging the proposed meeting, and from the President of the French Society of Civil Engineers, Paris, stating that they would be represented.

After organization and discussion a committee was appointed to formulate a plan and to report to the convention, which adjourned to meet again next morning.

The following report was submitted by them:

To the Chairman of the Convention of Delegates from Engineering Societies of the United States and Canada.

Dear Sir: Your Committee on Plan for establishing and maintaining a joint engineering headquarters in Chicago in 1893, during the World's Columbian Exposition, and for holding an International Engineering Congress at some time during the Exposition, beg leave to report:

It finds itself unable to present, at this time, more than a brief outline plan.

The proposition advanced by the Committee of the Western Society of Engineers to this convention yesterday, embodies our views, with some changes, which we have made in the plan herewith submitted:

FIRST.—ENGINEERING HEADQUARTERS.

In view of the existence in this country of several large engineering societies of high rank, which will desire the use of headquarters for their own members, and for the entertainment of foreign visitors, and the inconvenience and expense which would result from the maintenance of separate establishments, we think it very desirable that all the engineering societies of recognized standing in the United States and Canada be requested to unite in establishing and maintaining a joint engineering headquarters during the continuance of the Exposition.

The Exposition management will probably furnish space free of charge within the Exposition buildings, but it may be deemed advisable to provide additional quarters outside; the headquarters to be a rendezvous for all the members of the engineering societies in this country, and their use to be freely tendered to all foreign engineers.

It is expected that the staff shall consist of a joint secretary and two or more assistants, some of whom shall speak the principal European languages. The staff to be charged more especially with:

(*a*) To give information concerning the location of various engineering exhibits within the exposition.

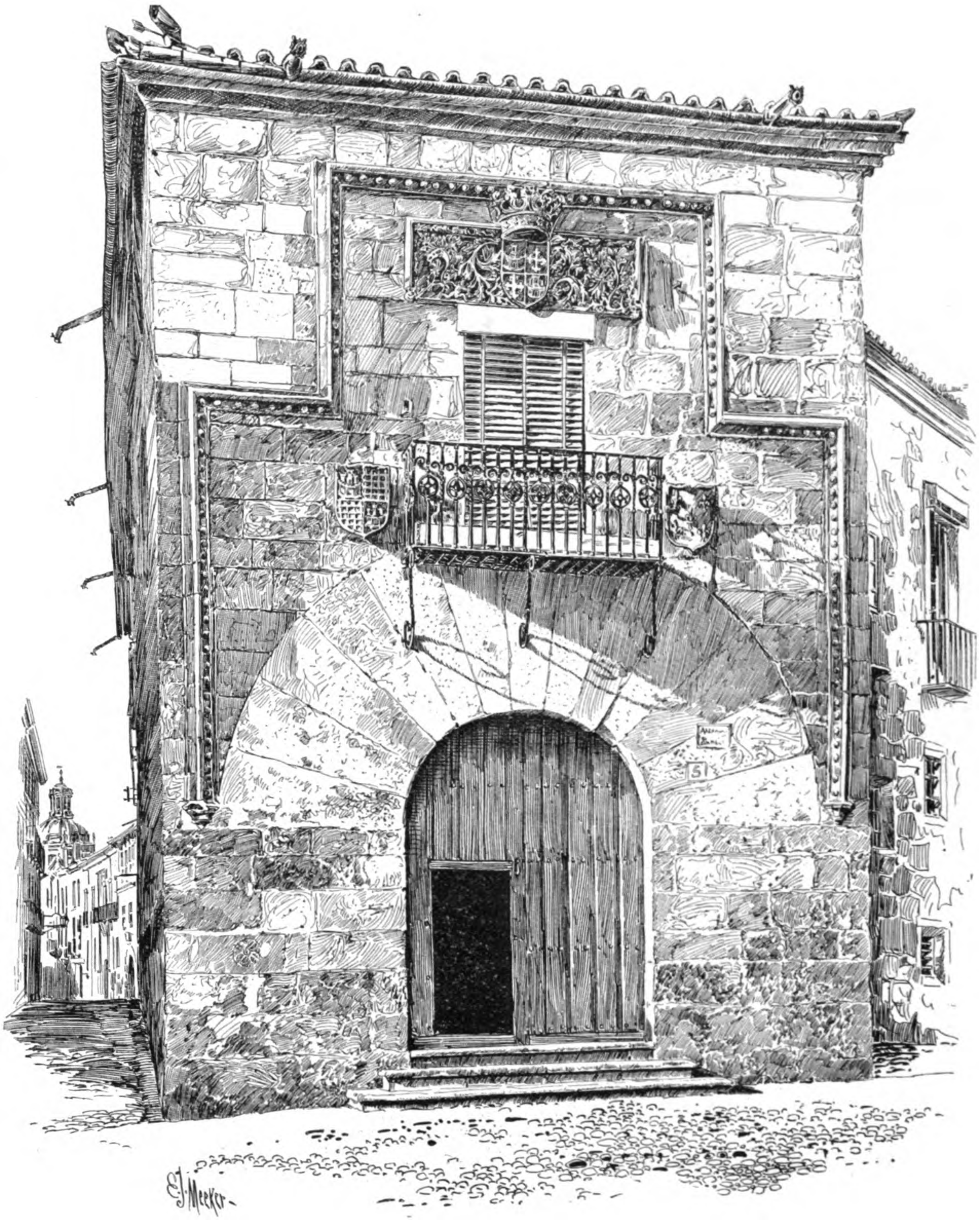
(*b*) To give visiting and foreign engineers information about points of engineering interest, outside of the Exposition, and to aid their investigations in other ways.

(*c*) To give visiting and foreign engineers introduction to those whom they may desire to meet, and to promote social intercourse.

(*d*) To keep a record of the addresses of visitors, and to invite them to the International Engineering Congress hereinafter outlined.

It is estimated that the expense will amount to about $10,000. This, it is suggested, may be met by an assessment of one dollar per member on each engineering society of this country which shall join this proposed association, and also by voluntary contributions The details to be hereafter adjusted.

It is evident that this plan will be far more economical than that of maintaining separate headquarters by the several societies.



THE ENGINEERING AND BUILDING RECORD ILLUSTRATED SERIES.

HOUSE OF MARY OF BRAVA, SALAMANCA, SPAIN.

NEW YORK, VOLUME XXII.

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SECOND.—ENGINEERING CONGRESS.

At some time to be hereafter designated during the Columbian Exposition, it is proposed to hold within the Exposition, in a building which the management thereof proposes to furnish, an international engineering congress open to engineers of all nations. This congress to last six days and to be conducted in the English language.

The opening session of welcome and organization to be a joint session, and if warranted by the attendance and the number of papers offered, the congress then to be divided into sections to consider and discuss the various branches of civil, mechanical, mining, metallurgical, electrical, military and naval engineering.

A chairman and secretary for each section to be designated in advance, and the sessions to be so timed that papers and discussions on allied subjects shall not occur simultaneously so as to preclude those interested from attending several sections.

The congress to terminate with another joint session.

All papers, so far as practicable, to be furnished in advance, to be carefully examined by the proper committees under rules to be hereafter laid down, and, if found acceptable, to be printed for distribution in advance to the members of the congress, at which they are to be chiefly read by title so as to admit of immediate discussion.

Intending contributors to be requested to confine their papers, so far as possible, to such new and recent constructions, machines, processes, methods, experiments and investigations, including proposed standards of tests and measurements as are of engineering importance. Papers on purely speculative subjects should not be received.

A small fee (say $2) to be paid by members attending the congress to defray its expenses. The papers and discussions to be subsequently printed and furnished to such members as may so request at a stipulated price.

A permanent committee to be chosen in advance, to organize the above proposed headquarters and congress.

Respectfully submitted,
E. L. CORTHELL,
O. CHANUTE,
JESSE M. SMITH,
D. J. WHITTEMORE,
C. L. STROBEL,
W. W. CURTIS,
J. B. JOHNSON.

The report was unanimously adopted in the following resolution:

Resolved, That the report of the committee on an International Congrees and joint headquarters be accepted, and that we report the same to our respective societies, with the recommendation that action in approval or in disapproval of the same be taken within the next two months, and that we desire the present committee to be continued with power to carry on the correspondence and organization until its successor is appointed.

In furtherance of the plan adopted the following resolution was passed by the convention.

Resolved, That it is the sense of this convention that the general permanent committee on International Congress and Engineering Headquarters be composed of one member from each of the societies which shall join in the plan, except that the American Society of Civil Engineers, the American Society of Mechanical Engineers, the American Institute of Mining Engineers, the American Institute of Electrical Engineers, and the Canadian Society of Civil Engineers, may each appoint two members, and the Western Society of Engineers may appoint three members of such committee.

The following resolutions were also passed:

Resolved, That the secretary be instructed to prepare minutes of the proceedings of this convention and the resolutions adopted, and that he, as soon as possible, have the same printed and sent to each delegate, and the secretary of each of the societies represented.

That the Executive Committee of the Convention be empowered to call the first meeting of the delegates, provided for in the resolution adopted, at such time as they may see proper after January 1, 1891.

THE AMERICAN INSTITUTE OF ARCHITECTS.

WASHINGTON MEETING.

THE annual meeting of the American Institute of Architects was held at Washington, D. C., last week, extending from October 22 until October 24. About 300 members were present.

Owing to President R. M. Hunt's illness his place was taken by J. W. Root of Chicago.

The annual address, written by President Hunt and forwarded to the convention, was read at the first session on Wednesday, October 22, by E. H. Kendall of New York. In this eulogistic reference was made to the works of the late president of the Institute, Thomas U. Walter, and then Mr. Hunt discussed the method in vogue of planning and erecting public buildings. According to his theory the present system was all wrong, and decidedly more expensive than it should be. The decease during the past year of important members of the Institute was touched upon, especial reference being made to the deaths of John McArthur, Jr., and Henry Ogden Avery. There were many expressions of sorrow at the untimely death of Architect A. B. Mullett, and resolutions of sympathy with the dead man's family were unanimously adopted.

The greater part of Wednesday and Thursday was devoted to the consideration of various committee reports, among them those on a proposed code of professional ethics, on clerks of works, uniform contracts and indemnification.

A letter from the National Association of Fire Engineers, asking the co-operation of the architects in the matter of procuring uniform fire ordinances, and a communication from Mr. Cummings, giving an account of the progress of the excavation of Delphi, were read.

Three papers were presented on Thursday, one being on "The Foundations for Kansas City Hall," by S. E. Chamberlain; the second, on "Thoughts on Architecture," by Frederick Baumann; and the third being a sketch of "The History and Status of the American Institute of Architects," by A. J. Bloor. Mr. Chamberlain's paper is given elsewhere in this issue.

Friday morning, October 24, was devoted to routine business, and to a reception by President Harrison.

During the afternoon session a paper on "The Science of Æsthetics," was presented by Mr. Marshall. The following officers for the ensuing year were elected:

R. M. Hunt, President; W. W. Carlin, First Vice-President; J. W. McLaughlin, Second Vice-President; John W. Root, Secretary; S. A. Treat, Treasurer.

Board of Directors: W. M. Poindexter, G. B. Ferry, T. J. Clark, Alfred Stone, George C. Mason, Levi T. Schofield, E. F. Fassett, M. J. Dimmock.

Boston, Mass., was selected as the next place of meeting.

Among those in attendance were the following:

W. G. Preston, Boston; E. G. Lind, Atlanta, Ga.; W. W. Carlin, Buffalo; William C. Smith, Nashville, Tenn.; Henry Lord Gay, Chicago; John W. Root, Chicago; Augustus Eichhorn, Orange, N. J.; Cyrus T. Porter, Buffalo; W. M. Poindexter, Washington, D. C.; Merrit J. Reid, Evansville, Md.; M. J. Dimmock, Richmond; W. L. Plack, Philadelphia; C. F. Schweinfurth, Cleveland, O.; G. H. Helmle, Frederick Baumann, Chicago; E. T. Little, New York; H. A. Linthwaite, Columbus, O.; Warren R. Briggs, Bridgeport, Conn.; A. J. Bloor, New York; E. H. Kendall, New York; Thomas Nolan, Rochester; O. K. Foote, Rochester; N. J. Cayton, Galveston, Tex.; C. A. Wallingford, St. Paul; Glenn Brown, Washington, D. C.; James Murphy, Providence; S. Huckel, Jr., Philadelphia; Otto Block, Rochester; Bernard Vonnegut, Indianapolis; S. S. Godley, Cincinnati, O.; C. A. Didden, Washington, D. C.; George C. Mason, Jr., Philadelphia; S. C. Earle, Worcester, Mass.; John H. Coxhead, St. Paul, Minn.; Alfred C. Clus, Milwaukee; Gustave W. Drach, Cincinnati; R. A. McLean, Chicago; G. W. B. Ferry, Milwaukee; L. M. Randolph, Chicago; F. W. Hamble, Buffalo; R. M. Upjohn, New York; H. J. Meier, Detroit; E. W. Arnold, Detroit; A. B. Cram, Detroit; R. T. Grow, New York; Robert Stead, Washington, D. C.; J. S. Rogers, Jr., Detroit; William Martin Aiken, Cincinnati; J L. Smithmeyer, Washington, D. C.; J. G. Hill, Washington, D. C.; C. M. Bartlerger, Pittsburg; Julian Barnes, Joliet, Ill.; L. T. Scofield, Cleveland; Samuel Hannaford, Cincinnati; N. Le Brun, New York; Thomas Lemos, New York; Sidney G. Osgood, Grand Rapids, Mich.; W. W. Clay, Chicago; J. Blaby, Palmyra, N. Y.; J. Appleton Wilson, Baltimore; J. H. Pierce, Elmira, N. Y.; J. B. Noel Wyatt, Baltimore; Theodore C. Kink, St. Louis, Mo.; W. T. Eames, St. Louis, Mo.; A. F. Rosenheim, St. Louis, Mo.; H. C. Kock, Milwaukee; E. G. Fassett, Kansas City; James W. McLaughlin, Cincinnati; C. A. Curtin, Louisville, Ky.; J. W. Yost, Columbus, O.; M. Crapsey, Cincinnati; John H. Boll, Cincinnati; W. R. Brown, Cincinnati; Edward I. Nickerson, Providence, R. I.; A. P. Cutting, Worcester, Mass.; C. O. Arey, Cleveland; F. A. Wright, New York; S. A. Treat, Chicago; George W. Baxter, Jr., Syracuse, N. Y.; J. H. Kirby, Syracuse, N. Y.; T. N. Clark, Boston; Luther Peters, Dayton, O.; Fred. H. Gough, Utica, N. Y.; R. W. Gibson, New York; E. T. Carr, Leavenworth, Kan.; A. C. Bruce, Atlanta, Ga.; C. C. Burke, Memphis, Tenn.; S. M. Patton, Chattanooga, Tenn.; Frank M. Day, Philadelphia; Charles I. Williams, Dayton, O.; C. Powell Karr, New York; Jay Fay, Rochester, N. Y.; George A. Frederick, Baltimore; V. V. Shipman, Chicago; D. Adler, Chicago; George H Smith, Cleveland, O; John Eisenmann, Cleveland, O.; C. H. Owsley, Youngstown, O., George W. Thompson, Nashville, Tenn.; Arthur Rotch, Boston; Alfred Stone, Providence, R. I.; G. W. Kramer, Akron, O.

ENGINEERING SOCIETIES.

THE annual meeting of the American Society of Mechanical Engineers will be held at Richmond, Va., beginning on November 11 and lasting until November 14. The society's headquarters will be at the "Exchange and Ballard" Hotel. The following preliminary programme has been issued:

Tuesday, November 11—Opening session at 4 P. M; address of welcome by Mayor of Richmond, followed by president's annual address. In the evening there will be a reception tendered to the society by the Governor of Virginia at the Philip McKinley Gubernatorial Mansion.

Wednesday, November 12.—Business session at 9.30 A. M. In the afternoon there will be an excursion on the James River, visiting various points of interest. In the evening there will be a session for reading and discussion of professional papers.

A fourth session will be held on Thursday morning, November 12. The afternoon will be devoted to drives to various points of interest in and around Richmond. In the evening the society will be entertained by the citizens of Richmond.

On Friday, November 14, excursions will be made to the Newport News Ship Building Company's yards, the Portsmouth Navy Yard, Norfolk, and other points.

THE last regular meeting of the Engineers' Club of Philadelphia was held on October 18, President H. W. Spangler in the chair; 21 members and one visitor present.

At the previous meeting it was ordered that a committee be appointed, to consist of the president of the club and two members whom he might select, to consider the question of the participation by the club in the proposed International Congress of Engineers at the time of the coming World's Fair in Chicago. The president presented, at the hands of the secretary, a report stating that he had appointed Messrs. Wilfred Lewis and E. V. d'Invilliers as the other members of this committee, and setting forth what had been done by the committee. This report was not presented with a view of positive action by the meeting, but in order to get some idea of the sense of the club with regard thereto. On motion of the secretary, the sense of the meeting was expressed to the effect that it is desirable for the Board to consider the said report in full, and report to the club at the next business meeting.

The secretary presented, for Mr. Robert A. Cummings, a photograph and description illustrating the effect of gases from locomotive stacks upon vegetation.

Mr. Arthur Falkenau presented an extensively illustrated description of a new "Method of Making Barrels by Machinery." There was considerable discussion of this subject, principally by Messrs. Henry G. Morris, Wilfred Lewis, John C. Trautwine, Jr., Max Livingston and the author.

PRESIDENT HARRISON, on October 28, appointed Lieutenant Francis R. Shunk, Corps of Engineers; Professor Henry A. Rowland, of Johns Hopkins University, and Andrew Rosewater, municipal engineer of Omaha, Neb., a board "to consider the location, arrangement and operation of electric wires in the District of Columbia, whether used for electric lighting, transmission of power, telegraphy, telephony or signalling, with a view to procuring as soon as practicable the construction of a safe and convenient system of conduits or subways, and the placing therein of all necessary electric wires along the streets, avenues and other public places, and the removal of all unused overhead wires and their supports," as provided for in the District of Columbia Appropriation bill of 1890.

PNEUMATIC tube transmission between Philadelphia and New York for letters, newspapers and small packages, is again being talked of.

THE NEW YORK WORLD BUILDING.

PART I.—GENERAL DESCRIPTION; PERSPECTIVE VIEW; FLOOR PLANS; FOUNDATION WALLS; PIERS AND DETAILS.

THE new building for the New York *World* is known as the Pulitzer Building, and is a notable example of modern fire-proof office building construction in this and other principal cities of the United States.

Joseph Pulitzer is the owner, George B. Post the architect, R. Maynicke chief of staff in charge of the work, all of New York.

The building is designed to serve two distinct purposes—*i. e.*, to provide all accommodations for the publication of the morning, evening and weekly editions, etc., of a newspaper of large circulation, and to have rooms and suites of rooms to rent for offices and business purposes.

The entire cellar, extending under the sidewalk on Frankfort Street, and under the sidewalk and 6 feet outside of the curb on Park Row, is made 16 feet high in the clear, and the boiler-room is made 18 feet high. The basement, extending the same distance under the Park Row sidewalk, is made 10 feet high. On account of the steep grade of Frankfort Street the basement floor is only a few steps below the sidewalk at the southeast end. In the cellar are located the main engine and the presses, and in the portion under Park Row are the dynamos and engines, auxiliary engine, the elevator and house pumps, and a large storage tank for water. In the portion under Frankfort Street galleries are provided for the storage of paper prepared for the presses, and under the galleries there are compartments for the ink rollers. All the belting and shafting in the cellar is underground.

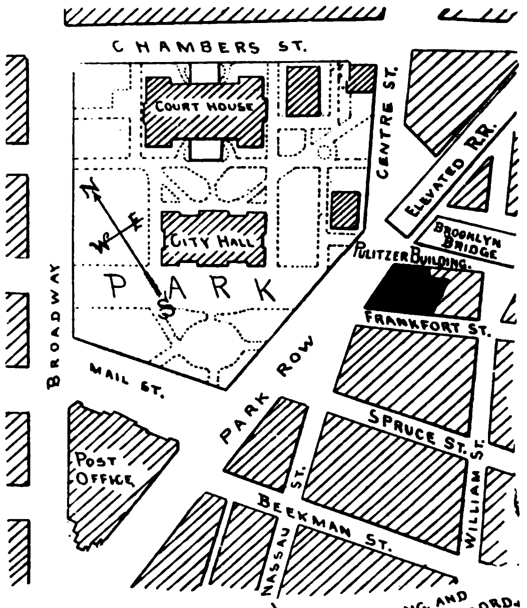
This arrangement, and the pits for the presses made it necessary to lay the foundations 7½ feet below the cellar floor. The cellar has a gallery running through the center for the use of visitors. The walls are wainscoted with glazed tiles, and above they are finished to resemble large blocks of stone. The usual steam and plumbing pipes on the cellar ceiling are omitted, and in their stead a network of overhead tracks is arranged for carrying the rolls of paper to the presses.

The basement story is occupied by the elevator machinery, and the steam and plumbing pipes are placed on this story instead of in the cellar. A large portion is taken up for the storage of roll paper and the wetting machines. There is also a room for the newsboys, and lavatories, baths and toilet rooms, and lockers for the pressmen. The entrance for the employees is on this story on Frankfort Street, with two large elevators running to the top of the building, and an entrance for those employed in the lower part. The stereotype room is located on this story over the boiler-room. This room has an iron floor and a large skylight. Two special elevators deliver the stereotype plates to the press-room. In connection with this are lavatories, bath-rooms and lockers.

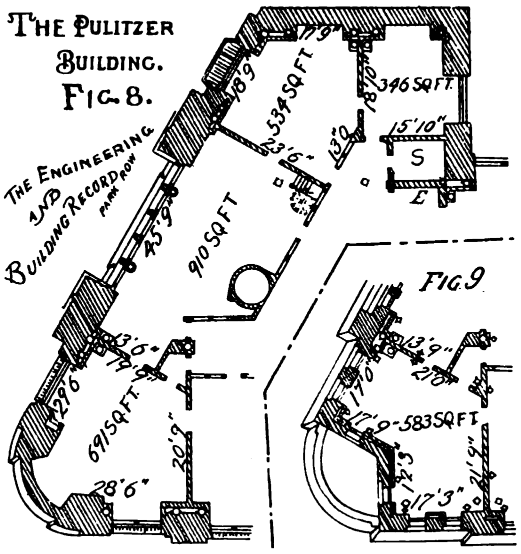
The rear portion of the building, Frankfort Street end, has two stories above the basement. The lower one is used for the delivery of newspapers, and the upper one for bookkeepers' and cashiers' departments. Four elevators carry the printed papers from the press-room to the basement and to the delivery rooms. The ground floor, at the corner, is devoted to the publication office, private offices, counting-room, etc., and is entered from the corner through a large circular vestibule with a grained ceiling, wainscoted with marble. The main entrance to the building is on the Park Row side. The walls are covered with marble. There are also three stores on this floor.

The next eleven stories are exclusively for rental for offices. The story above these is used for the composing room, and is surmounted by a flat roof on which there is a superstructure for the accommodation of the photographers and the photo-engraving department. From a special framework of steel girders in the roof, which are supported on lines of columns down to the ground, is built a steel dome that is essentially a large six-story building, complete in itself. This dome is surmounted by a lantern gallery and flagpole. The top of the dome is 275 feet from the ground. The highest standing room is 280 feet above the ground. The top of the lantern is 300 feet, the top of the flagpole is 340 feet, and the highest office floor 160 feet above the sidewalk. The dome is devoted entirely to Mr. Pulitzer's office, library, and the uses of the editorial staff.

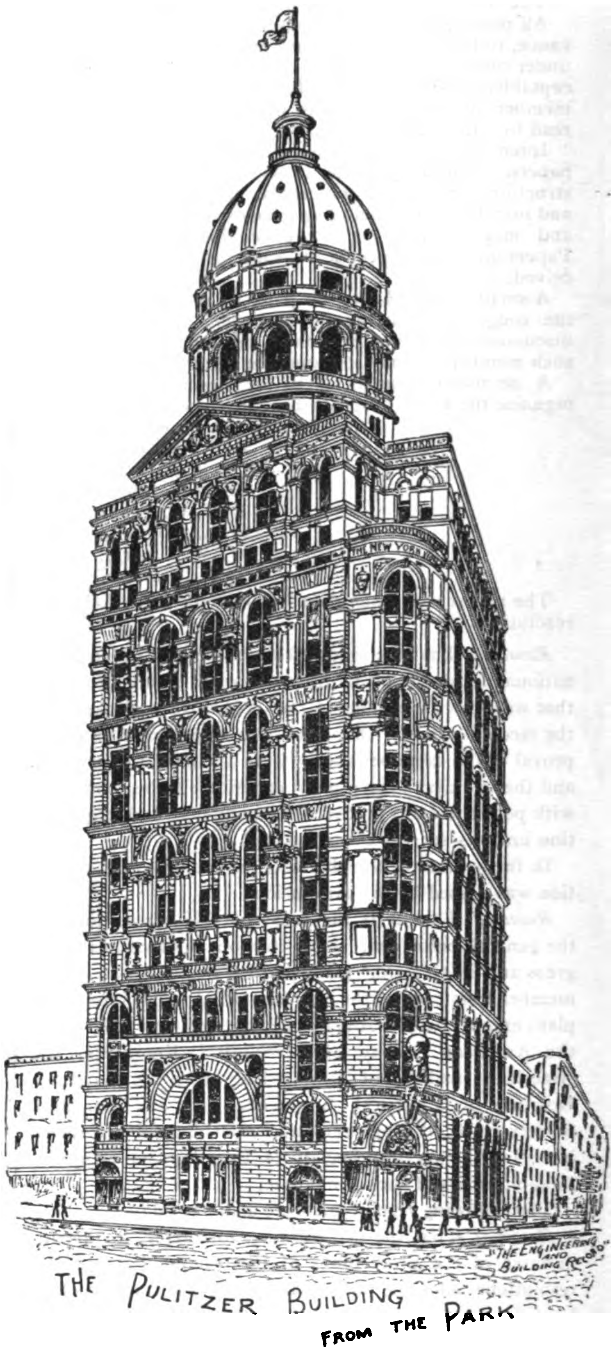
The location of the building, as shown in Fig. 1, is upon one of the most crowded thoroughfares in the world, but though the excavations extended far under the sidewalks, and the hoisting and delivery of materials and the operations of construction were for months going on adjacent to, underneath and above the sidewalks, no accident is known to have been caused to the hundreds of thousands of pedestrians, nor did they even sustain much obstruction or inconvenience. This was due, chiefly, to heavy, raised bridges over the excavations, and solid timber roofs, 4 inches thick, supported on large beams, above these bridges, and serving the double purpose of a roof to shield passers beneath, and of a working platform and storage yard when materials, etc., were received from wagons, and to which they were hoisted as required. This portion of the work was illustrated and described on page 232.



THE PULITZER BUILDING FIG. 1



THE PULITZER BUILDING. FIG. 8.


NEW YORK
THE ENGINEERING AND BUILDING RECORD

THE PULITZER BUILDING FROM THE PARK

The building has a frontage of 115 feet on Park Row, and 136 feet on Frankfort Street. The cellar floor is 28 feet below the sidewalk level, and the flat roof is 191 feet above it. The floors and roof are supported by steel I beams, carried from piers in the cellar by iron Phœnix columns. These are entirely separate from, and independent of, the walls, and were carried up several stories in advance of the masonry.

The roof and floors are of concrete on hollow-brick arches, turned between the lower flanges of the beams. The piers rest on continuous footings of concrete, carried down to a bed of gravel, and for the intermediate piers, connected by inverted arches of cut granite. All partition walls and joining are of hollow brick.

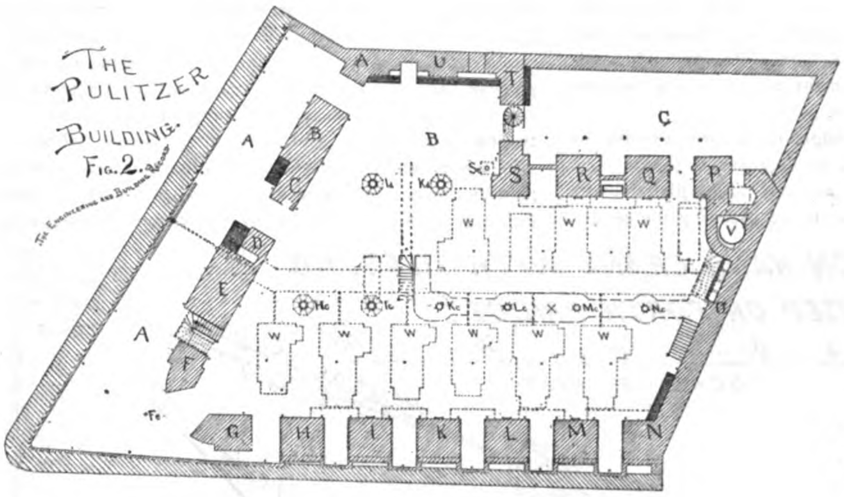
The Park Row façade is studied with a center motive, finished with a pediment at the top, supported on galvano-plastic caryatides, 16 feet high. This center portion is of Corsehill sandstone up to the fourth story above the ground floor, and above that, of buff brick and terra cotta, relieved by polished red granite columns and gray granite panels. The whole is flanged on both sides by stonework carried up to the eleventh story. The Frankfort Street façade is of the same kind of sandstone up to the fourth story, resting on a Quincy granite basement, and the upper portion is of buff brick and terra cotta. On the Park Row front, over the porch, on the fourth story, there will be four torch-bearing figures of heroic size, and the torches will be illuminated by electric light.

The stairs are of iron with Knoxville marble treads. The passenger elevators are of iron within glazed brick walls. In the woodwork finish of the building ash has been employed throughout, except in the publication office where mahogany is used. Office flooring is of Georgia pine placed upon a heavy concrete base. The halls are tiled and the entrances finished in marble. There are 3,500 electric lights throughout the building, ceiling and side lights being placed in each office with gas jets and electric lamps.

The building is heated throughout by direct steam radiators supplied ordinarily with exhaust steam, but having an available supply of live steam. There is pneumatic delivery service between the dome and the basement, and through all the corridors there are telegraph and telephone mains, from which branches lead to all offices and rooms where they are required. There are toilet rooms on every floor and wash-bowls in every office, all arranged in vertical tiers, each served by the same rising pipes. The latter are all carried up in recesses along the outside walls.

There are four paper elevators from the street level to the sub-basement, two employee elevators to the roof, three passenger elevators for office floors to the roof, and one elevator to the top of the dome. There are two Cutler U. S. mail chutes from the top story of the dome to the ground floor. As the building itself is incombustible, no fire escapes are provided other than are afforded by the wide central stairways.

The principal contractors were: R. L. Darragh, mason work; J. B. & J. M. Cornell, iron work; Perth Amboy Terra Cotta Company, terra cotta work; J. J. Spurr & Sons, cut stone work; Philip Herrman's Sons, carpenter work; Poulson & Eger, caryatides, staircases, ornamental iron work and copper dome; J. A. Rossman, plumbing and gas fitting work; Otis Bros. & Co., elevators; Batterson, See & Eisele, marble work; Baker, Smith & Co., steam heating and ventilating; U. S. Electric Light Company, electric light plant; Miller & Coates, glazed tiling; Cutler Manufacturing Company, mail chutes; Nicholson & Galloway, roofing and flashings; Pirsson & Renwick, granite work.


The Pulitzer Building. Fig. 2.
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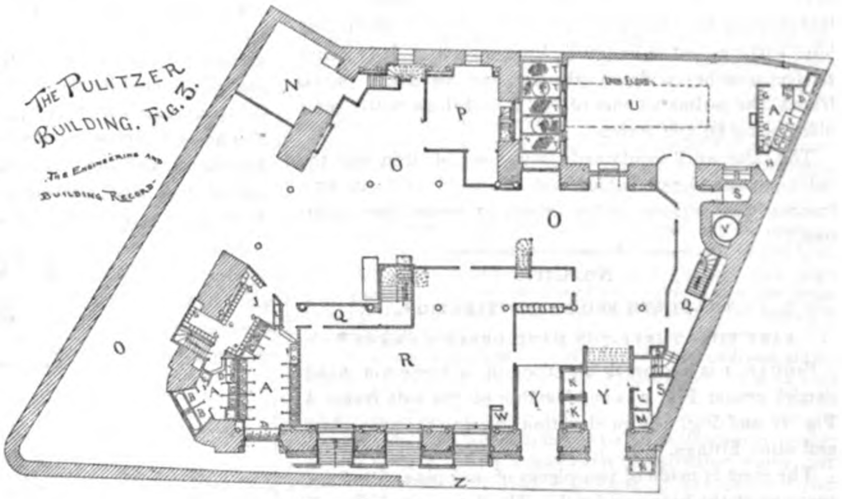
The Pulitzer Building. Fig. 3.
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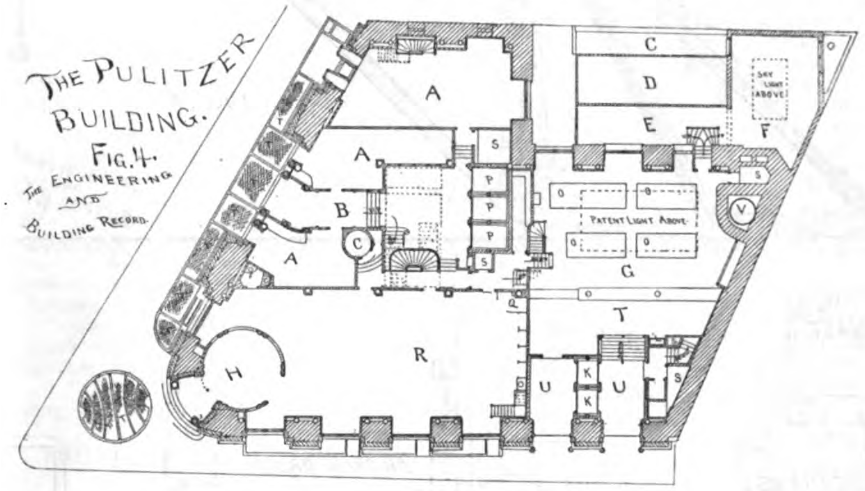
The Pulitzer Building. Fig. 4.
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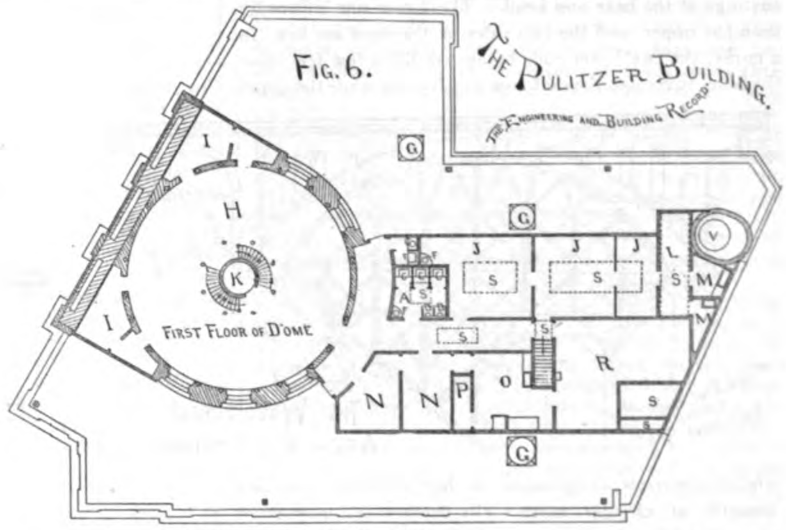


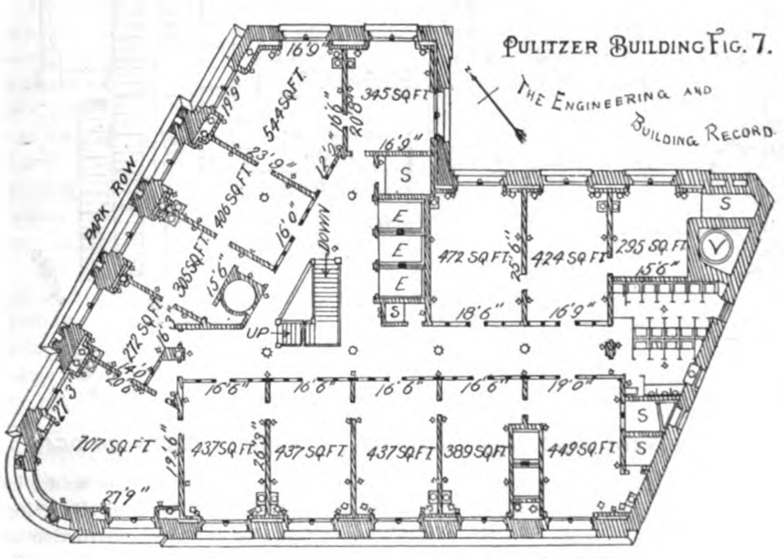


Fig. 5.

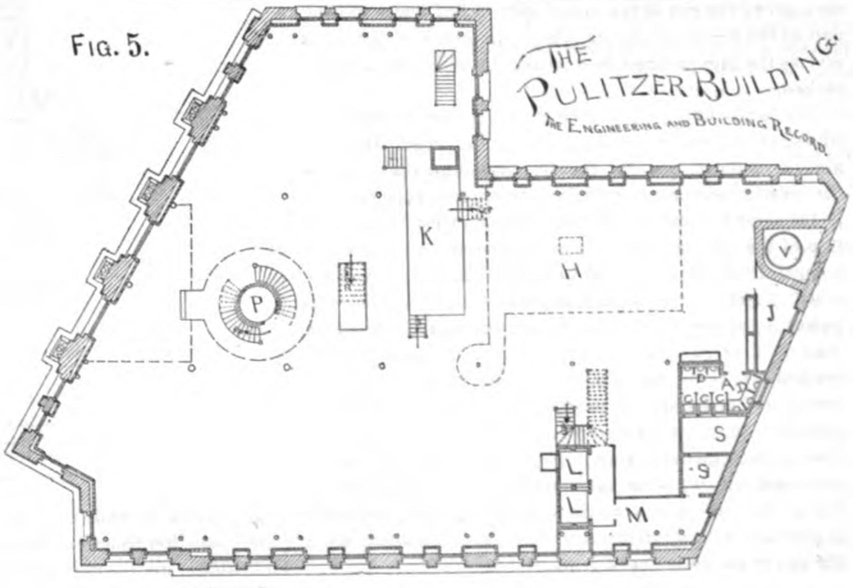


Figure 2 is a plan of the cellar; A A is the dynamo room; B is the engine room; C is the boiler room; V is the smoke-stack; W W, etc., are pits for the presses, and X is the visitors' gallery.

Figure 3 is a plan of the basement floor. A A are toilet-rooms; B B, bath-rooms; C C, etc., water-closets; D D, etc., urinals; E is a shower-bath; F F are wash-basins; G G are wardrobe cupboards; H is a storage closet; J is the pressmen's dressing room; I I, etc., are paper elevators; K K are compositors' elevators to twelfth story; L is a watchman's room; M is a tank room; S S are air and machine shafts; T T are patent illuminating tiles with ventilators; U is the stereotype room; and V is the chimney stack; O O is paper storage room; N is a store cellar; P is the machinists' room; Q Q are passageways; R is the newsboys' room; Y Y are driveways from the street; N is an iron door; W is the cashier's office; Z is the entrance down from Frankfort Street.

Figure 4 is a plan of the ground floor. A A A are stores for rental; B is the main entrance hall; S S, etc., are shafts; P P P are passenger elevators to the office floors; C is a roof, and D a skylight over the stereotyping room; E is the mailing room; F is the job room; G is the distributing and shipping room; O O, etc., are tables; V is the smoke-stack; C is the elevator to the dome; R is the counting room; H the rotunda; Q a telephone closet; U U are the street driveways to basement floor; T is a lobby; L is a sink.

Figure 5 is a plan of the twelfth story, which is devoted to the compositors' use. K is a bulkhead over the office floor elevators; P is the dome elevator; H is an elevated platform for clerks, telegraphers, etc.; J is an office; M the foreman's room; L L are compositors' elevators; S S are shafts; V is the smoke stack; A is a toilet room; C C are water-closets; D, urinals.

Figure 6 is a plan of the roof houses. S S, etc., are skylights; A is a toilet room; C C, water-closets; D D, urinals; F F, basins; J J J, engraving rooms; L, photograph room; M M, photographers' dark closets; R dining room; N N, private dining rooms; O, kitchen pantry; G G G, ventilators; H, editorial headquarters; K, elevator well; I I, closets.

Figure 7 is a plan of the ninth story. Its general arrangement is the same as that of all the other office floors, except that the rest have smaller toilet rooms, and that the arrangement of the rooms in the Park Row and Frankfort Street corner is modified in the first and eleventh office floors, as shown in Figs. 8 and 9, respectively. The eleven office floors contain altogether 150 offices.

(To be continued.)

A REMARKABLE CANAL.

The most remarkable canal in the world is said to be the one between Worsley and St. Helens, in North England. It is sixteen miles long and underground from end to end. Many years ago the managers of the Duke of Bridgewater's estates thought they could save money by transporting the coal underground instead of on the surface; therefore the canal was constructed, and the mines connected and drained at the same time. Ordinary canal-boats are used, the power being furnished by men. The tunnel arch over the canal is provided with cross pieces, and the men who do the work of propulsion lie on their backs on the loads of coal, and push with their feet against the cross bars of the roof.

BUILDERS' AND CONTRACTORS' ENGINEERING AND PLANT.

No. CII.

(Continued from page 329.)

THE WALDITOBEL ARCH CENTERING.

THE illustration of this false work is prepared from an article in the Paris *Annales des Ponts et Chaussees*, on the Arlberg Railroad, and requires little explanation.

The square panels of false work are 16.4 feet high and 16.4 feet wide. The opening, A, is of nearly 50 feet span, and the timber corresponds nearly to the following dimensions in inches: B, 8x9 inches; C, 10x12 inches; D, 6x12 inches; E, 8x10 inches, and F, 6x8 inches. The bridge is made of large, quarry-faced stone, with dressed joint surfaces, set in hydraulic lime mortar. It is about 14 feet 9 inches wide at the top, and cost about 76,000 francs, the estimated cost of an iron bridge at the same place being 66,500 francs.

The false work contained four tons of iron and 180 cubic meters (6,358 cubic feet) of wood, and cost 17.8 frances per square meter (about 33 cents—per square foot.)

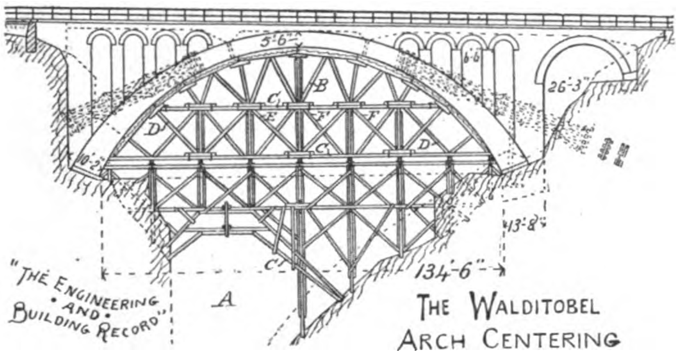
No. CIII.

THE FORTH BRIDGE CONSTRUCTION.

PART VII.—THREE-TON HAND-DERRICK CRANE.*

FIGURE 1 is a general elevation of a three-ton hand-derrick crane; Fig. 2 is an elevation of the side frame A, Fig. 1; and Fig. 3 is an elevation showing the gear wheels and other fittings.

The mast is made of two pieces of red pine, fitted into castings at the base and head. The lower one is broader than the upper, and the two sides of the mast are bent in a curve, the two lower ends being parallel a few feet from the base, to receive the cast-iron side frames, while the upper end is as narrow as possible, so that, with the necessary amount of circular motion, the back stays may come straight to the pin at the mast-head. The lower casting carries the center pivot, on which the crane revolves, as well as the lugs and cast-iron sockets by which the jib is attached.



THE WALDITOBEL ARCH CENTERING

The head casting carries the upper center, to which the iron straps connecting the back stays are attached. It carries also two pulleys, one for the jib chain and the other for the hoisting wire rope or chain. In order to keep the load at the same vertical height for any alteration in the position of the jib, the hoist chain is wound on a fusee, or conical drum, the thick end of which takes on the chain, when the jib is at its highest position. By this means less power is required to handle the jib, for, as it is raised the load is lowered and *vice versa*. At the same time the vertical height of the load is not altered in reducing or increasing its distance from the crane center. This compensation does not take place if the crane is worked by a steam winch through a hollow pivot, and the jib is the more difficult to handle in consequence, the load and jib being lifted or lowered at the same time. The jib barrel is provided with a ratchet and pawl, which holds it when the power clutch is not in gear.

The crane illustrated is provided with two safeguards against the falling of the jib when it is being neither raised nor lowered. These, by experience, have proved to be necessary, owing to the careless dropping in of the pawl. The additional safeguard is provided by the wheel, which, when not drawn forward by the lever and thrown into gear with the wheel on the hoisting shaft, slips over a projection cast on the side frame. This, passing between the arms, prevents any motion of the jib drum. By lifting the small weighted catch C, and moving the crank shaft longitudinally, the crane can be worked in single, quick, or double slow speed gear, or withdrawn entirely, to lower by the brake. The pinion on the crank shaft has 11 teeth, 1¼-inch pitch, gearing, when in double purchase, into a wheel having 48 teeth, 1¼-inch pitch, to the side of which is cast a pinion with 11 teeth, 1¼-inch pitch, keyed on the counter shaft. This pinion gears into the wheel on the main barrel shaft, having 76 teeth of 1¼-inch pitch.

The sliding wheel on the jib chain drum has 60 teeth of 1¼-inch pitch, gearing into a wheel on the drum shaft, having 76 teeth of 1¼-inch pitch. The horizontal legs are attached by straps to the base plate, and when the crane is erected lie at about right angles to one another. They are 24'8"x8"x7" red pine.

The back straps are at an angle of 45 degrees with the horizontal, and are fastened by bent straps to the horizontal legs and mast-head casting. The jibs, usually from 45 to 55 feet long, are 12 by 12 inches at the center, tapering at the ends to 8 by 8 inches, where they are fitted into cast-iron shoes or sockets, the lower one grasping the horizontal pin through the lugs on the casting at the mast base. The jib head casting carries a wheel, varying in diameter, according to whether the crane is used with wire rope or chain, and a boss on its under side, through which passes a pin, carrying the shackle supporting the jib.

3 TON HAND CRANE WITH 50 FT. JIB USED ON FORTH BRIDGE.

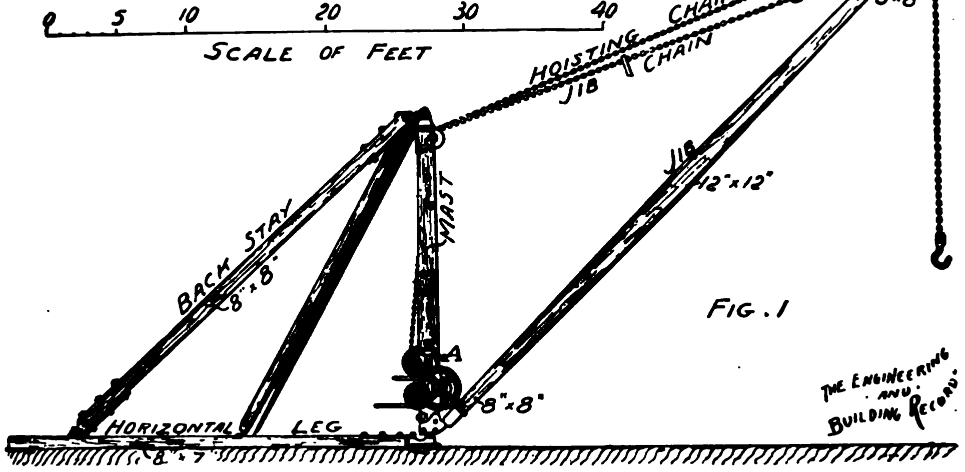


FIG. 1

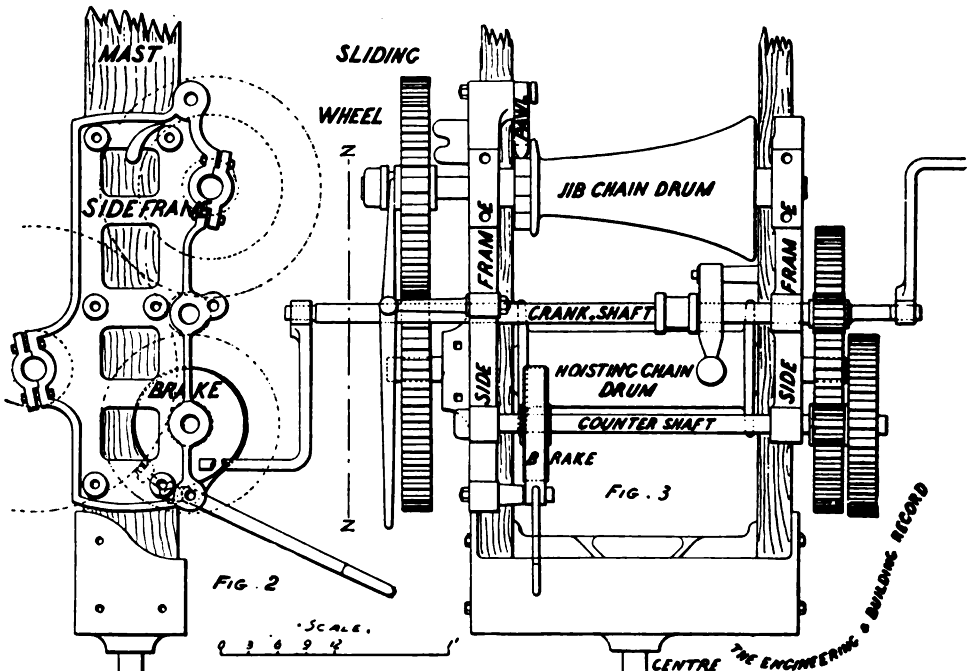


FIG. 2

FIG. 3

GEARING OF 3 TON HAND CRANE USED ON FORTH BRIDGE.

(TO BE CONTINUED.)

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[*] Part I., Tube Riveting Machines was published October 22, 1877; Part II., Material Lock in the Pneumatic Caissons, December 3, 1887; Part III., Oil Rivet Furnace, April 21, 1888; Part IV., 70-Foot Caissons, June 9, 1888; Part V., Hydraulic Spade, June 30, 1888; Part VI., Launching the 70-Foot Caissons, September 6, 1890.

A CABLE rack railroad is to be built at Prague, Austro-Hungary. In virtue of the contract entered into the municipality of Prague is to commence building the road at once, to complete and give it over to traffic within one year, and to operate it for a period of 75 years.

WATER POWER FOR AUSTIN, TEX.

THE continuous advance of the "New South" in industrial pursuits is illustrated by the movement to secure for the city of Austin, the capital of Texas, not only an efficient system of water-works and electric lighting, but also an abundant water power for manufacturing purposes.

The project, which bids fair to make a manufacturing center of the capital, having at present some 20,00 inhabitants, including the suburbs, is outlined in a report* by Mr. Joseph P. Frizell, M. Am. Soc. C. E., to the city authorities.

The city is at present supplied with water upon the so-called Holly system; but it is outgrowing the size of its pipes, and it is becoming difficult for the pumps to maintain a sufficient pressure for domestic service in the remote parts of the system, on account of the friction due to the small size of the mains, and the supply for proper fire protection is becoming still more precarious. "There is also a very wide impression prevailing that the amount paid by the city for water rates, fire service and electric lighting, is sufficient to supply the city on a much more ample and liberal scale, and at the same time secure incidental advantages of great value." The project developed in Mr. Frizell's report provides for the construction of a dam on the Colorado River, by which power would be obtained, not only for pumping the needed water supply into a reservoir at sufficient height to maintain a fire pressure on the pipes, but also to furnish power for electric lighting and for propelling street cars, and to give a large surplus that would be available for mill powers. The proposed dam, located about two miles from the city, will be of stone and have a height of 60 feet above low-water level (about 68 feet above bed-rock), a length on crest of

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[*] Report of Joseph P. Frizell, Civil Engineer, on the proposed dam and water-works for the city of Austin, Tex., and report of Consulting Engineer.

1,150 feet, a top thickness of 16 feet, and will spread out on its lower face in a broad toe or apron, so as to give a horizontal direction to the overflowing water and thus have a bottom thickness of about 50 feet. It is expected that in time of flood 16 feet of water may pass over the crest of the dam.

A reservoir will be constructed 320 feet above low-water level in the river, or 260 feet above crest of dam, and 140 feet above the highest occupied ground in the city, with a capacity of 37,000,000 gallons—half of which only it is proposed to construct at first. A clear spring on the river bank, within 2,000 feet of the pumps, and with a daily flow of 4,000,000 gallons, will furnish an abundant supply of water for domestic consumption for some time to come. Mr. Frizell estimates the ordinary low-water flow of the river at 1,000 cubic feet per second, which would give a continuous net power, delivered from the water wheels, of 5,227 horse-power. By using flash boards to retain the night and Sunday flow (the reservoir behind the dam having a length of from 30 to 35 miles, and an area of about 8 square miles), there would be available for a day of 10 hours, 14,636 horse-power, about one-third more than the permanent power of the Merrimac River at either Lowell or Lawrence, Mass. Reserving 600 horse-power for pumping 5,000,000 gallons daily, and 600 horse-power more for electric light and water-power, there would remain over 13,000 horse-power available for general manufacturing purposes. The estimated cost, including dam and gate house, head race, pump house and plant, reservoir, mains and distribution system, and system of electric lighting, is $1,362,781.

A report by Mr. John Bogart, Secretary Am. Soc. C. E., who was engaged as consulting engineer, is appended. He approves of Mr. Frizell's plans, and of the site selected for the dam, and gives it as his opinion that the dam can be constructed within the estimates given. He sums up the advantages of the project as follows:

"The result of the construction of the proposed dam, with its ponds of pure water, covering some eight square miles, will, in my opinion, be:

"*First.*—The provision to the city, for all future time, of a supply of excellent water in such quantities that it can be used not only for drinking purposes and for safety from conflagrations, but also can be, with considerable profitable return, sold for light power, as for electric light, elevators, etc.

"*Second.*—A lake of pure water, some 30 miles in length and of variable width. This will be a most valuable addition to the attractive features of the city.

"*Third.*—The provision of a water power which will bring great manufactories to the city."

FOUNDATIONS FOR THE CITY HALL, AT KANSAS CITY, MO.

IN a paper on the above subject, read at the Washington meeting of the American Institute of Architects last week, Mr. S. E. Chamberlain explained that the site selected for the city hall was the Market Square, which, a few years ago, consisted of a ravine running diagonally and on both sides of which were abrupt bluffs and hills. Later, the bluffs were cut away and the ravines filled up, making, to the casual observer, a nice plot of ground, but with a fill of 50 feet under about two thirds of the building, and a solid clay bank under the remaining third.

The "fill" was made at different periods with rubbish of all kinds, tin cans, rock, etc., and for some time the ravine at this point was used as a "public dump," making altogether a most unsatisfactory site on which to erect a large building.

The question of foundation for the proposed building was discussed, and the Board finally authorized Mr. Chamberlain to develop some tangible method that would not bankrupt the city nor endanger adjoining property. Piles were generally suggested, but in his judgment that system would be bad in that particular location, owing to the dryness of the earth in the fill and the tendency of piles to dry-rot in such soil. A trench dug in the conventional manner would not only have been very expensive but dangerous.

Mr. Chamberlain finally concluded that a system of piers for the whole substructure would solve the problem, but in this also to dig square holes, or pits, and crib the excavation would have been expensive and dangerous. The cylindrical form of piers was finally adopted, and they were made of uniform size so that the excavation could be done with a large auger operated by steam power and a $\frac{3}{16}$-inch caisson could be made to follow the auger.

This much being decided upon the question of material was taken up. Concrete was the first to suggest itself, but vitrified brick was finally adopted as the materials best suited for the filling of the caissons. These brick singly in a testing machine withstood a pressure of 135 to 140 tons before fracture. The piers are 4 feet 6 inches in diameter, laid in hydraulic cement mortar and grouted solid in each course and well bonded in all directions across. They are sunk to rock-bed of oolite limestone, about 3 feet in thickness, and are capped with cast iron webbed plates on which rests steel I beams all bolted together with standard connections and separators, and the interstices between the beams and the excavation of one foot each side, and one foot under the beams and caps are filled with concrete. The upper surface is capped with boiler plate ¼ inch thick bolted to flanges of beams. On this surface the walls of the building are started. The piers under the north wing, tower and smoke stack, and on each side of the main structure (having excessive weight in addition to the ordinary loads imposed on them) are reinforced by 12-inch "Z" bar columns, which also rest on the rock bottom.

The main principle of the system is the subdivision of the weight, each subdivision being carried by an isolated pier capable of sustaining its own individual load. By making these piers of uniform size the load superimposed on each is made about equal by locating them at a greater or less distance apart.

BROAD-TIRED WHEELS FOR COUNTRY ROADS.

UPON this subject the Scranton, Pa., *Truth* publishes the following:

"In the matter of road building the question of wagons and other vehicular arrangements should be considered. A tired wheel but an inch in width, loaded heavily, will do more damage to a wagon-way than one with the same load tired three inches wide.

"It is a fact that the width of the tire has much to do with the excellence of road beds. This is at present illustrated by the street roller operated by the paving company on our streets. What would a narrow tire effect in leveling the streets? Simply destruction of the streets.

"A heavily-loaded wagon with narrow tires soon ruins the road, and cuts deep ruts. Beside the continual expense of repairing such damages, the wear and tear on the horses and vehicles is great. Upon a smoothly paved street, of course, a narrow-rimmed wheel is all right. But take cobblestone, or wood block, or an earth road, a wide-tired wheel can do more to preserve a good road-bed and a plain, unimproved thoroughfare than anything else. A wide-tired wheel would pound down a good road instead of tearing it up and wearing it full of ruts, and it would not be nearly so tiresome to the horses.

"This is a matter that demands more attention than it has received. Vehicles as well as road-beds should be considered.

"In England the road tax is levied according to the width of the tire, varying from a merely nominal assessment for a wide tire to a heavy tax for a narrow one. It is a wonder that teamsters have not earlier considered this subject, one which must redound to their profit as well as to their comfort."

In a pamphlet on "The Repair and Maintenance of Roads," by W. H. Wheeler, M. Inst. C. E., issued by the Roads Improvement Association, of London, Eng., the author, speaking of the proper width of wheels, says:

"The following proportions have been recommended: ½ to ¾ ton on each wheel, tire 3 inches wide if without springs, 1 inch with springs; ¾ to 1 ton, 4 or 3 inches; 1 to 1½ tons, 6 or 4 inches. A clause proposed to be inserted in any new highway act, that may be passed, requires that all carts weighing over 672 pounds should have wheels of not less than 4 inches width, and vehicles drawn by more than three horses should have wheels of not less than 6 inches width. Wheels of a large dimension do less harm to a road than small ones. Stones will be pushed and moved out of place by the small fore wheels of a wagon, while the larger hind wheels will pass over without displacing them. Large and broad wheels not only do less harm to the roads, but cause less draught for the horses."

In this connection, Mr. W. N. Sweet's suggestion, given in THE ENGINEERING AND BUILDING RECORD for February 9, 1889, will bear repetition. Mr. Sweet there says that all two-horse farm wagons, and others carrying over one ton, should not only be required by law to have their tires 4 inches wide, but that the gauge of the hind wheels should be made 8 inches more than that of the fore wheels, thus diminishing materially the tendency to cut the roads into ruts.

A 1,000-LAMP electric light plant at Gastein, Germany, is operated by power derived from a 120 horse-power turbine, run by the Wildbach waterfall.

WATER HAMMER IN MAIN PIPES.

IN discussing the effects of water hammer on main pipes at the Portland, Me., meeting of the New England Water Works Association, Mr. George A. Stacey, Superintendent of the Marlborough, Mass., Water-Works, said:

"I think the danger from water hammer is something that pertains to the length of the pipe, and the velocity of the water through it. If you take a hydrant right off a large main, and you suddenly shut it, you are only arresting what water is coming from the main into the pipe. If you are running a 6-inch pipe down a mile, and you open the hydrant wide on that end and then shut it down suddenly, you will find you are going to pack the water much tighter than if there was only 12 feet of pipe. I tried an experiment once on 400 or 500 feet of 6-inch pipe, and in shutting the hydrant down from 97 pounds I could very easily get 200. We tried it, also, with shut-off nozzles, and we could get 140 pounds pressure there; it went from 97 to 140 the slowest way we could close the nozzle. Of course we had the elasticity of the hose to take up some of the shock. Up on the main street under the same conditions we wouldn't have got over 15 pounds additional pressure. So I think the danger from water hammer, with the thickness we allow for pipe now, is almost wholly on a long main where the outlet is sufficient to create a high velocity, and when the flow of the water is suddenly arrested. But with any ordinary gate, unless you work pretty quick, I think you would very seldom run the pressure up to the point that the pipe is tested at before it leaves the foundry."

Mr. Clark remarked: "We supply four railroad standpipes. Formerly we had two breaks, one on a 12-inch pipe and one on a 4-inch pipe, on account of the sudden shutting off of the water; but we have an arrangement at the present time which relieves us from the apprehension of any danger. It is a peculiarly constructed valve, partially automatic, so that a plunger in the cylinder rises up with the supply of the water. This plunger is perforated, and the perforations are, perhaps, half an inch in diameter, or smaller than that, making bare one hole after another till it is all open. It takes about three minutes to open it and three minutes to shut it. Since we have had this arrangement, the device of one of our Water Commissioners, we have had no trouble, except in this way, that there is a reduction of the pressure whenever the railroad is taking water. Two years ago, one Sunday, the motors in two of the churches were stopped by the pressure being reduced from 85 pounds down to 50 pounds. There doesn't seem to be any particular shock. I expected there would be a rupture of some of the joints, but the arrangement seems to work satisfactorily."

Mr. B. F. Steben, Manager, Brockville, Can., Water-works, said: "I don't know that any one has had much more trouble than we have had at Brockville, Ontario. We have been supplying the Grand Trunk for five years. They used to take it direct by opening a 6-inch valve, and every time they shut off so quickly our pumps would come almost to a standstill. So I advised our company to put up a tank; but they thought they wouldn't like to do it, they didn't care to spend any money on it. But, finally, about six months ago, the back pressure was so great one day that it broke one of the foundation stones of the engine in the engine-house. You can imagine what a back pressure there was. I told the directors they had better do something at once, or else there would be a very serious result. At last they let me put up a tank that holds 20,000 gallons. It is fed with a 2-inch pipe with a self-acting valve on top, and now the railroad company takes all its water from the tank, and we haven't had any trouble. It works most satisfactorily. The tank is 14x15 feet, and cost $500.

AN ENGLISH WAVE MOTOR.

ENGLISH papers recently described a wave motor designed by A. A. Clarke, of Hackney Road, London, and a working model of which is in operation on the Thames. The designer proposes to apply his system to purposes of ventilation.

The apparatus consists of a floating pontoon, moored so as to rise and fall with the tide, and to the side of which are attached, a little above the line of flotation, open-bottomed cylinders. Each cylinder, at the upper part of its chamber, is provided with two tubes, each fitted with a valve, one with an inlet valve and the other with an outlet valve. The bottom part of the cylinder being open, the waves surge into the cylinder, and force the contained air into and through the inlet valve and tube to be utilized for whatever purpose required, but in the tube fitted with an outlet valve the air is prevented by the closing of the valve from passing onward. On the waves receding and passing away out of the cylinder, the inlet valve is closed, and the air in the outlet tube is forced through the outlet valve into the cylinder to replace the subsiding water. This operation is repeated with each successive action of the waves.

AT a meeting, a short time ago, of the Scientific Association of Meriden, Conn., the sewerage question was discussed at some length. Several papers on the subject were presented.

Correspondence.

Communications giving information or opinions on matters of general interest to the engineer, the architect, the contractor, or the municipal officer, will be welcomed in this column. Fairness will suggest that when communications are sent simultaneously to this and other journals we should be informed of it at the time. Anonymous letters will not be noticed.

WATER WASTE.

ARTESIAN WATER COMPANY,
MEMPHIS, TENN., October 24, 1890.

To the Editor of THE ENGINEERING AND BUILDING RECORD:

SIR: I take the liberty of contributing a few of my humble ideas on some of the questions discussed at the last meeting of the American Water-Works Association, held at Chicago last May.

The question of waste of water has been up at every meeting, and, in my judgment, is one of vital importance to all water companies, both those owned and controlled by municipal government and by private parties. The popular idea that water is as free as air has long since been exploded. We all know, especially those who manage water-works, that every drop of water represents so much cash, although in some rare instances water is obtained from a source that requires no pumping machinery. Still, reservoirs and pipe systems have to be erected and maintained.

Water rates are generally based upon the cost of delivery to consumer, with a reasonable profit to pay an interest upon the investment and cost of management of the plant, and calculations are not made for anything but a legitimate use of the water. Very few cities can, with justice, quote other places as showing that the rates should be changed. There are some places, take "Colorado Springs, Col.," for example, where nothing is necessary but to dam the melted ice, which flows down from the grand old mountain, Pike's Peak, at a height sufficient to give the head desired, and run a main to the city. No machinery is necessary, and but few employees needed to operate the works. Water can be sold at such a place for a small sum. And yet, even there, the habit of allowing same to run to waste is a bad one; for, like everything else in this life, it is much more difficult to correct a bad habit than to acquire one. I am of the opinion that the increase in the demand for more pumping machinery and larger mains in some of our cities is not entirely due to the new uses to which water and water power has been applied, but, in a great measure, to the carelessness engendered by the apparently unlimited supply at hand, and to the fact that it is so easy to leave a faucet running. I may be mistaken, yet am of the impression that two-thirds of the water pumped in our large cities is wasted, and that, even allowing a lavish use for all legitimate purposes, and no waste, few of our cities would find that their machinery and mains were not ample for years to come.

The answer that the introduction of water meters is the remedy, is a good one for *some* classes of consumers, but, I think that for domestic purposes, the privilege of having the supply so convenient to the fixture is to be counted and paid for. Works operated by the city government are not to be made an exception, for the taxpayer is called upon to supply any deficiency in the budget for cost and care of water-works, in addition to rates paid for water. I do not think that the general public have had this matter sufficiently brought to their notice, and consider the majority of our people too honest to knowingly waste or throw away other people's property, as they do, when they tell their servant "Gallagher" to turn her on and "let-ter go," to prevent freezing.

W. L. CAMERON, Supt.

NOMENCLATURE OF CEMENTS.

UNIVERSITY OF ILLINOIS,
DEPARTMENT OF CIVIL ENGINEERING,
CHAMPAIGN, ILL., October 18, 1890.

To the Editor of THE ENGINEERING AND BUILDING RECORD:

SIR: In your issue of October 11, page 299, a correspondent protests against my nomenclature of hydraulic cements. It is a matter of small moment whether others agree with me in this matter, but it is very desirable that there should be more uniformity in the designation of that hydraulic cement which is not Portland. Therefore I ask the use of your columns for a few remarks on the nomenclature of cements, more particularly in answer to your correspondent.

Hydraulic cements may be divided into three classes—viz., Portland, Rosendale, and Pozzuolana. The first two differ from the third in that the ingredients of which the former are composed must be roasted before they acquire the property of hardening under water, while the ingredients of the latter need only to be mixed with water to a paste. The first two classes include the ordinary hydraulic cements, and the third includes the only cements which can properly be called natural cements The first—Portland—differs from the second—Rosendale—in being heavier, slower setting, and obtaining greater ultimate strength. It is the use of the word Rosendale to designate the second class of cements to which your correspondent objects.

Pozzuolana cement is so called from Pozzuoli, Italy, near which place the ingredients of which it is composed were first found. Portland cement derives its name from the resemblance which hardened mortar made of it bears to a stone found in the Isle of Portland, off the south coast of England. There is a great diversity, and some confusion, in the names employed to designate that cement which above is called Rosendale. The terms "natural," "American," "domestic," and "Rosendale" are frequently thus used. The writer proposed, in public print some two or three years ago, to call this cement Rosendale, from the place—Rosendale, Ulster County, N. Y.—where it was first made. With this use of the word Rosendale, cement made in Ulster County, N. Y., would be called Ulster County Rosendale, and that made at Louisville would be called Louisville Rosendale, etc.

In Europe the term Roman cement is employed to designate a cement of about the same character as Rosendale, apparently the only difference being that the former is made from an argillaceous limestone, and the latter from a magnesium limestone. Roman cement is but little used even in Europe, and is not imported. It was first known as Parker's, and was afterwards called Roman, probably on the supposition, or to convey the impression, that it was the cement employed by the early Romans, although it is in no way similar to that cement, which was a true natural cement—*i. e.*, Pozzuolana, as described above.

Your correspondent says: "By long custom the name Portland cement has come to mean any artificial cement, and is firmly fixed in this meaning in literature and in the minds of engineers." There is a so-called artificial Portland cement and also a natural Portland; but, if I am not greatly mistaken, the term Portland is employed to designate a heavy, slow-setting, strong cement, regardless of whether the materials are found combined in the proper proportions naturally, or whether the ingredients must be mixed artificially. Undoubtedly, most of those who use or prescribe Portland cement neither know nor care whether it is "natural" or "artificial" Portland. Of late years the manufacture of Portland cement has been commenced at a number of places in this country. Does your correspondent know whether the ingredients are found already mixed in their proper proportions, or whether they must be mixed artificially?

Your correspondent says that "the most appropriate name for a class of cements the material for which is found in nature ready for manufacture is 'natural cement.'" The term does not seem appropriate. In the first place, any cement which requires roasting before developing the property of hydraulicity, cannot, properly speaking, be called a natural cement, particularly when there are several substances which possess this property without roasting. In the second place, it is doubtful whether there is any cement on the market the ingredients of which are found mixed naturally. One of the marked characteristics of the impure limestones from which any grade of cement is made is a wide variation in composition and position, these variations frequently, and even generally, occurring within very short distances. Probably all the manufacturers of the so-called "natural" cement carefully select the rock from certain strata and exclude that from others, or equally carefully mix different proportions of the rock from different strata. This is certainly done by some manufacturers of "natural" cement. Some of the best of the so-called natural cements are made by combining the different ingredients in the proportions indicated by chemical analysis. In other words, the materials are combined artificially, and, therefore, such a cement is artificial, and, according to the argument of your correspondent, should be called Portland.

The names "American" and "Domestic" are inappropriate to designate the cement under consideration, since both Portland and Rosendale are manufactured in all portions of the country. Your correspondent suggests the names Roman, or Boulogne, as being preferable to Rosendale. The first is the better, since the latter refers to a Portland cement, even though it may not now be on the market. The introduction of an entirely new name, as Roman, would make more confusion than to extend the field now covered by the name Rosendale. According to the U. S. Bureau of Statistics, 40 to 50 per cent. of all the cement of the Rosendale type used in the United States, comes from Ulster County, N. Y., all of which is universally called Rosendale, even though only part of it comes from the village of Rosendale. The appropriateness of the name is shown further by the fact that the natural bed of limestones from which the original Rosendale is made, covers about one-third the State of New York, and the western part of Vermont, besides extending in a belt through New Jersey, Pennsylvania, Maryland, Virginia, and East Tennessee.

Your correspondent intimates that the writer's use of the term Rosendale leads to "confusion, or want of meaning," because this class of cements vary greatly in activity. If we follow your correspondent and call it natural cement, will the variation be any less?

IRA O. BAKER.

ACCORDING to the Los Angeles, Cal., *Mirror*, W. T. Spilman, who built the Los Angeles and Pacific Railroad, has secured a large contract from Barber & Co. Mr. Spilman will build a dam in the San Fernando Valley, near Santa Susanna Pass, 50 feet high, which will make a reservoir with a water surface of 130 acres. This dam is being built in connection with one already constructed higher up in the same cañon. The object is to have two reservoirs, one of which will be a storage reservoir and catch the surplus water from the higher one. These two reservoirs will furnish water with which 25,000 acres of land can be irrigated.

Novelties.

Devices are described under this head purely and strictly as news; because believed to be new and calculated to interest readers.

In no case is pay accepted, directly or indirectly, for publishing a novelty notice.

As the subjects are selected for their supposed novelty and interest merely, it will, of course, be understood that the selection does not imply indorsement.

ELECTRIC ELEVATORS AND HOISTS.

THE American Electric Elevator Company, 15 Cortlandt Street, New York, are putting on the market an electric elevator outfit, electric pumps and an electric dock hoist. Of two of these specialties illustrations are given on page 347.

Compactness is one of the important claims made for the elevator combination. The average size of the electric outfit is claimed to be such as to occupy a floor space of but 6 by 4 feet, and a height of about 4 feet. Owing to the small space occupied and the absence of vibration, the machine can be placed at the top of the elevator shaft, so that it is entirely out of the way, occupying no space which is of value for other purposes. When the machine is so placed, the car is lifted direct from the drum, no sheaves being required. This necessitates a specially grooved drum so made that as the lifting cable winds and unwinds on the drum the pull on the car is always in a vertical line.

The outfit consists of the electric motor, worm geart drum, reversing switch and rheostat combined, automatic electric brake and automatic stop device for stopping the elevator at the top or bottom of the lift, thus making it impossible for the elevator car to travel too far in either direction. The armature shaft of the motor is coupled direct to a worm shaft, and this coupling is also a brake wheel, to which the brake is applied automatically when the current is cut off, and thus not only serves the purpose of overcoming the momentum of the armature when stopping, but also serves to hold the car stationary, if, through accident at the generating station or from any other cause, the current should be cut off. The worm actuates a worm gear which is attached to the drum shaft. On the drum shaft, but not attached to it, is the wheel to which is attached the operating rope, the movement of which starts, reverses or stops the car at the will of the operator. The end of the drum shaft has a screw thread, and on it travels back and forth a nut which has wings, and which, when it meets with any obstruction, turns with the drum shaft, and is so attached to the operating wheel by means of the wings that it turns the wheel just enough to stop the motor. The necessary obstructions to the travel of the nut are in the form of collars, which are fastened to the shaft at just the right place to stop the machine at the top and bottom of the lift. The whole is assembled on one bed-plate.

There is claimed to be none of the noise and disagreeable jerking of the car noticed with some of the belt and spur gear machines. The electric motors are of a slow speed type, made especially for elevator service, which enables the coupling of the worm shaft direct to the armature shaft and yet permits running the worm at a sufficiently slow speed to insure quiet and smooth running. The worm runs in an oil cylinder, so that worm and worm wheel are constantly lubricated.

The armature shaft and worm shaft are fitted with automatic oiling bearings. The worm, which is of one piece with the worm shaft, is made of hard machinery steel and the worm gear is a bronze composition ring securely fastened on a cast-iron web. The bronze composition being much the softer metal, gets all of the wear, and when worn out can be readily renewed at a small cost.

An important point about the direct-connected electric machine is the economy of electric current. As the motor runs only when the elevator is in actual motion, no current is used during the time the elevator is standing. Another important point is the fact that while you have a motor capable of developing 5, 10, 15 or 20 horse-power, as the case may be, it actually develops only the power required at the moment.

The company recommend their direct-connected machines for high speed passenger elevators, or for any elevator in which smooth running and the greatest economy are results to be obtained; but in some cases, where there is a line of shafting available, driven electrically or otherwise, they are prepared to furnish belt elevators of their make. In these the drum is driven by worm gear like in the direct-connected machines, but the worm shaft instead of being coupled to the armature shaft of a motor has one fast and two loose self-oiling pulleys. This shaft is also provided with an automatic strap brake to hold the load stationary when at rest, and to render the changes of motion prompt. This machine, like the direct-connected machine, is provided with an automatic slack cable stop to prevent unwinding of the cable if the car should be obstructed in its descent, and an automatic stop, independent of the operating rope, for top and bottom of lift.

Figure 1, of the accompanying illustrations, illustrates the elevator arrangement.

A general view of an electric dock and ship hoist is shown in Fig. 2. A vertical section explaining the arrangement more clearly is given in Fig. 3. The apparatus consists of an electric motor coupled direct to the armature shaft, on which, as in the case just described, is a worm shaft and worm. The latter, as before, actuates a bronze worm gear D, and cast-iron friction clutch E, which is attached to a solid steel shaft F, to one end of which is attached a hauling drum or winch-head G, and on the other end of which is cut a thread. On this thread is a cast-iron hand-wheel nut H, which is supplied with steel handles on the inside of the rim, so placed in order that they will not catch in the clothing of, or strike the operator, and the movement of this hand-wheel nut forces the loose drum I into contact with the friction clutch E, or withdraws it at the will of the operator. The worm also runs in an oil cylinder J, and the worm gear is inclosed in a cast-iron casing K, which forms a bearing for the drum shaft F, and the standard L, which carries the other end of the drum shaft, also carries the switch M, and the switch lever N. The switch is completely inclosed in a cast-iron box O, which excludes all dust and dirt, and prevents the possibility of anybody coming in contact with it. The rheostat, or resistance box P, is placed within the bed plate, and the connections are so made that there are no wires in sight, and injury to the wires will not readily happen.

The operation is as follows: The operator moves the switch handle N to the left, which completes the electrical circuit and starts the motor. As he continues to move the lever to the left he cuts out more resistance until full speed or the speed desired is attained. The drum-shaft, winch-head and handwheel-nut are now in motion, but the drum is still at rest. The winch-head G alone may now be used if desired, but if it is desired to use the hoisting-drum I, the operator places his hand upon the hand-wheel H and holds it stationary. This has the effect of screwing the wheel against the hub of the drum I which is thus forced into contact with the friction clutch E, and when the pressure is sufficiently great to enable the drum to hoist the load, the operator is no longer able to hold the wheel, which then turns with the drum until the load is lifted to the desired height. The machine is then stopped by throwing the switch lever back to a vertical position, thus breaking the circuit and stopping the motor. The worm gear now holds the shaft with the friction clutch stationary, and the possibility of the worm being driven by the load is prevented by an automatic brake Q on the worm shaft The hand-wheel H is connected with the hub of the drum I in such manner that, while each can turn independently of the other, the drum is moved back and forth on the shaft, as the wheel is turned on the thread. To lower the load the operator moves the wheel H so as to withdraw the drum I from the friction clutch E until the load begins to descend by gravitation, and the speed of the descent is governed by the hand-wheel.

In the electric pump outfits of the company, centrifugal pumps are used. The outfits are compact and applicable to a variety of pumping purposes.

The electric motors are made by the Thomson-Houston Electric Co., and the other accessories are made by the Trenton Iron Co.

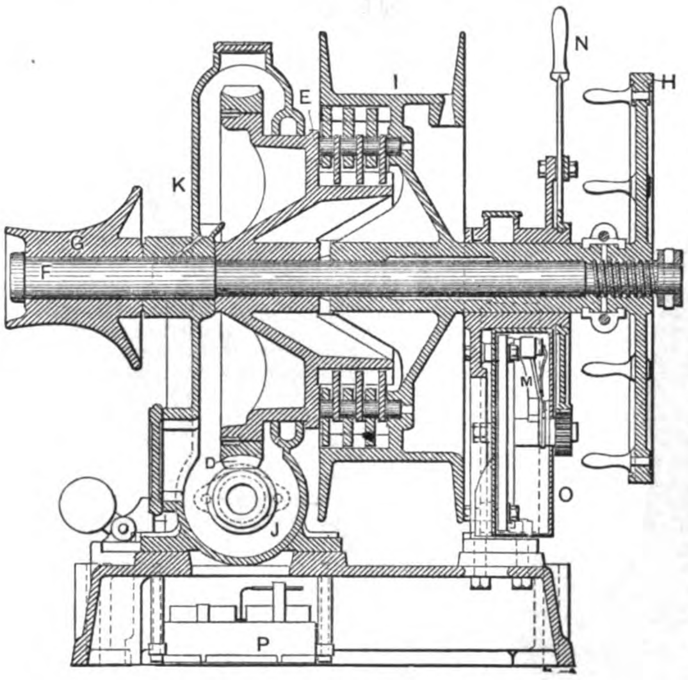


Fig. 3.—VERTICAL CROSS SECTION

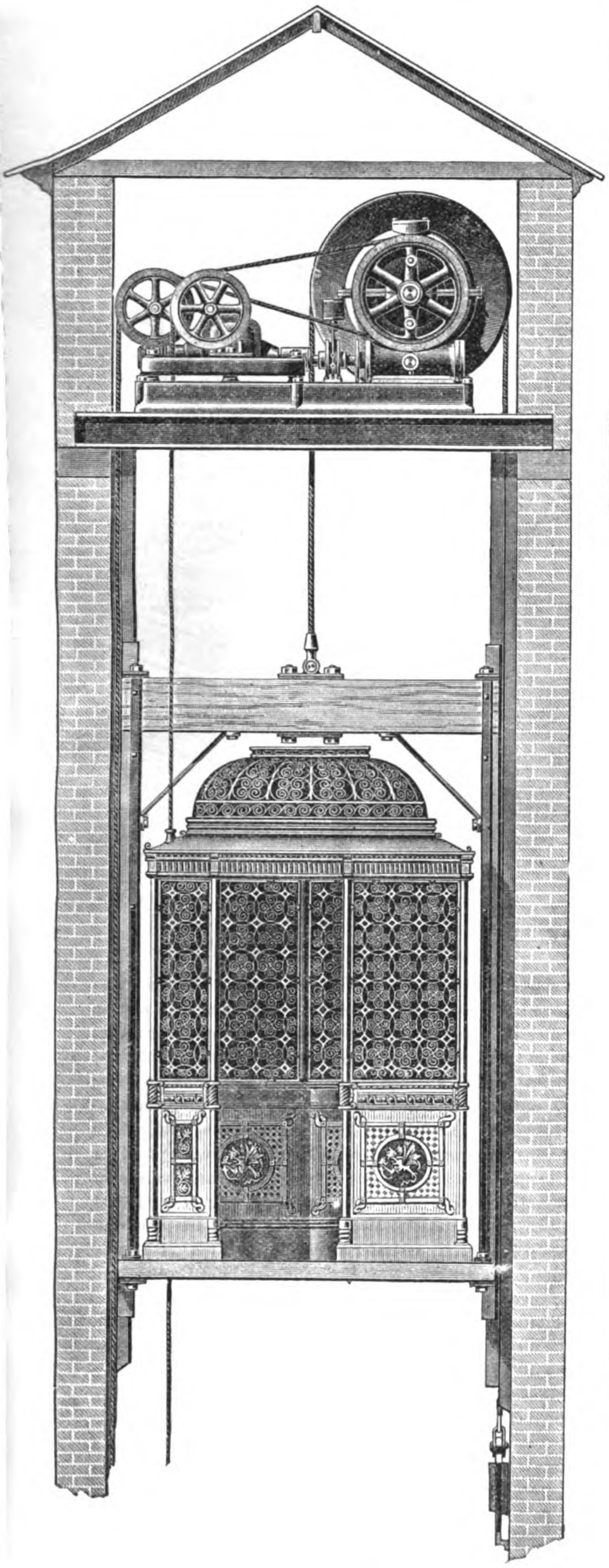


Fig. 1.—ELEVATOR OUTFIT.

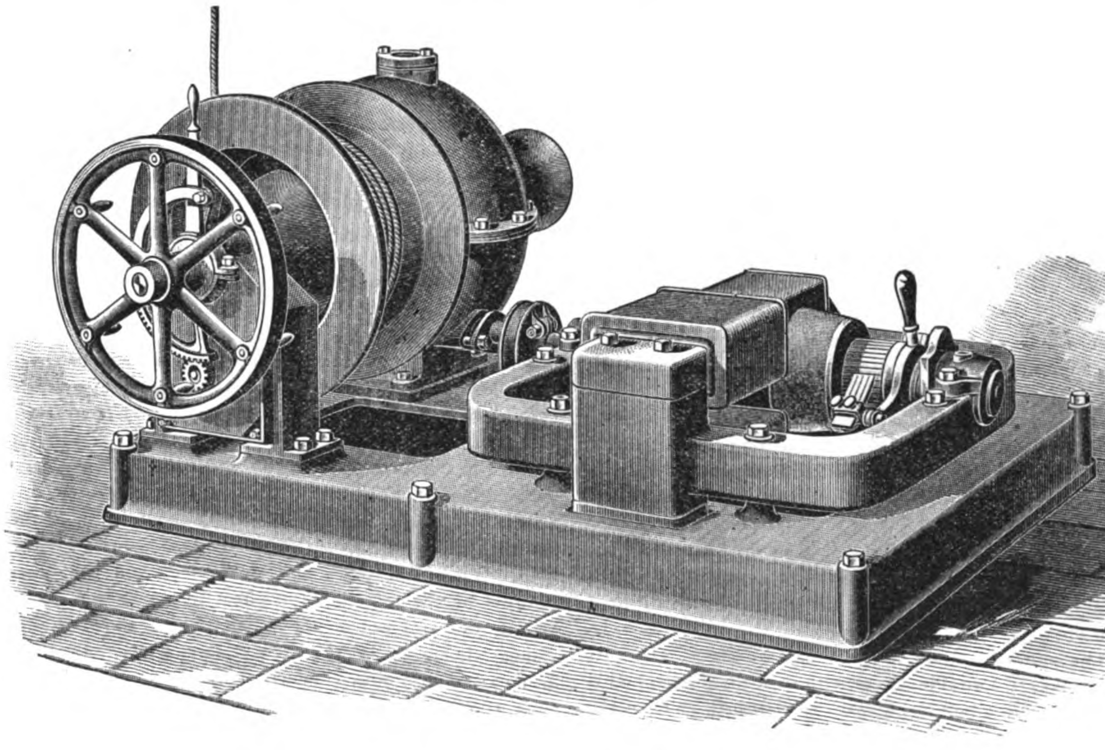


Fig. 2.—DOCK AND SHIP HOIST.

ELECTRIC ELEVATOR AND HOIST OF THE AMERICAN ELECTRIC ELEVATOR CO., NEW YORK.

LOSS OF THE DREDGE "DE LESSEPS."

THE Nicaragua Canal Construction Company has received a dispatch from Colon announcing the loss of its steam dredge, the "Count De Lesseps," about two weeks ago, while being towed in the Caribbean Sea along the coast from Colon to Greytown. It was learned that the "De Lesseps" had been sent to join five other similar vessels belonging to the company which are lying at Greytown. The "De Lesseps" started on October 18, in tow of the steamship "River Mersey," commanded by Captain Morton, an experienced navigator, and after having been some time under way encountered rough weather. The dredge carried a tower 60 feet high, and its oscillation, owing to the rocking of the vessel, is supposed to have opened her seams, causing her to leak badly. The motion of the tower disabled the steam pumps, which could not be operated, and the vessel filled rapidly and sank. The "De Lesseps" was 100 feet long and of 60 feet beam, drawing about eight feet of water. She could excavate a channel 30 feet deep and deposit dredgings at a distance of 160 feet on either side. Her monthly capacity was about 150,000 yards of earth. She was built for the American Contracting and Dredging Company, in Philadelphia, in 1882, by Slaven Bros., and cost, delivered at Colon, $175,000.

DOMESTIC PLVMBING HEATING LIGHTING & VENTILATION ENGINEERING

ELECTRIC MOTORS.

(Continued from page 332.)

THE U. S. ELECTRIC LIGHTING COMPANY'S MOTOR.

The latest improvements in the line of motors made by the United States Electric Lighting Company, 120 Broadway, New York, are shown in Figs 20, 21 and 22.

Figure 20 represents the type of motor designed for from $\frac{1}{16}$ to 20 horse-power. Its symmetry, solidity and simplicity are features to which attention is drawn by the makers, and its special features of construction are outlined as follows: Its contour is such as to practically protect all vital parts from accidental, mechanical injury. The field is made in the shape of a horse-shoe, cut in the center and fastened together by bolts. There is but one field coil wound upon a movable spool. This construction makes but one joint in the machine and renders the removal and replacing of the field coil very simple.

The armature is built up of disks of decarbonized steel. These disks are firmly secured to a steel shaft. The coils and bands, instead of being upon the surface of the armature, as is usual, are entirely below it. This is claimed to allow the safe running of the armature very close to the pole-pieces, thus largely reducing the amount of wire necessary, and consequently, the armature resistance; furthermore, the coils are thus entirely protected from any mechanical injury. The winding of the armature and the proportion existing between it and the field are such as to give a fixed point of commutation, thus overcoming the necessity of changing the position of the brushes on the commutator, however the load may vary, and entirely avoiding a spark.

The commutator is made very heavy, of pure copper strips insulated by mica. The brush holder is extremely simple and rigidly attached to the frame, as there is no necessity for changing the position of the brushes. It is made of brass, insulated from the yoke piece, carries copper brushes, and cannot be placed in any but its proper position. The form of machine permits of perfect alignment of the bearings, which are made of special hard bronze.

The motor is mounted on a cast iron base, where its size makes it desirable, either with or without legs, and is provided with a belt tightener. It is insulated from the base by hard wood blocks. The starting and stopping device is located on the motor itself and in high potential motors is inclosed in a glass case, thus avoiding any contact with parts in circuit.

The regular range of sizes of the motors made by the U. S. Electric Lighting Company extends from 1 to 150 horse-power, though special, smaller sizes, as above intimated, are also made. At present, the company are furnishing motors to several large manufacturing establishments for various purposes, such as operating cranes, testing machine tools, etc. Among these establishments are the Pond Machine Tool Works, at Plainfield, N. J.; the Baldwin Locomotive Works, at Philadelphia, Pa.; the Pennsylvania Railroad Shops, at Altoona, Pa., and E. P. Allis & Co., of Milwaukee, Wis.

(To be continued.)

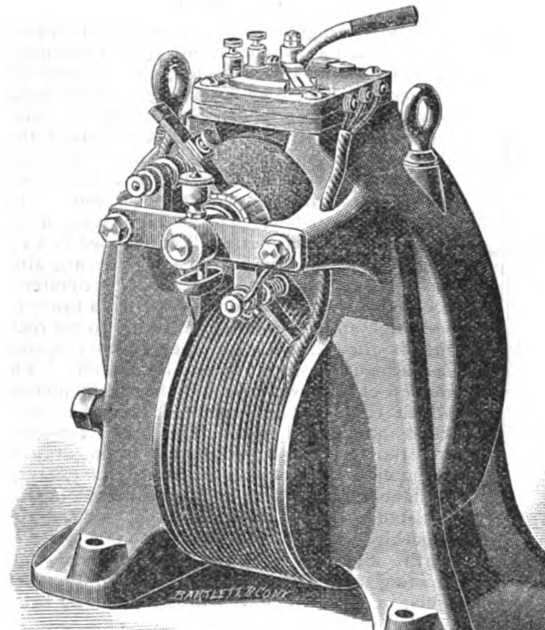


Fig. 20.— MOTOR WITHOUT BASE.

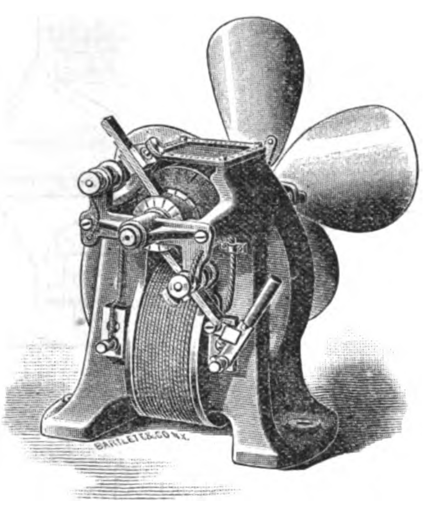


Fig. 22.—FAN MOTOR.

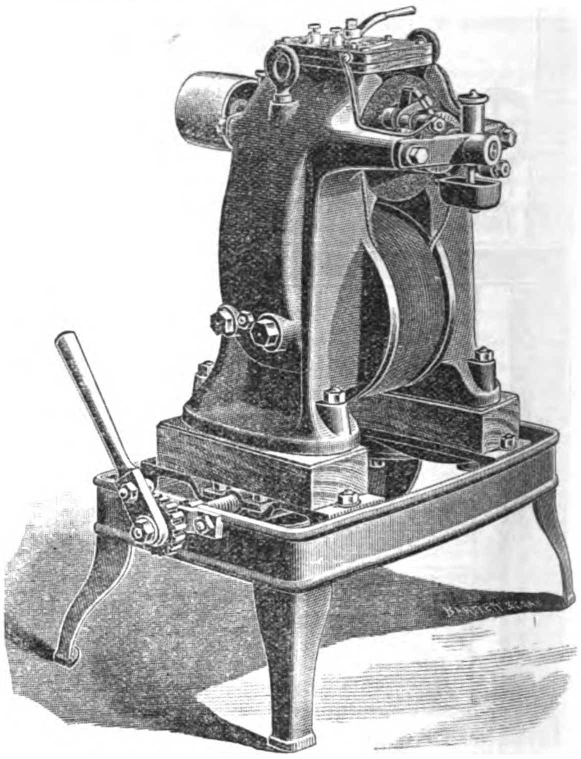


Fig. 21.—MOTOR WITH ADJUSTABLE BASE.

MOTOR MADE BY THE U. S. ELECTRIC LIGHTING CO., NEW YORK.

CORK COVERINGS FOR STEAM PIPES.

According to the Manchester, Eng., *Mechanical World*, M. Lecouvre has recently presented a report to a French society on the effect of cork coverings for steam pipes, which are more extensively used in France than here, both for steam pipes and as a protection of water service pipes against frost. There are two sorts of such coverings in use. One of these consists of pieces of cork shaped to fit the different sizes of pipes with radical joints, similar to the staves of a barrel, which are placed around the pipe and provisionally bound to the pipe by strings. After the pipe so covered has been used with steam for some time, and the cork been sufficiently dried, the crevices are filled in and the string is replaced by wire. Elbows are covered in the same manner. After the covering is finally fixed, it is advisable to close the pores and crevices by a coat of paint or lime wash. In the other system rectangular blocks of cork about 1¼ inch wide, and varying in thickness from ¼ inch for small pipes to ⅝ inch for pipes from 4 inch diameter upwards, and cemented to strips of cloth by an India rubber solution, are used. These bands are lapped spirally round the pipes and elbows, and covered by another band of water-proofed canvas lapped in the same manner so as to cover the joints of the cork bands, the whole being afterwards covered by a thick coating of paint or tar. Experiments with both of these coverings have been made at Creusot by M. Ch. Campere, engineer of the Paris Steam Users' Association, in a careful manner. The apparatus employed consisted of two inclined pipes communicating at the top with the steam supply, and at the bottom with a steam trap. One of the pipes was uncovered, and the other covered by the material, the effect of which was to be tested, the surfaces of the pipes, which were without flanges, being in each case a square meter. In these trials a cast iron pipe 10 inches in diameter, covered with cork, showed an economy of 38*s*. per square yard of surface for 300 days of 12 hours, assuming the coal used to cost 20*s*. per ton, and to evaporate 7 pounds of water per pound of coal. With a copper tube 6½ inches in diameter the saving amounted to 31*s*. under the same conditions.

STEAM HEATING IN A SIXTY-SEVENTH STREET RESIDENCE, NEW YORK.

The large four-story and basement house at No. 7 East Sixty-seventh Street, New York, was originally provided with heat from a hot-air furnace. Recently this furnace was discarded and the house heated by indirect steam radiators so arranged as to utilize the old hot-air flues and ducts and involve no changes, rebuilding, mason work or piping above the cellar, and only the addition of simple apparatus there.

Figure 1 is a plan of the cellar, and is not drawn to scale, but merely shows the arrangement and location. A and B are the old brick furnace chambers, which, with their smoke-pipes D and D′, are left intact, except that a few lengths of D′ are unjointed for convenience; C C, etc., are the old hot-air ducts to the wall flues E E, etc., and F F are the old fresh-air inlets, all left undisturbed.

For the reconstructed system new inlets were made at G G, through which fresh air is admitted to filter chambers H H, and thence taken, through ducts I I, to brick chambers J and K, each about 7 feet high and 4x7 feet square inside.

These chambers contain steam radiators, and the air, after being heated by them, passes into the distributing boxes L L, which communicate by branches O O O, etc., with the ducts C C, etc., and thus distribute the hot air as in the old system. The steam used is supplied from the mains of the New York Steam Company, but as excavations in the street at this point are prohibited for a certain number of years the supply was branched from the connections in the adjacent house and is received through the 1¼ inch pipe M; N is a 1-inch drip-pipe, and P P are steam traps; Q Q, etc., are dampers automatically controlling the hot-air supply by the Johnson heat regulating system, which was illustrated and described on pages 156 and 171; T is the air-pump operating the electro-pneumatic valves in case S that, through the air-pipes R R, etc., control the damper valves (not shown here) at Q Q, etc., and the steam valve U. The latter is closed as soon as all the rooms in the system are at the required temperature, and is opened as soon as any one of them falls below it. V is a globe valve for controlling the steam supply by hand. A regulating valve, not shown, reduces the pressure to any required amount.

Figure 2 is a perspective view from Z, Fig. 1. The same reference letters have the same meaning there as in Figs. 1, 3, 4 and 5. Figure 3 is a horizontal section through *m m*, Fig. 2, and Fig. 4 is a vertical section at *w w*, Fig. 3; Fig. 5 is a view of the interior of chamber K.

Steam from pipe M is delivered to radiator *d* and returns, with the condensation water, to trap P. This steam, together with that from pipe N, is supplied through pipes *y* and N to the secondary radiator *g*, Fig. 5 (in this case a Gold extended surface radiator), designed to utilize most of the remaining heat and discharge the condensation water at a comparatively low temperature into the sewer through the drip-pipe *p*; *a* is a draw-cock, *b* a manhole giving access to chamber K, and *c* an automatic air-valve. As shown in Figs. 3 and 4, the elbows, which connected the old flues *c c*, etc., to the vertical branches *p p*, etc., of the old furnace, were replaced by tees S S, etc., which join the flues C C, etc., to the branches O O, etc., from the distribution box L, and the vertical pipes *r r*, etc., were closed by the stoppers *t t*, etc., thus entirely cutting out the old furnace but leaving the connections so that it could be quickly thrown into service again if necessary.

In Fig. 5 *f* is a pipe frame supporting the radiators *d* and *g*; *d* is the standard Evan's radiator, one end of which is shown in section in Fig. 6. It consists simply of a hollow cast-iron box *h*, with inlet *j*, outlet *k*, and air-pipe *l*. The radiator pipes (in this case about 300 pieces, 1 inch in diameter and 4½ feet long) are simply Bundy loops screwed into the sides of box *h*, with a pitch of about 1 in 10.

Figure 7 shows the filter air closet H, which is a tight cell, about 7 feet high and 5 by 7 feet square, reaching from the floor to the ceiling, built of matched pine stuff and lined with tin. A folding screen is made considerably longer than the closet and just as tall as its inside height. It is then partly opened and the ends hooked to the walls at *v v*, etc., so that its half-opened panels *q q*, etc., that are covered with fine cheese-cloth *u u*, etc., make a zig-zag barrier through which all the cold air from inlet G is filtered before entering the 2-foot galvanized iron duct I. When the screen becomes dusty it can readily be removed, cleaned and put back in place by any servant.

Figure 8 shows the Johnson air pump for compressing the air that operates the pneumatic valves. Figure 9 is a diagram (not drawn to scale or exact detail) illustrating the operation of the pump. The latter consists essentially of two cast-iron shells G G, about 12 inches diameter, each containing a rubber diaphragm H, connected to rod O; F is the pressure pipe with check valves E E opening upwards; D D are air inlet pipes which can be closed by stopper N; B is the delivery, and M the discharge water pipe, and L L are their branches, controlled by the four-way rotary valve K with lever Q.

Figures 8 and 9 show the pump nearly at the end of the right hand stroke. Water is entering the left hand chamber J, and is forcing air out of I into F, while on the right hand the check valve E is closed and air enters I as the diaphragm H moves to the right, and expels the water from chamber J through branch L to waste pipe M. At the end of the stroke the link P, fixed to rod O, will throw lever Q into the position shown in Fig. 8, thus shifting the stopper M to N′. This opens the left, and closes the right hand air inlet D, and also rotates valve K in direction R so as to reverse the water currents in branches L and L. Water will, therefore, be admitted to the right hand chamber J and expelled from the left hand one, and air will be expelled from the right hand chamber I through valve E, and admitted to the left hand chamber I through its pipe D. When the diaphragms reach the positions H′ H′ the valves again reverse, and so on.

The steam heating in this house was designed and constructed by the Q. N. Evans Construction Company of New York, and the automatic regulating system was put in by the Metropolitan Electric Service Company, also of New York.

RELICS OF ANCIENT ROME.

THE *English News* states that the commission in charge of the improvement of the City of Rome has unearthed great quantities of lead water-pipe, each plainly stamped with the name of the owner of the house, the year of the plumbing, the name of the consuls for that year, and that of the reigning emperor. In opening the 82 miles of new streets in that city, material has been found sufficient to add to our present knowledge a thousand details concerning the baths, heating flues, water pipes and house sewer pipes, the organization of the police and fire brigades, etc.

REFERRING to the recently published paragraph that New York is shortly to have a steam heated wharf, and that the only other one in the country is at Boston, Mass., a Boston correspondent writes that this latter establishment is the warerooms of the Boston Fruit Company, the building being heated by hot water circulation, and a Gurney boiler being used. It is said to give a very even temperature and to admirably suit the purposes for which it has been adopted.

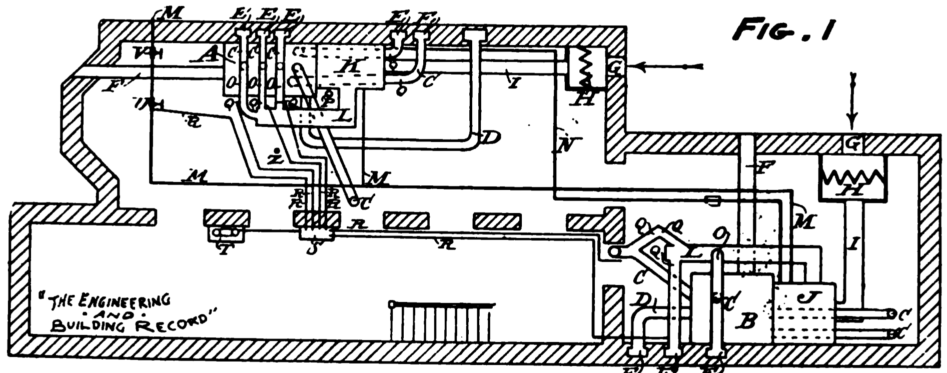


FIG. 1

STEAM HEATING IN A 67TH ST. RESIDENCE.

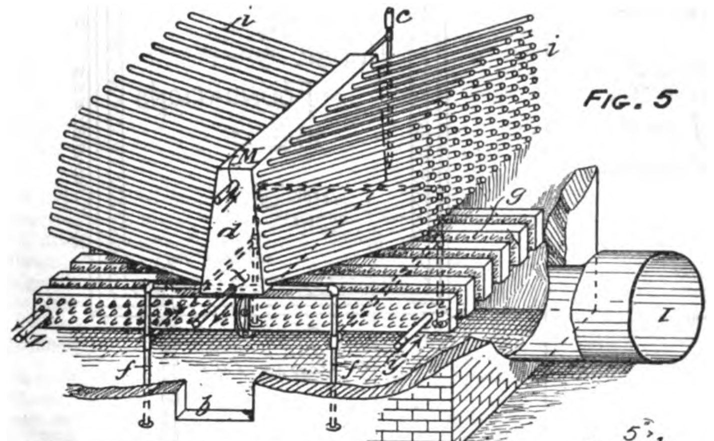


FIG. 5

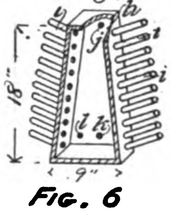
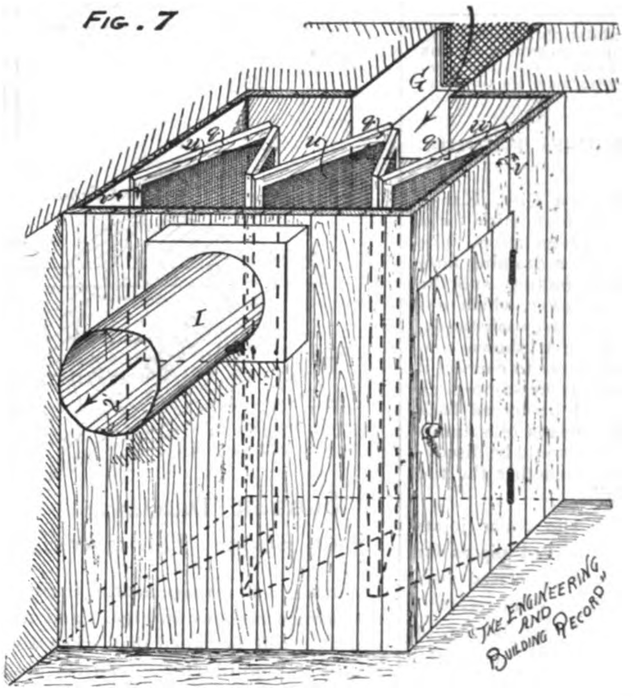


FIG. 6

STEAM HEATING IN A 67TH ST. RESIDENCE

FIG. 7



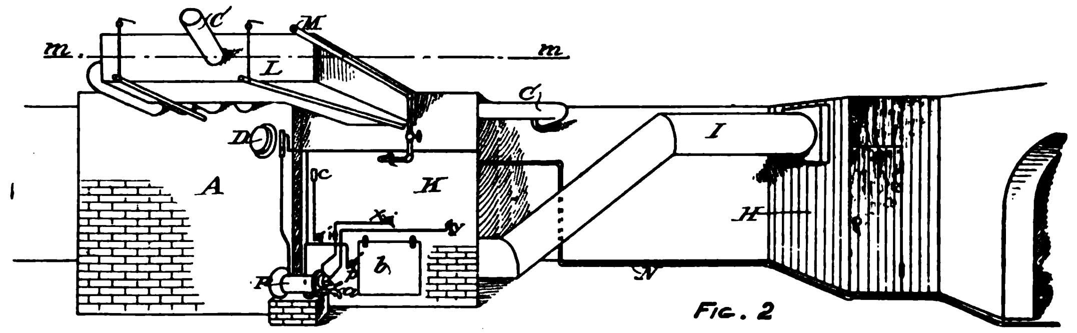


FIG. 2

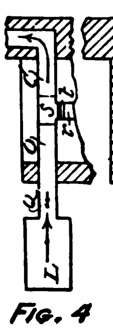


FIG. 4

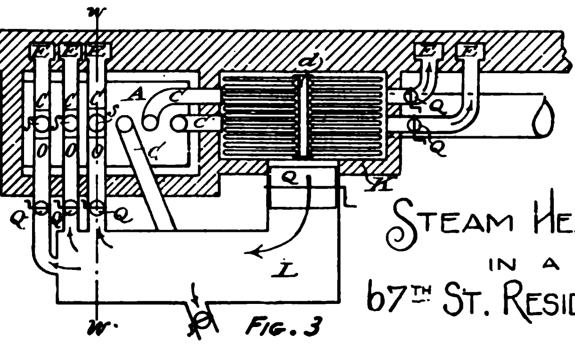


FIG. 3

STEAM HEATING IN A 67TH ST. RESIDENCE

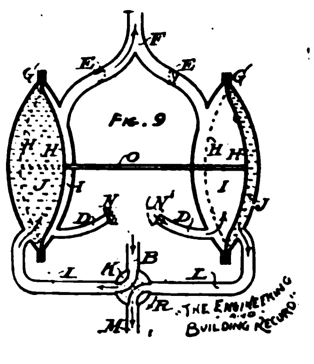


FIG. 9

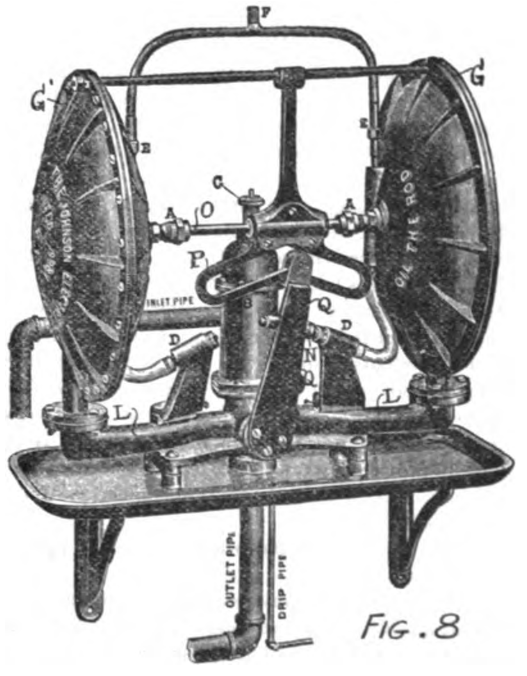


FIG. 8

STEAM HEATING IN A 67TH ST. RESIDENCE

Questions and Answers.

All questions relating to building construction, paving, sewerage, water supply, or kindred subjects, will be welcomed in this column provided they relate to matters of general interest and are not such as should properly be referred to a consulting engineer. Answers will be carefully prepared and a proof of both question and answer mailed to the inquirer as early as proper consideration will permit. They will be published for the benefit of other readers as soon as convenient. The full name and address should be given, not necessarily for publication, but as a guarantee of good faith, and to facilitate further correspondence in case the question is not sufficiently explicit.

Inquiries of the Editor, in order to secure prompt attention, should *not be written on the same piece of paper as a communication* to the *Publishing Department.* Letters renewing subscriptions are sent to a clerk in the publishing office, and matter for the Editor, if in the same enclosure, is likely to be overlooked unless it is on a separate piece of paper, so that it may be promptly sent to the Editor.

COPYING DRAWINGS IN COLORS.

IN response to an inquiry from Joliet, Ill., for particulars of some quick process of copying drawings in all colors, we would say that the only device which we know of, designed to accomplish this purpose, is the hektograph. From what we have seen of the work done with it the device would seem to be well adapted to our correspondent's requirements. It is in use in many architects' and engineers' offices for all kinds of copying work. In all cases a specially prepared ink must be used. This can be obtained in various colors from the makers of the hektograph, The Hektograph Manufacturing Company, 82 and 84 Church Street, New York.

Notes and Queries

on Domestic Engineering.

Communications relating to the practical details of plumbing, heating, lighting and ventilation will be welcomed in this column. The writer's true name and address must always be given, but an assumed name may be used for publication if preferred.

SUBSOIL DRAINAGE OF HOUSE FOUNDATIONS.

THOMAS LLOYD BETTON, of Kansas City, Kans., writes: "Please find inclosed a plan of foundation for a building, with drain tile running around foundation. Tile is hubless, such as is used on farms for draining farm land. It runs about eight inches above footing and the architect wishes us to connect same to sewer, which has to convey water from two water closets, two washstands, two bath-tubs, two sinks, as you will see it shown connected in our plan. We say it is not proper to connect it to main sewer, for in case trap should become stopped up in any way everything from house would be forced back into the hubless tile, and would be the means of saturating the ground around building before it would be discovered. Please give us your opinion as to whether the tile should be laid above or below footing."

[Two-inch cylindrical land tiles with slip collar joints should be used, with Y branches and curved pieces for change in directions. The tiles should be placed on a plank bottom laid to grade of about 6 inches in 100 feet. The invert of the tile should be level with the bottom of the footing course at the front of the house (or at the point of discharge of the tiles), and should rise in both directions from this point to a "summit" at the back (or opposite side) of the house. Care should be taken to prevent mud from flowing into the drains while being laid. The joints in the tile are sometimes made with cloth or tar paper wrapping instead of slip collars. It is a good plan to fill in the trench with broken stones to a depth of 6 inches over the pipe and to cover this with salt hay or straw before filling in the earth. The outside wall of the house should be thoroughly plastered and troweled smooth with Portland cement mortar (1 to 2) and allowed to set before the tile is laid. This plaster coat should extend from an inch or two above the surface of the ground to the bottom of the footing course. A coating of bitumen laid on hot outside of this will make the foundation walls doubly proof against water and dampness. The discharge from the subsoil drains should not connect with the sewer if it can be otherwise disposed of. In case it is impossible to provide other means of draining the subsoil line, it may connect with the house sewer under the following conditions:

First.—It must be independently trapped against the entrance of drain air.

Second.—The trap must be supplied with water from an unfailing source, and had best be connected with a rain leader or yard drain. The ground water supply alone should not be relied on to furnish seal for the trap, as during dry seasons the subsoil drains may carry no water.

Third.—The subsoil drains should be effectually trapped against the back flow of sewage, which may be occasioned by a stoppage in the main drain beyond the junction of the subsoil line. For this reason it is, perhaps, best to connect the subsoil line on the sewer side of the house drain; as stoppages in the main house trap, which are not infrequent, would not then affect the subsoil line. The prevention of the back flow of sewage must depend on some mechanical trap, which is always to be deprecated, as no mechanical trap is reliable; and it is for this reason chiefly that the connection of the subsoil drains with the house sewer is to be avoided if possible. For the purpose in view a mechanical trap with a floating ball is preferable to flap valves and metal balls seating downward, as the floating ball is less liable to fail to seat itself. A failure in the operation of the mechanical trap, in case of stoppage in the house sewer beyond the subsoil junction, will result in flooding the subsoil drains with house sewage which is not liable to be discovered until some of the house fixtures fail to operate properly or until the flooded subsoils become offensive. This is a risk which cannot be overcome, and it is essential, therefore,

Fourth.—That the traps be located where they can be frequently and readily inspected and cleaned.

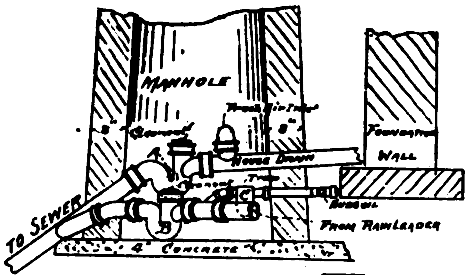


FIG 2

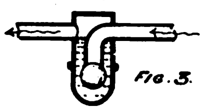
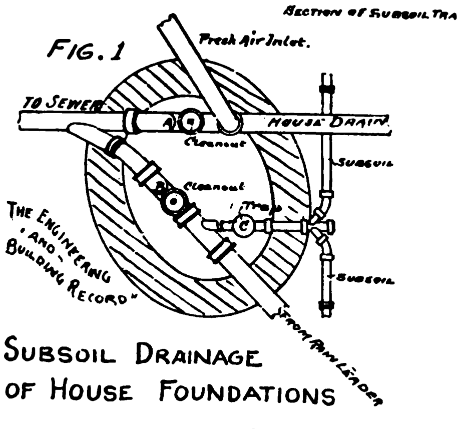


FIG. 3.

SECTION OF SUBSOIL TRAP

FIG. 1



A convenient arrangement of traps to cover the points enumerated is shown in Figs. 1 and 2, in connection with which it will be noted that, when working properly, the trap B is supplied with water from a yard drain or rain leader. The trap C, Fig. 3, is a ball float mechanical trap allowing the subsoil water to flow into B, but preventing back flow of water or sewage when the ball is seated. A patented trap of this general pattern is in the market. If C runs dry, B prevents the back flow of drain air, and, in case of the back flow of sewage, the first entrance of sewage into C would float the ball and seat it. The rain leader should be carried up with iron pipe and tight joints to the height of the fresh-air inlet, or above the level of a yard drain, so that sewage backing into the leader may not escape until it has found its way out at some opening, where it will be a nuisance and be brought to the attention of the householder.

The traps, as shown in the drawing, can be grouped in an oval manhole 4x3 feet.

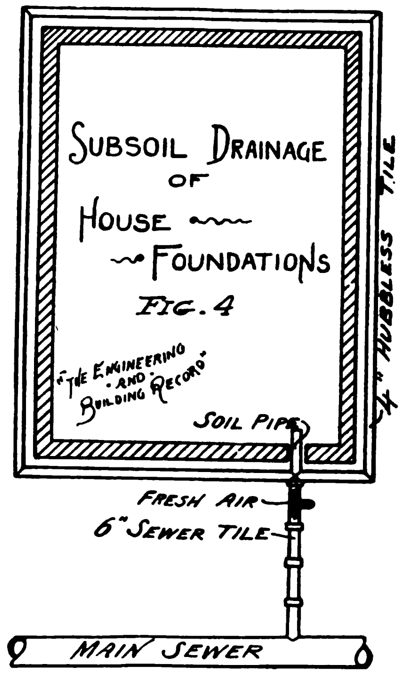
From what has been said it is evident that you were right in saying it would not be proper to connect the subsoil drain as shown in your sketch. The correct method of laying the tile has been indicated. If laid *below* the footing course, it may undermine it and crack the wall; if laid above the footing course it is not draining the subsoil to the greatest available depth.]

THE Dallas, Tex., plumbers' association has passed a regulation by which no plumber can take a sub-contract. They contend that contracts for work in their line must come direct from the party having the work done.

NOTES ON SEWER INSPECTION.

WE have received a pamphlet, issued by a firm of plumbers in Illinois, which is very good reading, as will be seen by the appended extracts. The orthography and the grammar may be a little shaky, but there is no room for doubt as to the author's meaning.

"A poor, inexperienced inspector on a sewer is of no value to a city, all from the fact that if a contractor has one or more expert sewer men around his job they will beat this so-called inspector right along; then the contractor makes the city accept the work, because the inspector said it was all right, and of course he don't know anything about it, and the pipe setter and the foreman beat him in every point, not because it is any advantage to them or the contractors that they work for, but just to make a fool out of a crank; and I will state that when any city employs a man to inspect any city work who is not a safe, industrious mechanic, they are only wasting money, because any man who drinks to excess can be brought to hold his tongue while contractors rob the taxpayers to suit themselves—such is generally the case; but, if first class mechanics cannot be had, then it is best not to have any at all, because the contractor will always do a much better job, because he has no reason to either cheat or vary from his contract. We will say that the grade line has been established and the contractor ready to begin, the engineer, if he has anything else to look after, such as whiskey to drink, will need a competent and reliable inspector, who cannot be led off to some saloon or place of pleasure every ten minutes, but will stay on the ditch every minute that the work goes on, to see that the sewer is actually laid as it should be, and to see that the materials are what have been agreed upon, and upon this some inspector rests a large part of the burden of securing an excellent piece of work. * * * Poor sewers are a boon to doctors and undertakers, while they are a ruin to those who live close by them, and also to the taxpayers. All those things you will find to be true when you have a poor sewer connection in your house and typhoid and malaria fever carries off the dear ones of your heart. * * *


Subsoil Drainage of House Foundations
Fig. 4
"The Engineering and Building Record"
Soil Pipe
4" Hubless Tile
Fresh Air
6" Sewer Tile
Main Sewer

"Every city should have a man in charge of their sewers who was an expert, and a man not afraid of mud and water, that has a place of business, and could sleep right by his telephone, so that if anything happened in the night he could be had at once; and in case of heavy storms he should be out on the line continually, until the storm is over, to see that the grates are all clear and not overflowing in some cellar, to cause the city to be sued for damages. This man should be one who is properly fixed with all the necessary conveniences to open up and curb a line on short notice, day or night, and fully understand his business, stay sober, and be ever at his post; if a man does not do this, then he shall be discharged, and a good man put in his place, if such can be had.

"No so-called expert should be employed in this position because he spends his money with some particular member of the City Council, or some one that has the appointing of him. The people at large, whose property and lives are held in the grip of this same Inspector of Sewers, should have something to say about this, and the taxpayers will find that some man of this kind will generally have the place if they do not look after it; whether he has ever done a day's work in his life, or ever seen a sewer, he must have the place, because he spends his money with some official above him; no matter if he is drunk or sober, asleep or awake, if he spends his money this way he holds his position, and the taxpayer has to suffer all kinds of nuisance and still pay on and on for nothing."

A TUNNEL between Ireland and Scotland is at present being discussed. According to one of the proposed plans the tunnel would be 33 miles long, and its greatest depth 500 feet.

CONTRACTING NEWS DEPARTMENT.

A WEEKLY RECORD

OF SPECIAL INTEREST TO CONTRACTORS, BUILDERS AND MANUFACTURERS OF ENGINEERING AND BUILDING SUPPLIES.

THE ENGINEERING AND BUILDING RECORD,
277 Pearl Street, New York.
November 1, 1890.

CONTRACTING INTELLIGENCE.

For works for which proposals are requested see also the "Proposal Columns," pages i-ii-353.

WATER.

For Additional Water Items see Proposal Columns.

Manchester, N. H.—With reference to the proposed addition to the system of water-works of this place, the report of the engineer, M. M. Tidd, of Boston, has been accepted by the Water Board, who voted to have it printed and to submit the matter to the city government for further action.

Alliance, Neb.—A system of water-works, to cost $20,000, is to be established at this place. Plans, etc., are now being prepared by A. A. Richardson, of Lincoln, Neb., who will furnish particulars.

Canton, S. D.—Engineer A. A. Richardson, of Lincoln, Neb., is now engaged getting up plans for $21,000 water-works for this city. For further information apply to him, as above.

Quincy, Ill.—Plans and estimates are now being made for a complete system of water-works for this place.

Sturges, S. D.—This place is to have a complete system of water-works at once.

Martinsville, Va.—Reports say that the projected water-works for this place will be established at once.

Seymour, Tex.—It is proposed to establish a complete system of water-works at this place. Address Morgan Jones, as above, for particulars.

Hebron, Neb.—Owing to the delay in getting specifications to bidders, and from the general dissatisfaction by contractors and manufacturers at the short time in which to bid intelligently, the Council, at the urgent request for more time, have decided to hold open for the receiving of bids until November 5, no bids having been opened.

Menasha, Wis.—C. C. Garland, of Minneapolis, Minn., writes: "There is nothing being done in the way of water-works at Menasha, Wis. My proposition has been withdrawn."

Aberdeen, Wash.—City Clerk J. H. White writes: "At the election held here October 7 the people decided in favor of establishing a system of water-works."

Cisco, Tex.—The Superintendent of the Cisco Water Company writes: "Charter obtained to supply this town with water; supply to be got by damming a canon; 145 acres of ground bought. Engineers to make proper estimates, etc., for dam, stand-pipe, engine, pipes, etc. Capitalists ready to invest $50,000, at least that much subscribed."

San Angelo, Tex.—It has been decided to lay seven additional miles of water mains. Address J. I Millspaugh for particulars.

Centralia, Wash.—The engineers have about completed surveys of the water-works and work will be begun at an early day.

Ironwood, Mich.—A system of water-works, to cost $100 000, is to be established at this place by the Ironwood Water-Works Company.

Kirkwood, Mo.—The company organized to establish water-works at this place will, it is understood, begin operations at once.

Jamesville, Mass.—This place is to procure a water supply from Worcester. The necessary mains, etc., will be laid at once.

Benton Harbor, Mich.—It is proposed to expend the sum of $100,000 on a water-works system for this place.

Oakland, Cal.—The Blue Lakes Water Company will soon be ready to begin work, nearly all of the stock necessary having been already subscribed. This company, in addition to supplying water for Stockton and Oakland, will furnish power to operate electric light and power plants.

Bay City, Mich.—It has been decided to settle the question of expending the sum of $50,000 for improving the water-works system by the taxpayers, who will vote for or against the project at the election next month.

Union City, Wash.—The water-works system of this city is to be increased by the addition of numerous branch lines.

Cranford, N. J.—It is expected that the water company recently organized at this place will soon begin the construction of a system of water-works.

Key West, Fla.—Numerous additional water mains are to be laid in this city. Address President Maloney, of the City Commissioners, for particulars.

Dayton, O.—Important water main extensions are to be made in this city.

Belleville, Ill.—The City Council has authorized Mayor Rainey to appoint a committee of three of its members "to confer with the Board of Trade, manufacturers, millers and business men generally in reference to the proper steps to be taken to secure an ample supply of good, pure water." This committee, consisting of Alderman W. T. Crouch, Geo. Krug and E. S. Winkle, met with the Board of Trade in the County Treasurer's office, October 27, to discuss the water question, and it is thought that a strong home company will soon be organized, and a supply of water insured by bringing it direct from the Mississippi River above East St. Louis.

San Jose, Cal.—The San Jose Water Company has increased its capital stock from 7,000 to 10,000 shares of $100 each, and extensive improvements will be made at once.

Zanesville, O.—J. W. Hill, C. E., of Cincinnati, O., has recommended that the sum of $175,000 be expended on the improvement of the water-works system at this place. The people will vote on the question of issuing bonds for that purpose at the coming election.

San Francisco, Cal.—The American Land and Water Company has been incorporated here by Timothy F. McCarthy, Edwin Windele, and others. The capital stock is $200,000.

Elgin, Ore.—The Elgin Water-Works Company has been incorporated at this place, and a plant will be established. For particulars address J. W. Snyder, as above.

Davenport, Iowa.—The Davenport Water Company has decided to establish a filter system in connection with its plant.

Water-Works.—See our proposal columns for information regarding water-works and water-works furnishings at the following places: Rushville, Ind.; Philadelphia, Pa.; San Angelo, Tex.; Ellsworth, Kan.; Galt, Ont.; Columbus, O.; Chambersburg, Pa.; Harrison, O.; Chester, S. C.; Chamberlin, S. D.; Huron, S. D.

SEWERAGE.

For Additional Sewerage Items see Proposal Columns

Atlanta, Ga.—Extensive sewer work is to be done in this city. Address the City Engineer for particulars.

Akron, O.—The construction of a storm water sewer is projected at this place.

Belfast, Me.—The question of introducing a system of sewerage at this place is being discussed by the local officials.

St. Louis, Mo.—Extensive street improvements are to be made in this city.

Babylon, N. Y.—There is a project on foot at this place to establish a system of sewers. The Town Clerk can furnish particulars.

Oakland, Cal.—Considerable new sewer work has been authorized at this place.

Trenton, N. J.—Numerous sewer extensions are to be made in this city. Address the Clerk of the Board of Water Commissioners, as above.

Haverhill, Mass.—The Board of Aldermen has authorized the construction of numerous additional sewers at this place.

Salem, N. J.—The local officials are considering the question of putting in a sewer on West Broadway. T. J. Yorke has been authorized to consult Colonel Waring on the subject.

Hamilton, Ont.—Numerous sewer extensions are to be made at this place.

Oakland, Cal.—The order approving the system of sewerage for the Point Lobos District, as proposed by City and County Surveyor Smith, has been passed by the Supervisors.

Sewers.—See our Proposal Columns for information regarding sewer construction at the following places: New York, N. Y.; Victoria, B. C.

BRIDGES AND IRON STRUCTURES.

For Additional Bridge Items see Proposals Columns.

Saco, Me.—Mayor Enoch Lowell writes: "Contract was closed October 8 with Berlin Iron Bridge Company, East Berlin, Conn., for a wrought iron deck truss bridge, length 50 feet, roadway 68 feet, for the sum of $3,750."

St. Paul, Minn.—The following bids for constructing the superstructure of the bridge on Sixth Street were received by J. T. Kerker, Clerk of Board of Public Works, October 23: Milwaukee Bridge and Iron Works, Milwaukee, Wis., $135,951; Chicago Bridge and Iron Company, Chicago, Ill., $148,000; Chicago Forge and Bolt Company, Chicago, Ill., $128,875; Keystone Bridge Company, Pittsburg, Pa., $136,000; The New Jersey Steel and Iron Company, Trenton, N. J., $135,900.

Dayton, Tenn.—The Tennessee Industrial Land Company, of this place, will build two iron bridges over railroads.

Hancock, Ind.—The Hancock Bridge Company has been chartered here. The object of the corporation is the erecting of the proposed toll bridge across the Potomac at this place. The capital stock is $30,000. Edmund P. Cahill, J. F. Fields, and others are named as directors.

Cheyenne, Neb.—Cheyenne County will vote on a proposition to issue $10,000 in bonds to build a bridge across the Platte.

Lynchburg, Va.—Repairs are to be made to the bridge over Blackwater Creek, at Hollin's Mill, near this city.

Cranford, N. J.—It is suggested that a bridge be erected over the railroad crossing at Union Avenue this place.

Willimantic, Me.—A new iron bridge is to be erected at this place. Address the Town Clerk for particulars.

Philadelphia, Pa.—The following proposals for constructing wrought-iron approaches to Walnut Street bridge, in this city, were opened by Louis Wagner, Director of the Department of Public Works. The figures given are for the following work in detail: 1, east approach, between Piers 1 and 7, inclusive; 2, west approach, between Piers 12 and 41, inclusive; 3, bituminous concrete, 38 feet wide, per lineal foot. Bidders: Levering & Garrigues, Philadelphia, 1, $57,590; 2, $208,874. A. & P Roberts & Co., Philadelphia, 1, $55,263; 2, $208,698. Edge Moor Bridge Works, Edge Moor, Del., 1, $220,989; 2, $58,885; 3, $13.50. Pottsville Bridge Co., Philadelphia, Pa., 1, $61,220; 2, $211,400. Wrought Iron Bridge Co., Canton, O., 1, $62,700; 2, $227,300. King Iron Bridge and Manufacturing Co., Cleveland, O., 1, $72,000; 2, $257,000. Phœnix Bridge Co., Philadelphia, 1, $71,252; 2, $261,012; 3, $13.35. Keystone Bridge Co., Pittsburg, Pa., 1, $71,500; 2, $270,400; 3, $15.

New Haven, Conn.—The Commissioners of New Haven and Fairfield Counties, at a recent meeting, decided to make the new bridge over the Housatonic, at Derby, a 24-foot bridge with two foot-walks 7 feet wide. Contracts will be awarded as soon as possible.

St. George's, S. I.—A survey has been ordered by the Supervisors for a bridge at the Fresh Kill on the County Road, between Northfield and Westfield, S. I.

Oakland, Cal.—Plans are being prepared by Assistant Engineer L. I. Geleonte, for a steel and iron draw bridge across Park Street, at this place.

Long Island City, N. Y.—It is probable that a bridge will be erected over Newtown Creek, at Maspeth, at a cost of $25,000. Address Supervisor Joseph Dykes, Flushing, L. I., for particulars.

Chattanooga, Tenn.—The Chattanooga Railway Bridge and Terminal Company will erect a $500,000 railroad bridge over the Tennessee River, at this city.

Houston, Tex.—The following proposals for the construction of an iron truss bridge, on Sabine Street, to connect the Fourth Ward, north and south, were opened by the Common Council, October 27: George S. Govier, of Dallas, for the King Iron Bridge and Mfg. Co., $9,170. Chicago Bridge and Iron Co., $10,800. Smith Bridge Co., Toledo, O., and approaches, $6 per lineal foot, $6,600. Approaches, per lineal foot, $5. Wrought Iron Bridge Co., Canton, O., $10,190. Groton Bridge and Mfg. Co., Groton, N. Y., Exhibit A, $9,375; Exhibit B, $9,697; Exhibit C, $10,650; Exhibit D, $11,050; Exhibit E, $10,440; Exhibit F, $10,800. Milwaukee Bridge and Iron Works, $9,978. The Berlin Iron Bridge Co., East Berlin, Conn., $12,800. Columbus Bridge Co., Columbus, O., four bids, $9,352.21, $9,014.46, $8,086.80, $8,348.25. Lane Bridge and Construction Co., Newark, O., $10,500, $9,000. Variety Iron Works, Cleveland, O., Plan A, $6,715; Plan B, $6,473. Pittsburg Bridge Co., Pittsburg, Pa., by S. A. D. Oliver, Plan A, $7,458; Plan B, $10,219; Plan A, 5 feet cylinder, $8,125; Plan B, 5 feet cylinder, $9,554. King Iron Bridge and Mfg. Co., Cleveland, O, Plan A, $8,380; Plan B, $8,680. Wisconsin Bridge and Iron Co., Minnesota, Wis., Plan A, $6,076; Plan B, $6,566. Southwestern agent of the Penn Bridge Co., Dallas, Tex., $11,000; sidewalk additional, $500. Trenton Bridge and Iron Co., Trenton, Iowa, $8,050. Lane Bridge and Iron Works, Chicago, Ill., $10,808. The bids were referred to the Board of Public Works, as required by the charter.

Orange Grove, Va.—The sum of $22,000 is to be expended on a bridge to span the Patapsco River at this place.

Elizabeth, Pa.—It has been recommended by the Committee on the Banta Bridge, at Roselle, that the present structure be replaced by a new iron beam bridge, and the Supervisors have adopted the recommendation.

Lincoln, Neb.—A proposition has been submitted to the City Council by the Missouri Pacific, Fremont, Elkhorn and Missouri River roads, to construct two viaducts, at a total cost of $30,000.

Bridges.—See our Proposal Columns for information regarding bridge construction at the following places: Rochville, Mo.; Joliet, Ill.; Zanesville, O.; Willimansette, Mass.; Marble Falls, Tex.

NEW DEPOTS.

St. Louis, Mo.—President Taussig, of the St. Louis Terminal Board, can give information of the proposed construction of a new union depot in this city.

Little Rock, Ark.—The Iron Mountain Railroad will build a $50,000 round-house here.

STREET-WORK AND PAVING.

Newark, O.—The Council has instructed the engineer to prepare plans for a considerable amount of street paving for next season.

Columbus, O.—Considerable street paving is to be done at this place.

Arkansas Pass, Tex.—Street improvements are to be made at this place, at a cost of $15,000.

Houston, Tex.—The City Council has authorized the paving of several streets of this city. The City Engineer can furnish particulars.

Flushing, N. Y.—The sum of $45,000 is to be expended on paving the principal streets of this place.

GAS AND ELECTRICITY.

Rushville, Ill.—The electric lighting plant projected for this place will be constructed at once.

Pittsfield, Mass.—The sum of $25,000 is to be expended on an electric light plant for this place.

Mare Island, Cal. — The Thomson-Houston Electric Company has been awarded the contract for erecting the electric light plant at this place. The plant is to be finished within five months, and is to cost $44,900: it will consist of one 30-light arc dynamo, 2,000 candle-power; 27 arc lamps (double), and all accessories; 2 incandescent dynamos of 1,300 and 650, 16 candle-power light capacity.

Cambridge, O.—Owing to expiration of contract, the Western Electric Company has taken down all arc lamps in this city, they refusing to take less than former price, $72 per lamp. Bids for lighting the city will be asked for at once.

Sturgis, S. D.—An electric light plant is to be established at this place.

Branford, Ont.—An electric light plant is to be established at this place, at a cost of $15,000. Stony Creek and Short Beach, suburbs of this city, are also to be lighted.

Leighton, Pa.—The Carbon County Manufacturing Company has been organized, with a capital stock of $50,000, to start an ice factory and an electric-light plant.

Titusville, Fla.—The electric light plant projected for this place is to be established at once. For particulars address S. F. Gray, as above.

San Francisco, Cal.—The Mutual Gas and Electric Light Company has been incorporated here, with $3,000,000 capital. Directors, Israel W. Knox, Edward Bosqui, and others.

Shamokin, Pa.—It has been decided to establish an electric light plant at this place.

Hannibal, Mo.—The City Council, at a special meeting held October 20, decided to submit to a vote of the people a proposal to issue bonds amounting to $20,000 to increase the power of the electric light plant from 100 to 300 horse-power, to the end that an incandescent light plant may be put in and operated in connection with the present arc light plant owned by the city.

Cramer's Hill, N. J.—The contract for the electric light has been given to the National Electric Light Company of Philadelphia.

Little Falls, N. Y.—It is proposed to establish a system of electric lighting at this place. Address for particulars, Alderman John H. Kane, as above.

Waterford, N. Y.—The question of introducing an electric light plant is being discussed by the local officials.

Electric Railroads.—New electric railroads are projected and improvements are to be made to those already established at the following places: Bethlehem, Pa.; Providence, R. I.; Northfield, Conn.; Gardiner, Mass.; New Bedford, Mass.; Boise City, Idaho; Ottawa, Ont.; Rochester, N. Y.; Austin, Tex.; Middleboro, Mass.; Whitinsville, Mass., Danvers, Mass.; Gloversville, N. Y.; Wilmington, Del.

GOVERNMENT WORK.

Sedalia, Mo.—The following proposals for the erection and completion, except heating, of the post office building at this place were opened October 28, by the Supervising Architect of the Treasury Department: Martin Hendricks, Washington, D. C., $34,837.22; R. K. Allen & Son, St. Joseph, Mo., $35,500; V. Jobst, Peoria, $38,791; W C. Green Brick Co., Wichita, $37,497; W. H. Stemberg, Wichita, $41,979; Anderson Bros., Wichita, $48,900; W. P. Cousley, Sedalia, $49,187; Clark, Raffen & Co., St. Louis, $62,353; L. L. Leach & Sons, Chicago, $45,473; Mode & Stewart, Sedalia, $46,696.

BIDS OPENED.

New York City.—The Board of Trustees of the Hall and Asylum Fund, F. & A. M., have accepted the bid of Dickison & Allen, of Syracuse, N. Y., at $134,500, for the construction of the Masonic Home and School at Utica, upon the park on the confines of that city, now the property of the Fraternity of the State of New York. There were 18 bids received from builders in Massachusetts, Connecticut and this State. The highest bid was $174,000, and the lowest $130,000, but the latter was not considered, for the reason that it was unaccompanied by securities, as called for by the Trustees in their call for bids for the work. The plans for the proposed structure were prepared by architect W. H. Hume, of New York City.

Mendocino, Cal.—Proposals for erecting the State Insane Asylum at this place have been opened, as follows:

Masonry work: Bateman Bros., $115,000; P. R. Wells, $135,055; Richardson & Gale, $110,000; Dennis Jordan, $130,000; A. McElroy, $119,400; A. J. Meany, $112,900; C. Ferris, $104,900, McGowan & Butler, $103,900.

Roofing and galvanized iron work: W. B. Glen, $14,500; W. Cronan, $15,999; Mangran & Otter, $19,237.

Plumbing work: Henry Williamson, $14,450; Joseph Risk, $15,990; J. J. Lawton, $13,321.

Carpenter work: Bateman Bros., $50,800; J. H. McKay, $58,700; Robert McKillican, $68,500; F. M. Mason, $66,000; A. L. Campbell, $53,875; A. McElroy, $59,000; Ingerson & Gore, $59,600.

Contracts were awarded as follows: Masonry work—McGowan & Butler, $103,900; roofing and galvanized iron work—W. B. Glen, $14,500; plumbing work—J. J. Lawton, $13,321; carpenter work—Bateman Bros., $50,800. Total amount of contracts, $182,521.

RAILROADS CANALS ETC.

St. Paul, Minn.—A street car line is proposed from the end of Race Street to Lake Owasso. D. D. Merrill, R. F. Marvin and S. G. Sloan are interested.

INDUSTRIAL.

Wabash, Ind.—The Indiana Steel Company will erect a steel plant here.

Clinton, Ia.—Our correspondent writes: "The City Engineer is preparing plans for a $100,000 plant for the manufacture of street paving and building brick."

Lowell, Mass.—The Shaw Stocking Company will double the capacity of their works.

Madison, Ill.—Railroad car works, to cost about half a million dollars, will be erected here. The Merchants' Terminal Bridge Railway Company, of St. Louis, Mo., are interested in the enterprise.

Seattle, Wash. — The Commission of United States engineers appointed to have charge of the survey for a ship canal to connect Lakes Union, Washington and Samomosh, consisting of Col. G. H. Mendell, Major T. H. Handbury and Capt. T. W. Symons, have held a meeting and placed the matter in the hands of Captain Symons, who has employed Philip G. Eastwick to superintend the work.

Pell City, Ala.—A company, with a paid up capital of $200,000, has been formed for the purpose of erecting a plant at this place for the manufacture of all kinds of iron pipe and plumbing fixtures. Operations are expected to begin within 90 days.

Building Intelligence.

NEW YORK.

230–36 E 21st st, 4 br flats; cost, $23,000; o, C Ruff; a, Schneider & Herter.

113th st, s s, 100 e 5th av, 4 br flats; cost, $22,000 each; o, J S Scott; a, J C Burne.

116th st, n s, 50 e Madison av, 2 br and st flats; cost, $25,000 each; o, P J Quinn; a, J W Cole.

1105 3d av, br flat; cost, $25,000; lessees, Weil & Mayer; a, Schneider & Herter.

72d st, s s, 44.11 w Boul, 4 st dwells; cost, $80,000 each; o, W Miller; a, W H Boylan.

83d st, s s, 175 w Columbus av, stone flat; cost, $22,000; o, W Rankin; a, J W Cole.

8th av, n e cor 118th st and s e cor 119th st, 2 br flats; cost, $16,000 each; o and b, P Braender; a, W Graul.

8th av, e s, 25 11 n 118th st, 6 br flats; cost, $11,000 each; o, a and b, same as above.

133d st, n s, 300 e 7th av, 2 br flats; cost, $22,000 each; o, W J Gilmore; a, J C Burne.

119–21 W 141st st, br and st flat; cost, $25,000; o, Jane Moncrief; a, D & J Jardine.

Tiebout av, w s, 50 s Clark st, Valentine av, e s, 25 s Clark st, 5 fr dwells; cost, $3,100 each; o, W H Duncan; a, D W King; c, Perry & Schoonmaker.

115 st, nr Madison av, 3 br flats; cost, $85,000 all; o, T White; a, B Walther.

S s 119th st, 46 e Lenox av, 7 br dwells; cost, $84,000 all; o, J E Rogers; a, F Wiennermer.

E s 11th av, 25 n 64th st, br dwell; cost, $10,000; o, T F Devine; a, H P Seybert,

BUILDING INTELLIGENCE.

ALTERATIONS—NEW YORK.

109 E 15th st, extension; cost, about $12,000; o, The L B Brewers' Board of Trade; a, Weber & Drosser.

8th av, w s, 49th to 50th st, interior alterations; cost, $7,000; o, 8th Av R R Co; a, J W Cole; c, G L Haag.

E s Centre st, bet Canal and Walker sts, br factory; cost, $15,000; o, O D Munn; a, Lamb & Rich.

541–47 Pearl st, br factory; cost, $15,000; o, E Faber; a, R Berger.

BROOKLYN.

Bainbridge st, n e cor Saratoga av, brownstone store and flat; cost, $9,000; o, Samuel R Good; a, H A Sibley.

48th st, s s, 100 e 4th av, 3 fr dwells; cost, $3,000 each; o, Stephen Hazard; b, E J Gildersleeve.

E s Central av, 25 s Woodbine av, 6 frame dwells; cost, $30,000 all; o and a, E B Sturges.

E s Waverly av, 60 n Greene av, 2 br dwells; cost, $20,000 all; o, Geo W Phillips, Jr; a, Danmar & Fischer.

S s 51st st, 180 w 3d av, 2 br dwells; cost, $7,000 all; o, M Dalton; a, not given.

N e cor Willoughby and Grand avs, br factory; cost, $39,600; o, Morris Bldg Co; a, Benj Wright.

N w cor Jefferson av and Marcy av, br dwells; cost, $12,000; o, J Gaddington; a, F D Vrooman.

S s Marshall st, 150 E Gold st, br dwells; cost, $8,000; o, Atlantic White Lead Co; a, W N Rae.

S s S 4th st, 275 e Keap st, br dwells; cost, $9,000; o, Hugh Fehling; a, Th Engelhardt.

S e cor 5th av and 38th st, br dwells; cost, $8,000; o, R Wahler; a, J R Schoonorn.

N s Montrose av, 155 E Bushwick av, 3 fr dwells; cost, $18,000 all; o, Maurer & Heilmann; a, Th Engelhardt.

W s 7th av, 30 s Carroll st, 4 br dwells; cost, $36,000 all; o, C B Sheldon; a, not given.

S s S 4th st, 165 w Hooper st, br dwell; cost, $9,000; o, H Buermann; a, Th Engelhardt.

E s 5th av, 25 S 14th st, br dwells; cost, $10 000; o, W Schink; a, G M Miller.

10th st, s s, 285.9 w 8th av, 6 br flats; cost, $4,000 each; o, o, L Bonard; a, R Dixon.

Flushing av, s e cor Franklin av, br beer brewery; cost, $75,000; o, George Malcolm; a, O C Wolf; b, W and T Lamb.

243 Floyd st, store and ten; cost, $9,000; o, H Ritting; a, F Holmberg.

Belmont av, s s, 20 e Atkins av, 4 fr dwells; cost, $8,800, o, Donald and Mary E Laing; b, D Laing.

120 1st pl, s s, 225 e Court st, br ten; cost, $11,000; o, James Finlay; a, J J Kierst & Co; m, Kierst & Finlay.

W s Shepherd av, 180 n Ridgewood av, 6 fr dwells; cost, $15,000 all; o and a, J Graham.

N s Bainbridge st, 23 e Saratoga av, 5 br dwells; cost, $20,000 all; o, S R Good; a, H A Sibley.

S s Cooper st, 100 w Bushwick av, 2 br dwells; cost, $14,000 all; o, E Sutterlin; a, C Infanger.

W s Albany, 21 n Butler st, 8 br dwells; cost, $32,000 all; o, Taber & Carr; a, A Hill & Son.

N s Macon st, 180 e Reid av, br dwell; cost, $7,500; o, F C Swimm; a, A Hill & Co.

E s Ocean pl, 18 n Atlantic av, 5 fr dwells; cost, $10,000 all; o, Hannah Hodge; a, W H Adams.

S s Woodbine st, 80 w Knickerbocker, 5 fr dwells; cost, $14,000 all; o, A Buckmeier; a, A Buckman.

S s Moore st, 496 e Bushwick av, 2 fr dwells; cost, $15,000 all; o, B Schaffner; a, F Holmberg.

S s Quincy st, 24 w Throop av, 4 br dwells; cost, $20,000 all; o, W Gibson; a, I D Reynolds & Son.

N s Herkimer st, 20 w Saratoga, av, 6 br dwells; cost, $30,000 all; o, G H Gibley; a, E Nesher.

W s Oakland st, 240 n Van Cott av, 2 fr dwells; cost, $9,000 all; o, S E Walker; a, F Weber.

S s S 5th st, 150 w Union st, br dwell; cost, $10,000; o, F Kremeyer; a, F Holmberg.

BUILDING INTELLIGENCE.

BROOKLYN.—Continued.

E s Bedford av, 60 n Atlantic av, 5 br dwells; cost, $17,500 all; o, R O Frost; a, F B Langston.

S s Garnet st, 100 e Court st, 4 br dwells; cost, $20,000 all; o, A C Hartington; a, G C Gillespie.

S s Madison st, 100 e Hamburg av, 12 fr dwells; cost, $33,000 all; o and a, G A Craig.

N s St Mark's av, 375 w Franklin av, 3 br dwells; cost, $12,000 all; o and a, H Toulmine.

MISCELLANEOUS.

ABINGDON, VA.—The Abingdon Development Company will shortly erect 20 tenements at this place.

ANNISTON, ALA.—A brass and plumbers' supply foundry is to be erected at this place. R. H. Cobb, as above, can furnish particulars.

ARKANSAS CITY, ARK.—The Kentucky and Arkansas Land and Improvement Co will erect a hotel here, to cost about $20,000.

AUSTIN, TEX.—A cotton mill, to cost $500,000, is to be erected here.

BIRMINGHAM, ALA.—A stock company has been organized to erect a cotton factory here.

A school bldg is also to be erected, at a cost of $40,000. Address Messrs Thompson & Hutchinson for particulars.

BOERNE, TEX.—A stock company is about to erect a hotel at this place.

CHARLOTTE HARBOR, FLA.—A new Methodist Church is to be erected at this place.

CHICAGO, ILL.—3742–44 Wabash av, br flats; cost, $15,000; o, B F Ferguson; a, J W Ackermann; b, E Slattery & Son.

1236–38 Fairfield av, br store and flats; cost, $25,000; o and b, Jas Arnold; a, D A Lapointe.

563 W 14th, br flats; cost, $8,000; o, Miss M Krast; a, F Foening; b, G Bahmann.

12–14 Throop av, br dwell; cost, $10,000; o, Sydney Walker; a, C L Stiles; b, C Carpenter.

594–98 Ogden av, br store and flats; cost, $16,000; o, A E Jacobs; a, J Bongard; b, J Wagner.

109 S Jefferson, br factory; cost, $35,000; o, Spoor & Webb; a, Treat & Foltz; b, Lotz & Thomson.

4201–03 Ellis av, br flats; cost, $28,000; o, C J Blomstrom; a, Ostling Bros; b, Oscar Anderson & Co.

4421–29 Buckley av, br flats; cost, $10,000; o, Bennett & Pullen; a, Jas Ray.

5037 Madison av, br dwell; cost, $8,000; o, David Quigg.

550 67th, br flats; cost, $11,000; o, Greblock & Penhallegon; a, Fred Ahlschloger.

402 47th, br store and flats; cost, $12,000; o, P Corcoran; a, J F & J P Doerr; b, M McCarthy.

Winter and 80th, br flats; cost, $9,000; o, S Domby & Anderson.

6650 State, br store and flats; cost, $8,000; o, Timothy Judge; a, H Van Pelt; b, Moore Bros.

635–7 Harvard, br dwell; cost, $8,000; o, Mrs Mary A Carson; a, Small & Bishop.

632–34 Noble, br store and flats; cost, $15,000; o, Paul Patkonski; a, Bauer & Hill; b, Theo Owstrowski.

480 N Clark, br store and flats; cost, $11,000; o, Alex F Stevenson; a, Frohman & Jebsen; b, Jno Woodstrom.

636 Wells, br store and flats; cost, $13,000; o, Aug Gross; a, J Huber; b, C Thiele.

3d av, bet 12th and 14th, br addn to freight depot; cost, $18,000; o, Wabash R R.

200-12 Jay, school-house; cost, $60,000; o, Board of Education; a, C Rudolph; b, F A Johnson.

Lincoln and Belmont avs, br store and flats; cost, $16,000; o, Adolph Westerndorf.

34–36 Sidney court, br dwell; cost, $13,000; o, Jas O'Malley; a, Ostling Bros; b, McGraw & Muller.

BUILDING INTELLIGENCE.

CHICAGO, ILL.—1384–1406 W Congress, br flats; cost, $60,000; o, Sister Eliz Cooley.

521 W 18th, front addn; cost, $13,000; o, V Kolan; a, A Charvat; b, V Huber.

Washington, near Canal, br manufactory; cost, $45,000; o, Jas H Marten; a, Howe & Shelton.

Monroe, near Clark, remodeling store bldg; cost, $25,000; o, Rand & McNally; a, Thos W Wing.

44th, near Drexel boul, st and br dwell; cost, $22,000; o, Mrs E F Skinner; a, I K & A B Pond.

Cor Belden av and Larabee, br and st apartment house; cost, $45,000; o, W L Prettyman; a, L G Hallberg.

State, near Schiller, st and br dwell; cost, $14,000; o, Mrs A M Chetlain; a, L G Hallberg.

171 buildings less than $7,000 in value.

CLEVELAND, O.—Mr. Schweinfurth, architect, of this city, has plans on the boards for a cathedral, parish house, and church house to be erected here.

80–84 Euclid av, pressed br business bldg; cost, $18,000; o, R Cohen; a, F C Bate; b, E J Rickards.

COATESVILLE, PA.—At a recent congregational meeting plans for the new Presbyterian Church were adopted. Steam heat will be introduced and all modern improvements. The pastor of the church is Rev Henry A MacKubbin.

COLUMBUS, O.—Locust cor 5th, br business bldg; cost, $11,000; o, A H Packard.

31 dwells; cost, $61,600.

DANVILLE, KY.—Crapsey & Brown, architects, of Cincinnati, O., are preparing plans for a $15,000 school building to be erected at this place.

FERNANDINO, FLA.—A cold storage warehouse and ice factory is to be erected at this place by a stock company.

FINDLAY, O.—Presbyterian Congregation will build a $40,000 church in the spring. No plans have been accepted; R M Mitchell, Pastor.

FISHER'S ISLAND, CONN.—Plans are being prepared for a large hotel, to be erected at this place by G. Hoppes.

GLASSBORO, N. J.—Whitney Brothers are about to erect 20 dwellings at this place.

HARTFORD, CONN.—The plans and specifications for the new building of the Board of Trade Room and Power Co, of Hartford, are now ready and may be seen at the office of the Hartford Screw Co. The building is to be of brick and brownstone, and will be located on the corner of Capitol Avenue and Woodbine Street. The plans were constructed under the supervision of George E Witherell, mechanical engineer of the Hartford Machine Screw Co, and the whole has been under the general supervision of Mr George A Fairfield, president of the company and chairman of the building committee, who can furnish particulars.

HOT SPRINGS, ARK.—An extensive addition is to be made to Hotel Eastman, at this place, by Messrs. Sithen & Daw.

JOHNSTOWN, PA.—Walnut st, br bldg; cost, $12,000; o, Congregational Church; a, Smith & Robinson; b, William Lloyd & Son.

KIMBALL, TENN.—S M Patton Chattanooga, Tenn., has plans completed for hotel, at this place, to cost $125,000. Separate contracts will be let for heating, plumbing, elevators, etc.

Also hotel at Tallapoosa, Ga., to cost $100,000.

LEAMINGTON, ONT.—2-story br schoolhouse; cost, $11,000; o, Board of Education; a, Albert E French, Detroit, Mich; b, not let.

MARION, PA.—An opera house is to be erected here at a cost of $25,000.

MEADVILLE, PA.—A hospital, to cost $10,000, is to be erected in this city.

MERIDEN, CONN.—High School av, 3-story br bldg, 2 stores, 2 tens; cost; $6,600; o, R Hicks; a, H M Jones; b, James Kane & Son.

BUILDING INTELLIGENCE.

MIDDLETOWN, CONN.—The city officials have instructed J M Hubbard to secure plans for a town and county building.

MILWAUKEE, WIS.—Broadway and Mason st, office bldg; cost, $40,000; o, Wisconsin Telephone Company; a, Ferry & Clas; b, P Dunn.

MINNEAPOLIS, MINN.—325 1st av S, br office bldg; cost, $27,500; o, A McKay; a, J Haley.

230 Oak Grove st, br and fr dwell; cost, $12,000; o, E S Kendrick; a, Mr Joy; b, A McMullen & Co.

Cor 2½ st and 20th av S, br church; cost, $10,000; o, Westminster Presbyterian Church; a, Chas E Sedgwick; b, Emil Bruce.

745–7 Washington av N, br wholesale blk; cost, $37,500; o, James & Byrnes; a, Edw S Stebbins.

River bank at foot of Plymouth av, fr sawmill; cost, $40,000; o, Leighton & Barrows.

113 University av S E, br ven ten; cost, $10,000; o and a, J A Wright.

MOUNT HOLLY, N. J.—The Mount Holly Carpet Mills have been purchased by James Dunlap & Co., of Philadelphia, and additional buildings will be erected at once.

NEW DECATUR, ALA.—A furniture factory is to be erected at this place by a recently organized stock company.

ORLANDO, FLA.—Reports say that Mayor Marks is to establish a cigar factory at this place.

PETITE COTE, ONT.—2-story fr hotel; cost, $8,000; o, Albert Chapus; a, Albert E French, Detroit; b, not let.

PHILADELPHIA, PA.—189 Bringhurst st, shop; o, Thos Why & Son.

S s Wysteria st, e Miller st, 8 dwells, b, Jas Hillyer.

N w cor Boyer and Duane st, 2 dwells; b, Lamb & Wilson.

E s Broad st, s Tioga st, Masonic Home; b, Jos Bird.

W s 30th st, s Chestnut st, office bldg; b, Lewis Havens.

S s 48th st, e Gray's Ferry av, 4 dwells; b, Isaac Wood.

S s 50th st, e Willow av, dwell; b, John F Newlin.

S s Hight st, e Cedar st, dwell; b, Jno O Broadbent.

S s Eleanor st, w 2d st, dwell; b, Lewis B Bitters.

W s 35th st, n Wharton st, 6 dwells; o, Wm Marshall.

W s 9th st, n Jefferson st, 7 dwells; b, Robt Kaighn.

S s Market st, w 21st st, storehouse; b, W J Kelly.

2412 N Front st, dwell; b, Ed Malloy.

E s Emma st, s Abigail st, 3 dwells; b, Jas McNutt.

E s 4th st, n Poplar st, dwell; b, Porter & Thompson.

E s 8th st, cor Ginter av, shop; b, John Weile.

Ann, Jane and Chatham sts, 18 dwells; o, C W Cox.

E s Venango st, n Del av, warehouse; o, M L Shoemaker.

POINT MARION, PA.—It is proposed to erect a new school building at this place. Address Mr. Gans for particulars.

POTSDAM, N. Y.—Ives Bros are about to build three additional stores to the ones now building; stone fronts, 3 stories high; cost, $15,000 to $18,000; a, J P Johnston, Ogdensburg, N. Y.

PROVIDENCE, R. I.—Bowen st, 2 fr dwells; cost, $8,000; o, P H and M E Mason; b, H L Bassett.

Atwells av, 2 fr dwells; b, Watts Bros.

N Main and Corn sts, br and st fire station; cost, $15,000; o, City of Providence; b, H L Bassett.

Sycamore st, 2 fr dwells; o, Susan Harrington; b, W Sherman.

Sutton st and Broadway, Queen Anne cottage; cost, $10,000; o, W A Waldon; b, Henry R Evans.

Beacon av and Frank st, school-house; cost, $25,000; o, City of Providence; b, Richard Hayward.

BUILDING INTELLIGENCE.

RED BANK, N. J.—A new Baptist church is to be erected at this place. For particulars address the Rev J K Manning, pastor, as above.

ROCKWOOD, TENN. — The Rockwood Hotel Company will erect a hotel, to cost $30,000, from plans prepared by W H Floyd, of Chattanooga, Tenn.

SHARON HILL, PA.—A new Methodist church is to be erected at this place.

SIOUX CITY, IOWA.—14th and Pearl sts, stone dwell; cost, $15,000; o, C Bruen; a, C P Brown; b, not let.

11th and Pearl sts, fr dwell; cost, $8,000; o, W Lerch; a, same as above.

SOUTH AMBOY, N. J.—A new Baptist church is to be erected here.

SPRINGFIELD, O.—Cor Limestone and Main sts, stone front bldg; cost, $50,000; o, Gotwalt.

STEELTON, PA. — The Pennsylvania Steel Company contemplates erecting a foundry at this place, and the company's draughtsman is now preparing the plans.

ST. LOUIS, MO.—Lindell av and Sarah st, br dwell; cost, $10,000; o, W A Stephens; b, C G Ewing.

Morgan st and Ewing av, br flats; cost, $8,500; o and b, J J Biszant.

S w cor Leffingwell and Lucas avs, br store and dwell; cost, $25,000; o, Geo Sauerburn; b, P Riechers.

Geyer and Missouri avs, br shop; cost, $12,000; o, U D Ry Co; b, Wm Cochran & Son.

ST. LOUIS, MO.—The Mercantile Club will erect a $250,000 club house. Judge John H Terry, J B Case and others, are interested in the enterprise.

ST. PAUL, MINN.—Richmond near Clay, kitchen laundry, bedrooms and boiler house; cost, $40,000; o, City Hospital Commission.

North near John, completion 3-story br school house; cost, $14,000; o, St Mary's Church.

TACOMA, WASH.—Inspector Forbes has issued a permit to the city for the new city hall to be erected at the corner of 9th and C sts. Hatherton & McIntosh are the architects, John T Long contractor. The cost of the building is estimated at $300,000.

TALLAPOOSA, GA.—A hotel, to cost, $100,000, is to be erected at this place from plans by Architect S M Patton, of Chattanooga, Tenn.

TERRELL COUNTY, GA.—This county has decided to erect a $30,000 court-house.

THURLOW, PA.—The members of the A. M E Zion Church will erect a new edifice at this place.

VERONA, N. J.—Grove av, fr dwell; cost, $6,000; o, Dr H B Whitehorne; a, Harry L Yost; b, not let.

WACO, TEX.—City hospital; cost, $11,000; o, City; a, W W Larmour; b, B Louguth.

WASHINGTON, PA. — A new Baptist church is to be erected at this place.

WATERBURY, CONN.—A new public school building is to be erected at this place.

WHEELING, W. VA.—J B Hall, 2212 Market st, is preparing plans for a bank bldg, to cost $15,000. The material will be brick and stone, open grates, tiling, etc.

WINTER PARK, FLA.—The sum of $25,000 is to be expended in improving the Winter Park Hotel at this place.

BUILDINGS.—There is nothing over $7,000 to report at the following places: Ogdensburg, N. Y.; Clinton, Iowa; Poughkeepsie, N. Y.; Topeka, Kan.; Harrisburg, N. Y.; Galveston, Tex.; Worcester, Mass.; Geneva, N. Y.; Allegany, N. Y.; Bay City, Mich.; Wilkesbarre, Pa.; Charleston, S. C.; Baltimore, Md.; Knoxville, Tenn.; Dayton, O.; Bethlehem, Pa; Newark, O.; Saginaw, Mich.; Warren, O.; Canton, O.; New Haven, Conn.; Springfield, O.

PROPOSALS.

(Continued from page ii.)

PROPOSALS FOR IMPROVING ENTRANCE to Galveston Harbor.—U. S. Engineer Office, Galveston, Tex., October 25, 1890.—Sealed proposals, in duplicate, will be received at this office, until 12 o'clock, noon, 90th Meridian time, December 27, 1890, and then opened for delivery of materials in place for improving the entrance to GALVESTON HARBOR, TEX. Preference will be given to materials of domestic production or manufacture, conditions of quality and price (import duties included) being equal. The attention of bidders is invited the Acts of Congress approved February 26, 1885, and February 23, 1887, Vol. 23, page 332, and Vol. 24, page 414, U. S Statutes at Large. For blank forms, for proposals and all necessary information, apply to CHAS. J. ALLEN, Major, Corps of Engineers. 22-23-24

PROPOSALS FOR ROCK EXCAVATION and dredging, U. S. Engineer Office, Cleveland, O., October 14, 1890.—Sealed proposals, in duplicate, will be received at this office until 12 o'clock M., MONDAY, November 3, 1890, at which time they will be opened in presence of bidders, for **ROCK EXCAVATION** and **DREDGING** at ASHTABULA HARBOR, O. All information can be obtained at this office. The United States reserves the right to reject any or all proposals. Preference will be given to materials and plant of domestic production or manufacture, conditions of quality and price (import duties included) being equal. The attention of bidders is invited to the Acts of Congress approved February 26, 1885, and February 23, 1887, Vol. 23, page 332, and Vol. 24, page 414, Statutes at Large. L COOPER OVERMAN, Major of Engineers. 22

U. S. ENGINEER OFFICE, 905½ EAST MAIN Street, Richmond, Va., October 13, 1800.—Proposals for **DREDGING** and excavating rock from the channel of the James River near RICHMOND, VA., for the construction of mattress dykes and jetties, will be received until noon of December 9, 1890, and then opened. Attention is invited to Acts of Congress approved February 26, 1885, and February 23, 1887, Vol. 23, page 332, and Vol. 24, page 414, Statutes at Large. Information can be had on application to Mr. C. P. E. Burgwyn, 905½ E. Main Sreet, Richmond, Va. WM. P. CRAIGHILL, Colonel, Corps of Engineers, U. S. A. 23

BREAKWATER AT NEW HAVEN, CONN.—Engineer Office, U S Army, Room 74, Army Building, 39 Whitehall Street, New York, November 1, 1890.—Sealed proposals, in triplicate, for construction of a breakwater at NEW HAVEN, CONN., will be received at this office until twelve (12) o'clock noon, on TUESDAY, December 2, 1890. The attention of bidders is invited to Acts of Congress approved February 26, 1885, and February 23, 1887, Vol. 23, page 332, and Vol. 24, page 414, Statutes at Large. Further information can be obtained at this office. D. C. HOUSTON, Colonel of Engineers. 25

OCTOBER 24, 1800.

SEALED PROPOSALS WILL BE RECEIVED at the office of the Supervising Architect, Treasury Department, Washington, D. C., until 2 o'clock P. M., on the 18th day of November, 1890, for all the labor and materials required for the **JOINERY WORK, WOOD FLOORING,** etc., for the U. S. Court-House and Post-Office building at PITTSBURG, PA., in accordance with drawings and specification, copies of which may be had on application at this office or the office of the Superintendent. Each bid must be accompanied by a certified check for $500. The Department will reject all bids received after the time herein stated for the opening of the same; also, bids which do not comply strictly with all the requirements of this invitation. Each proposals must be inclosed in an envelope, sealed and marked, "Proposal for the Joinery Work, Wood Flooring, etc., for the U. S. Court-House and Post-Office building at Pittsburg, Pa.," and addressed to JAS. H. WINDRIM, Supervising Architect. 23

TREASURY DEPARTMENT, U. S. LIFE-Saving Service, Washington, D. C., October 22, 1890.—Sealed proposals will be received at this office until 2 o'clock P. M. of WEDNESDAY, November 5, 1890, for the construction of two LIFE-SAVING STATIONS, one on FENWICK'S ISLAND, DELAWARE, one and a half miles north of the light, and one near OCEAN CITY, MARYLAND. Proposals will be received for one or both stations, and bidders proposing for both should state for what sum they will build each alone, and for what sum the two. Plans and specifications containing full information, and forms of proposals, can be obtained from the Collector of Customs, Wilmington, Delaware, Superintendent Fifth Life-Saving District, Onancock, Virginia; Superintendents of Construction, Life-Saving Stations 24 State Street, New York City, and upon application to this office. HORACE L. PIPER, Acting General Superintendent, D. T. J. 22

OCTOBER 25, 1890.

SEALED PROPOSALS WILL BE RECEIVED at the office of the Supervising Architect, Treasury Department, Washington, D. C., until 2 o'clock P. M., on the 19th day of November, 1890, for all the **LABOR AND MATERIALS** required to furnish and fix in place complete the low pressure, return circulation, steam heating and ventilating apparatus, and to complete the plumbing of the U. S. Court-House, Post-Office, etc., building at WINONA, MINN., in strict accordance with the drawings and specification, copies of which may be had on application at this office or the office of the Superintendent at Winona Minn. Each bid must be accompanied by a certified check for $300. The Department will reject all bids received after the time herein fixed for opening the same; also, all bids which do not comply strictly with all th requirements of this invitation. Proposals must be inclosed in envelopes, sealed and marked, "Proposal for Low-Pressure, Steam Heating and Ventilating Apparatus, and for completion of the Plumbing of the U. S. Court-House, Post-Office, etc., building at Winona, Minn," and addressed to JAS. H. WINDRIM, Supervising Architect. 23

PROPOSALS.

U. S. ENGINEER OFFICE, BOSTON, MASS., October 15, 1890.—Sealed proposals, in triplicate, will be received at this office until noon of November 21, 1890, for **DREDGING** from HINGHAM HARBOR, MASS., 20,000 cubic yards, more or less, of material. Attention is invited to the Acts of Congress approved February 26, 1885, and February 23, 1887, Vol. 23, page 332, and Vol. 24, page 414, Statutes at Large. For full information apply to S. M. MANSFIELD, Lieut.-Col. of Engineers. 23

U. S. ENGINEER OFFICE, BOSTON, MASS., October 15, 1890. Sealed proposals, in triplicate, will be received at this office until noon of November 21, 1890, for DREDGING, from WEYMOUTH RIVER, MASS., 25,000 cubic yards, more or less, of material. Attention is invited to the Acts of Congress approved February 26, 1885, and February 23, 1887, Vol. 23, page 332, and Vol. 24, page 414, Statutes-at-Large. For full information apply to S. M. MANSFIELD, Lieut. Col. of Engineers. 23

PROPOSALS FOR CONSTRUCTION.—U. S. Engineer Office, 89 Euclid Avenue, Cleveland, O., October 14, 1890.—Sealed proposals, in duplicate, will be received at this office until 12 o'clock M. on MONDAY, November 3, 1890, when they will be opened in presence of bidders, for constructing 450 lineal feet, more or less, of the structure of east **BREAKWATER** at CLEVELAND, O. All information can be obtained at this office. The United States reserves the right to reject any or all proposals. Preference will be given to materials and plant of domestic production or manufacture, conditions of quality and price (import duties included) being equal. The attention of bidders is invited to the Acts of Congress, approved February 26, 1885, and February 23, 1887, Vol. 23, page 332, and Vol. 24, page 414, Statutes-at Large. L. COOPER OVERMAN, Major of Engineers. 22

PROPOSALS FOR DREDGING.—UNITED States Engineer Office, Cleveland, O., October 14, 1890.—Sealed proposals, in duplicate, will be received at this office until 12 o'clock M. on MONDAY, the 3d day of November, 1890, and then opened, for **EXCAVATING** 240,000 cubic yards, more or less, of material from SANDUSKY BAY along line of proposed straight channel for Sandusky Harbor, O. Preference will be given to materials and plant of domestic production or manufacture, conditions of quality and price (import duties included) being equal. The attention of bidders is invited to Acts of Congress approved February 24, 1885, and February 28, 1887, Vol. 23, page 332, and Vol. 24, page 414, Statutes at Large. All information can be obtained at this office. The United States reserves the right to reject any or all proposals. L. COOPER OVERMAN, Major of Engineers. 22

U. S. ENGINEER OFFICE, ST. AUGUSTine, Florida, October 15, 1890. Sealed proposals, in triplicate, for furnishing materials and constructing **JETTIES** at the mouth of ST. JOHN'S RIVER, Fla., will be received at this office until 12 o'clock, noon, standard time, on November 15, 1890, and then be opened immediately. For all information apply to this office. The attention of bidders is invited to the Acts of Congress approved February 26, 1885, and February 23, 1887, Vol. 23, page 332, and Vol. 24, page 414, Statutes at Large. W. M. BLACK, Captain, Corps of Engineers, U. S. A. 23

U. S. ENGINEER OFFICE, CHARLESTON-Kanawha, W. Va., September 29, 1890.—Proposals for building the **FOUNDATIONS**, and the pier, abutment, etc., for a movable dam at lock No. 7 of the great KANAWHA RIVER improvement, will be received at this office until 3 P. M. of December 3, 1890, and then opened. The attention of bidders is called to the Acts of Congress approved February 26, 1885, and February 23, 1887, Vol. 23, page 332, and Vol. 24, page 414, Statutes at Large. Information can be obtained by application to ADDISON M. SCOTT, Resident Engineer. WM. P. CRAIGHILL, Colonel of Engineers, U. S. A. 23

U. S. ENGINEER OFFICE, 18 W. SARATOGA Street, Baltimore, Md., September 30, 1890.—Proposals for completing the **SHIP-CHANNEL** leading to the harbor at Baltimore, will be received until noon of December 2, 1890, and then opened. The attention of bidders is invited to the acts of Congress approved February 26, 1885, and February 23, 1887, vol. 23, page 332, and vol. 24, page 414, Statutes at Large. For information apply to WM. P. CRAIGHILL, Colonel Corps of Engineers, U. S. A. 22

U. S. ENGINEER OFFICE, BOSTON, MASS., October 15, 1890.—Sealed proposals, in triplicate, will be received at this office until noon of November 22, 1890, for **DREDGING** from SCITUATE HARBOR, MASS., 30,000 cubic yards, more or less, of material. Attention is invited to the Acts of Congress approved February 26, 1885, and February 23, 1887, Vol. 23, page 332, and Vol. 24, page 414, Statutes at Large. For full information apply to S. M. MANSFIELD, Lieut.-Col. of Engineers. 23

OCTOBER 17, 1890.

SEALED PROPOSALS WILL BE RECEIVED at the office of the Supervising Architect, Treasury Department, Washington, D. C., until 2 o'clock P. M., on the 14th day of November, 1890, for all the labor and materials required to do all the **DECORATIVE PAINTING**, etc., for the first, second, and attic stories and main stairway hall of the U. S. Post-Office, etc., building at SPRINGFIELD, O., in accordance with the specification and general plans of building, which may be had on application at this office or the office of the Superintendent. Each bid must be accompanied by a certified check for $100. The Department will reject all bids received after the time herein stated for opening the same; also, bids which do not comply strictly with all the requirements of this invitation. Bids must be inclosed in an envelope, sealed and marked, "Proposal for Decorative Painting, etc., for the U. S. Post Office, etc., building at Springfield, O.," and addressed to JAS. H. WINDRIM, Supervising Architect. 22

PROPOSALS.

PROPOSALS FOR DREDGING.—U. S. ENGINEER Office, 601 Eighteenth Street, N. W., Washington, D. C., October 17, 1890.—Sealed proposals, in triplicate, for **DREDGING** in the Potomac River at Washington, D. C., will be received at this office until 12 M. on TUESDAY, November 25, 1890. The attention of bidders is invited to the Acts of Congress approved February 26, 1885 and February 23, 1887, Vol. 23, page 332, and Vol. 24, page 414, Statutes-at-Large. For specifications, forms of bid and other information, apply at this office. PETER C. HAINS, Lieut.-Col. of Engineers. 24

U. S. ENGINEER OFFICE, BOSTON, MASS., October 15, 1890.—Sealed proposals, in triplicate, will be received at this office until noon of November 24, 1890, for **DREDGING** in BOSTON HARBOR, MASS., 70,000 cubic yards of material, more or less. Attention is invited to the Acts of Congress approved February 26, 1885, and February 23, 1887, Vol. 23, page 332, and Vol. 24, page 414, Statutes at Large. For full information apply to S. M MANSFIELD, Lieut.-Col of Engineers. 23

PROPOSALS FOR DREDGING.—UNITED States Engineer Office, Mobile, Ala., October 20, 1890.—Sealed proposals for **DREDGING** in MOBILE HARBOR, ALA.; BILOXI HARBOR, MISS., and PASCAGOULA RIVER, MISS., will be received at this office until 12 o'clock M., THURSDAY the 20th day of November, 1890, and opened immediately thereafter in presence of bidders. Specifications, general instructions to bidders, and blank forms of proposal will be furnished on application to this office. The attention of bidders is invited to the Acts of Congress approved February 26, 1885, and February 23, 1887, Vol. 23, page 332, and Vol. 24, page 414, Statutes at Large. A. N. DAMRELL, Major of Engineers, U. S. A. 23

U. S. ENGINEER OFFICE, BOSTON, MASS., October 15, 1890.—Sealed proposals, in triplicate, will be received at this office until noon of November 21, 1890, for the delivery of 225,000 tons, more or less of **RUBBLE-STONE**, for the Harbor of Refuge, SANDY BAY, CAPE ANN, MASS. Attention is invited to the Acts of Congress approved February 26, 1885, and February 23, 1887, Vol. 23, page 332, and Vol. 24, page 414, Statutes at Large. For full information apply to S. M. MANSFIELD, Lieut. Col. of Engineers.

U. S. ENGINEER OFFICE, ROOM 62, ARMY Building, New York, October 15, 1890.—Sealed proposals, in triplicate, will be received at this office until 12 o'clock, noon, WEDNESDAY, November 19, 1890, for the following work: I. For the construction of new DIKES; II., for rebuilding and repairing existing dikes; III., for dredging in the Hudson River between New Baltimore and Troy, N Y. Amount available, $105,000. The attention of bidders is invited to Acts of Congress, approved February 26, 1885, and February 23, 1887, Vol. 23, page 332, and Vol. 24, page 414, Statutes-at-Large, and the River and Harbor Act of September 19, 1890, Sections 6 to 12. For specifications, blank forms, and all information, apply to the undersigned. G. L. GILLESPIE, Lieut.-Col. of Engineers. 24

OFFICE CONSTRUCTING QUARTERMASter, Fort Thomas, Ky., October 27, 1890.—Sealed proposals, in triplicate, subject to usual conditions, will be received at office of Constructing Quartermaster, U. S. A., FORT THOMAS, KY., until 11 A. M., November 27, 1890, and then opened, for construction there, of a **HOSPITAL** and hospital steward's quarters, and for the steam heating apparatus for the hospital, and for the plumbing of each building. The United States reserves the right to reject any or all bids, or parts thereof. Plans and specifications to be seen at this office, with full instructions as to bidding. Envelopes containing proposals should be marked, "Proposals for Hospitals, etc.," and addressed to 1st Lieutenant R. B. TURNER, 6th Inf'try, A. A. Q. M., U.S.A.

OCTOBER 28, 1890.

SEALED PROPOSALS WILL BE RECEIVED at the office of the Supervising Architect, Treasury Department, Washington, D. C., until 2 o'clock P. M. on the 25th day of November, 1800, for all the **LABOR AND MATERIALS** required for the erection and completion of the U. S. Court-House, Custom-House and Post-Office building at BROWNSVILLE, TEX., in accordance with the drawings and specification, copies of which may be had on application at this office or the office of the Superintendent at Brownsville, Tex. Each bid must be accompanied by a certified check for $500. The Department will reject all bids received after the time herein stated for opening the same; also, bids which do not strictly comply with all the requirements of this invitation. Proposals must be inclosed in an envelope, sealed and marked, "Proposal for the Erection and Completion of the U. S. Court-House, Custom-House, and Post-Office building at Brownsville, Tex.," and addressed to JAS. H. WINDRIM, Supervising Architect. 23

OCTOBER 25, 1890.

SEALED PROPOSALS WILL BE RECEIVED at the office of the Supervising Architect, Treasury Department, Washington, D. C., until 2 o'clock P. M., on the 20th day of November, 1890, for all the **LABOR AND MATERIALS** necessary to complete the approaches, mailing platform, post-office lookout, etc., for the U. S. Court-House and Post-Office building at PITTSBURG, PA., in accordance with the drawings and specification, copies of which may be had on application at this office or the office of the Superintendent. Each bid must be accompanied by a certified check for $300. The Department will reject all bids received after the time herein stated for opening the same; also, bids which do not comply strictly with all the requirements of this invitation. Proposals must be inclosed in an envelope, sealed and marked, "Proposal for the Approaches, Mailing Platform, Post-Office Lookout, etc., for the U. S. Court-House and Post-Office building at Pittsburg, Pa.," and addressed to JAS. H. WINDRIM, Supervising Architect. 23

PROPOSALS.

WATER-WORKS, Ballinger, Tex.—Proposals are wanted until January 1, 1891, for the construction of a system of water-works. Address Mayor B. S. Taylor, as above.

BRIDGE, Sheboygan, Wis.—Proposals are wanted, no date specified, for furnishing specifications for a swing iron bridge. Address C. V. Boley, City Engineer, as above.

STREET WORK, Kansas City, Mo.—Proposals are wanted until November 3 and 6, for the improvement of certain streets of this city. Address E. Butts, City Engineer, as above.

DIKE, New York City.—Proposals are wanted until November 19, for building about 1,000 feet of dike at Saugerties Harbor, N. Y. Address Lieut.-Col. G. L. Gillespie, U. S. A., as above.

WATER-WORKS, Ellsworth, Kan.—Proposals are wanted until November 15, for constructing a system of water-works on the reunion grounds at this place. Address Ira F. Collins, Department Commander and Chairman Trustees G. A. R., as above.

STREET WORK, New Haven, Conn.—Mr. A. B Hill, City Engineer, will receive bids until November 10, for removing about 27,000 cubic yards of earth, and for furnishing and setting about 13,000 lineal feet of 16-inch curb stone—North River bluestone.

ELFCTRIC LIGHT PLANT, Harrison, O.—Proposals are wanted until November 24, for the construction of an electric light plant at this place. Address Mayor J. A. Graft, as above.

REMOVING ROCK, New York City.—Proposals are wanted until November 26, for removing 560 000 cubic yards, more or less, of material from the Harlem River, Spuyten Duyvil Creek, and from the cut through Dyckman's Meadow. Address Lieut.-Col. G. L. Gillespie, U. S. A., as above.

WATER-WORKS, Hebron, Neb.—Proposals are wanted until November 5, for the construction of a system of water-works at this place. Address F. C. Hensel, City Clerk, as above.

WATER-WORKS, Lexington, Neb.—Proposals are wanted until November 10, for the construction of a system of water-works at this place. Address A. A. Richardson, C. E., Lincoln, Neb.

BRIDGES, Hamilton County, O.—Proposals are wanted until November 22, for the construction of three iron bridges. Address the Board of County Commissioners, as above.

BRIDGE APPROACHES, Roanoke, Va.—Proposals are wanted until November 14, for the erection of the approaches to the bridges at Randolph, Henry and Park Streets. Address the Committee on Bridges, as above.

DREDGING, Chicago, Ill.—Proposals are wanted until November 16, for doing dredging in Calumet River, Illinois and Indiana, and in Calumet Harbor, Ill. Address Captain W. L. Marshall, Corps of Engineers, U. S. A., as above.

DREDGING, New York City.—Proposals are wanted until November 19, for dredging and blasting Middle Ground, off Sunken Meadow, East River, N. Y. Address Lieut.-Col. G. L. Gillespie, U. S. A., as above.

DREDGING, New York City.—Proposals are wanted until November 21, for dredging in Newtown Creek, N. Y.; Gowanus Bay, N. Y.; and Raritan Bay, N. J. Address Lieut.-Col. G. L. Gillespie, U. S. A., as above.

DREDGING, New York City.—Proposals are wanted until November 19, for dredging in Wappinger's Creek, near New Hamburg, N. Y. Address Lieutenant-Colonel G. L. Gillespie, U. S. A., as above.

WATER-WORKS, Harrison, O.—Proposals are wanted until November 24, for the construction of a system of water-works at this place. Address Mayor J. A. Graft, as above.

RIPRAP STONE, Charleston, S. C.—Proposals are wanted until November 18, for furnishing about 50,000 tons of riprap stone on the South Jetty, at this place. Address Captain Frederic V. Abbot, U. S. A., as above.

DREDGING, Charleston, S. C.—Proposals are wanted until November 21, for dredging in Wappo Cut, S. C., Brickyard Creek, S. C., and between Estherville and Minim Creek, S. C. Address Captain Frederic V. Abbot, U. S. A., as above.

LIGHTING, Jersey City, N. J.—Proposals are wanted until December 1, for lighting the public streets of this place for one year from December 1. Address G. P. Robinson, Clerk of the Board of Police Commissioners, as above.

DREDGING, Charleston, S. C.—Proposals are wanted until November 20, for dredging about 40,000 cubic yards of material at this place. Address Captain Frederic V. Abbot, U. S. A., as above.

PROPOSALS.

ARTESIAN WELL, Charleston, S. C.—Proposals are wanted until December 1, for sinking an artesian well. Address Zimmerman Davis, Secretary Water-Works Department, as above.

SEWERS, Victoria, B. C.—Proposals are wanted until December 17, for the construction of certain sewers at this place. Address Wellington J. Dowler, as above.

ARTESIAN WELLS, Huron, S. D.—Proposals are wanted, no date specified, for sinking, etc., 10 artesian wells. Address Fred. B. F. Coffin, as above.

WATER-WORKS, San Angelo, Tex.—Proposals are wanted until November 10, for furnishing a quantity of material for the Water-Works Department Address J. V. Millspaugh, President San Angel Water-Works Company, as above.

BRIDGE, Zanesville, O.—Proposals are wanted until November 11, for the construction of a bridge across the Muskingum River. Address J. A. Knight, Auditor, as above.

RESERVOIR, Philadelphia, Pa.—Proposals are wanted until November 7, for the construction of a reservoir. Address Louis Wagner, 1321 Filbert Street, as above.

STREET WORK, Norwood, O.—Proposals are wanted until November 5, for doing certain street work at this place. Address E. G. Balies, Village Clerk, as above.

DREDGING, Fall River, Mass.—Proposals are wanted, no date specified, for doing certain dredging. Address Wm. C. Atwater & Co., as above.

LEVEE WORK, Tallulah, La.—Proposals are wanted until November 5, for the construction of certain levees. Address F. L. Maxwell, President Levee Board, as above.

VIADUCT, Columbus, O.—Proposals are wanted until November 17 for the construction of a viaduct at this place. Address Frank J Reinhard, County Auditor, as above.

BRIDGE, Joliet, Ill.—Proposals are wanted until November 10, for the erection of an iron bridge at this place. Address Charles C. Wilcox, City Clerk, as above.

SEWERS, New York City.—Proposals are wanted until November 6, for the construction of certain sewers in this city. Address the Department of Public Works, as above.

HEATING, St. Louis, Mo.—Proposals are wanted until November 11, for hot water generator and piping and covering steam pipes at Female Hospital. Address George Burnet, President Board of Public Works, as above.

DREDGING, New York City.—Proposals are wanted until November 12, for dredging the bulkhead at Seventy-eighth Street, North River; the bulkhead between Seventy-eighth and Seventy-ninth Streets, North River, and the half slips adjoining Seventy-ninth Street Pier, North River. Address the Department of Docks, Pier A, North River, as above.

BRIDGE, Marble Falls, Tex.—Proposals are wanted until November 18, for the construction of an iron bridge over the Colorado River at this place. Address Louis G. Hester, Civil Engineer, as above.

ARTESIAN WELL, Chamberlain, S. D.—Proposals are wanted until December 5, for the completion of the Pleasant Grove artesian well. Address A. E. Roberts, County Judge, as above.

BRIDGE, Rothville, Mo.—Proposals are wanted until November 5, for the erection of a bridge over Yellow Creek. Address John A. Lee, Clerk Chariton County Court, as above.

WANTED.

TOO LATE FOR CLASSIFICATION.

WANTED.—POSITION AS DRAUGHTSMAN on bridge or hydraulic works, in New York, Brooklyn or Jersey City, if possible, by a Swede graduate from the Royal Technical High School at Stockholm. Have had some experience. Want a small salary to start with. Address S. N., care of THE ENGINEERING AND BUILDING RECORD, New York. 23

WANTED—SALESMAN FOR OUT OF TOWN trade, to sell hot-water heater on commission. One having trade with steam fitters and plumbers preferred. Address TRADE Box 103, this office.

FIRST-CLASS PLUMBER WOULD LIKE JOB out of city. Address C. J. C., Box 103, this office. 23

THE THAMES RIVER BRIDGE AND APPROACHES.

Report by ALFRED P. BOLLER, Chief Engineer, to the General Manager of the New York, Providence & Boston R. R.

A DESCRIPTION OF THE LONGEST DRAW-SPAN IN AMERICA.

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AND

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SPECIAL OFFERS.

DOUBTLESS many of our subscribers have a friend or friends who think of subscribing to THE ENGINEERING AND BUILDING RECORD for the coming year, and as every paper, however successful it may be, desires to increase the number of its subscribers, the following offers are made, to hold good during October, November and December, 1890:

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THE ENGINEERING AND BUILDING RECORD,
P. O. Box 3037. 277 Pearl Street, New York.

THE AMERICAN SOCIETY OF CIVIL ENGINEERS' NOMINATIONS FOR 1891.

THE nominations for officers of the American Society of Civil Engineers for the coming year, as reported in another column, will excite special interest, because of the nomination for secretary.

This is the first time that the members are given the opportunity of voting in the regular way in favor of the policy that the chief executive officer of the society—*i. e.*, the secretary, should be a man who is not practicing the profession of a civil engineer, but who gives his entire time and efforts to the society and to the furtherance of its interests. Our readers will remember that this journal distinctly advocated such a policy several years ago, when the present popular secretary was elected to the office of State Engineer. His growing practice as a consulting engineer, and his duties for the State, have made it manifest that it is a physical impossibility for him to give to the society the time that its members have a right to expect and that its interests demand. We presume that the nomination of another man for the position of secretary is due to the fact that Mr. Bogart is unwilling to give up the active practice of a profession, in which he has attained distinction, for the salary which the Society will pay its secretary. His election to the position of first vice-president will, however, be an honor well-earned by long and valuable services.

The nominating committee are deserving of credit for giving the membership of the Society the opportunity of declaring for or against the policy that the chief executive officer should not be in active practice, but should devote his sole time and energies to the Society's interests. It should be distinctly understood that in adopting this policy it is no reflection on the present secretary, because he accepted, and has held, the position with the distinct understanding that he was to remain in active practice.

WISDOM IN NOT SELLING A WATER-WORKS FRANCHISE TO THE HIGHEST BIDDER.

THE authorities of Montclair, N. J., an attractive suburb of New York, have recently taken an action with regard to the purchase of their water-works, under an option held by them, from the original builders of the same, which is noteworthy as one of the few instances where public officers have the courage to decide a case on its merits, in spite of the criticism that follows a refusal to let a contract to the lowest bidder, or to sell a franchise to the highest one.

The water works at Montclair were owned by responsible parties, who are also connected with the corporation which own water privileges in the Ramapo Water Shed, and who are now constructing works to carry out their contract to furnish Newark with a new supply. It is only a question of time when the Montclair Company will have to abandon its present source of supply as being in danger of contamination, because of the growth of the town. When that time arrives, the present owners would be in possession of the most available source—and if other parties owned the works they would, in all probability, have to purchase water of them on their terms, or maintain an inferior service. The town cannot, at this time, issue bonds to buy the works, yet they might have taken the option, under a sharp construction of their contract, in order to sell it again to speculators at a profit. The decision, therefore, not to make merchandise of the option was, under the circumstances, a wise one, since the character and responsibility of the owners of a water-works franchise is a most important consideration.

We commend such action to the authorities of other communities who fear criticism on the rejection of the lowest bid, though their judgment tells them such action would be for the ultimate best interests of their town.

THE PROPOSED JUNGFRAU RAILROAD AND ITS PROBABLE EFFECT ON THE HEALTH OF THE PASSENGERS.

AS NOTED in our columns a short time ago, the Swiss Federal Council has under consideration proposals for constructing a railroad up the Jungfrau Alp for the convenience of tourists. The question as to whether the great and rapid ascent to be obtained would be injurious to the health of the passengers has been referred to a medical committee, consisting of Geelick, Kronecker and Veith, whose report, dated September 18, is now before us.

The proposed railroad would be about 6 kilometers long, and rise from an altitude of 870 to one of 4,130 meters above sea level. One of the plans proposes to use a cable, another compressed air as the motive power. The greater part of the road would lie above the level of the perpetual snow line, and the dangers to health would arise in part from exposure to cold and storms, but chiefly from the comparatively sudden diminution of atmospheric pressure. So far as the question of exposure is concerned, the projectors propose to avoid it by constructing the road largely, or entirely, in tunnels. On the pneumatic plan the tunnel would be a necessity.

Many men on the Andes and the Himalayas live continuously at heights of from 3,000 to 4,000 meters above the sea level, and in Thibet there is at least one village, at the height of 4,900 meters, where the inhabitants do not appear to be injured by their elevated positions. Nevertheless, it requires a long period to fit men to live under such unusual conditions, and the more sudden the change the greater the suffering.

In the construction of a tunnel in the Andes for a road from Callao to Oroya, the tunnel being at an altitude of about 4,000 meters above the sea, almost every workman, except those who were natives of the vicinity, suffered from the rarity and diminished pressure of the air. Sensations of want of breath, palpitation of the heart, giddiness, headache, etc., are common. In some cases, where the ascent has been rapid, there are hemorrhages, and these are especially to be feared in cases of advanced disease of the lungs. Usually, travelers ascending mountains begin to complain at an elevation of about 3,000 meters, but there are great differences in different localities in this respect.

The report suggests that any peculiarities of this kind which the vicinity of the Jungfrau may have can easily be determined by experiment, using a captive balloon for the purpose, and finishes with the conclusions: (1) That the construction of such a railroad is possible; (2) That it should not extend above a height of 3,000 meters; (3) That it is not expedient to grant a permit for the construction of the road until those who seek the privilege have shown that such a rapid ascent is without danger to health. The latter clause would have no weight in this country. We should say that if the promoters of the road chose to take the risks of its being a pecuniary failure, as it certainly would be if a few cases of serious injury to health occurred among its passengers, they could do so, and should leave it to their self-interest to furnish the demonstration suggested.

THE PANAMA CANAL.

The Panama Canal Company will be given an opportunity to pass its work over to a new company, under the provisions of the bill in reference to its affairs, which it is expected will soon become a law. In the bill the Colombian Government grants the representative of the company an extension of ten years in which to complete the canal and open it to traffic. The extension is granted on numerous conditions. The bill provides that a new company shall be formed to finish the work, to which company the liquidators of the present company shall turn over the canal, its equipments, etc. The new company is to be organized with sufficient capital to complete the work, and to recommence excavations within eighteen months from the date of the signing of the contract under the present law.

The present company is to cancel, as indemnity to the Government, for expenditures incurred on the Isthmus, the $500,000 loan for which the Government is now liable. The company will be obliged to furnish the Government $100,000 per year in order to maintain a garrison of 250 men to preserve order along the line of the canal while work is in progress, and subsequently for the protection of the transit. The lands required by the company for all artificial lakes and banks will be gratuitously ceded when the Government is the owner, and, when private individuals, they will be judicially expropriated and transferred to the company at a cost not calculated in their possible value subsequent to the completion of the canal.

In return for the extension of time the company will be required to pay the Government $4,000,000, and to cede shares and privileges in the new company to the value of $4,000,000. The payment of this sum is to be made within five years, in yearly installments, the first installment to be paid in three months after the new company shall have been definitely formed. Should the new company not be organized and work resumed within the eighteen months fixed, the contract in force will become void and the Government will take possession of the property. The delegate the Government had the right to appoint on the managing council of the old company will hold the same advantages in the new company. The guarantee of $150,000 given by the company will continue in force in order to insure compliance with the obligations imposed by the former contract and those that may be made. The Government is authorized, in case the privileges expire, as provided by the old contract, or under the conditions of the bill, to contract with a new company for the completion of the canal under certain conditions.

NOTES.

Ottawa, Can., is to have an electric street car line, and a local firm has been awarded the contract.

According to *L'Electricite*, Santa Cruz, a city of 16,000 inhabitants, and the capital of the Canary Islands, has a soil of such extreme hardness that trenches and street excavation for gas works have been impracticable, and present negotiations for an electric light service make special allowance for the post holes, and reduce their number as much as possible.

According to a Corpus Christi, Tex., account, a party of Government engineers recently viewed Rope's Pass through Mustang Island, from Corpus Christi to the Gulf. The passage now is a canal 30 feet wide by 16 feet depth, with a fall of about 6 inches to the mile, two miles long, through Mustang Island. The project is to dig a ditch 30 feet wide and 16 feet deep from Corpus Christi to the Gulf. This, it is thought, will in 90 days make a channel 500 feet in width, of sufficient depth to admit the passage of vessels of the largest draught.

The Allegheny, Pa., County Road Convention met at Pittsburg last week. The object of the convention was to take action in regard to the enactment of a law by the next Legislature for the improvement of the public roads.

The prevalence of diphtheria at San Francisco, Cal., is ascribed to the neglect to flush the city's sewers.

Spokane Falls, Wash., utilizes water power for generating electricity, the latter serving for both lighting and power purposes. There is an available head of 70 feet of water and 12 pairs of Victor turbines are employed.

Springfield, Mass., is studying the electric street car problem with the view of adopting one of the several systems now available.

The project to construct a ship canal across New Jersey, from the Delaware to the Atlantic, has already taken hold of the public mind, and seems to rank high among the probabilities of the future.

IMPORTANT TUNNELS OF THE WORLD.

Among the important tunnels of the world, the following have recently been given :

The Allegheny Portage tunnel was built in 1831.

The Black Rock tunnel, on the Reading railroad, was constructed in 1836.

A tunnel 6 606 feet long was driven under Lake Erie from Cleveland, O., for the purpose of obtaining pure water.

The Sand Patch tunnel, on the Pittsburg and Cornellsville branch of the Reading, was completed in 1871.

Cæsar found Alexandria honeycombed with subterranean tunnels supplying water from the Nile to the houses of the city.

The St. Gothard tunnel through the Alps was begun in the fall of 1872. Its length is nine and a quarter miles and its cost some $10,000,000.

The Kingwood and Broadtree tunnels, and the Chesapeake and Ohio railroad and the Great Bend tunnels are specimen pieces of heavy tunneling in the United States.

The Hudson river tunnel is progressing satisfactorily. The daily progress is 3.4 feet. The distance already reached is 2,260 feet, the total distance to be covered being 5.060 feet.

The tunnel driven under Lake Michigan, to secure pure water for Chicago, begun in March, 1864, was constructed two miles in length to a crib in the lake, inside of which an iron cylinder was sunk.

The new aqueduct from the croton dam to New York City, a distance of 29.63 miles, or including the pipe lines to the Central Park reservoir of thirty-three miles, is the largest piece of tunneling yet done.

Of subaqueous tunnels the most famous is that under the Thames at London, begun in 1807 and finally completed for foot passengers in 1843; total length, 1,200 feet; cost, $6,000 a lineal yard, or a total of $2,500,000.

The cast-iron tunnel under the St. Clair river, connecting Canada with the United States, has recently been completed. The total length is 6,050 feet, of which 2,300 feet is under the river bed. The outside diameter is 21 feet.

The Mont Cenis tunnel was a tremendous engineering work, in which air pumps were worked by hydraulic power although the work was begun by hand labor in 1857. It was finished in 1871, the total cost having been $15,000,000.

The Hoosac tunnel project was originally considered as far back as 1825. It was not until the Shanly Brothers, of Montreal, in 1868, took the contract that construction was rapidly pushed. They completed their work in December, 1874.

The Roman tunnels served as aqueducts, the one to tap Lake Albanno, begun 389, B. C., being 6,000 feet long. On the aqueduct to connect Lake Fucinus with the River Liris 30,000 men were employed for ten years, the work being finished A. D. 52.

The Musconetcong tunnel, on the Lehigh Valley railroad, a specimen of heavy tunneling by means of machine drilling, was begun in 1872 and finished in 1875.

If "Architect" of Brooklyn, N. Y. will send us his name and address, his letter under date of November 4 will receive attention. Ordinarily anonymous communications are destroyed unnoticed.

MEETINGS OF ENGINEERING SOCIETIES.

The American Society of Civil Engineers holds its regular meetings on the first and third Wednesday in each month, at the House of the Society, 127 East Twenty-third Street, New York.

The Boston Society of Civil Engineers holds its regular meetings at the American House, Boston, at 7.30 P. M., on the third Wednesday in each month.

The Western Society of Engineers holds its regular meetings at No. 78 La Salle Street, Chicago. at 7.30 P. M., on the first Wednesday in each month.

The Engineers' Club of St. Louis holds regular meetings in the club's room, Laclede Building, corner Fourth and Olive Streets, St. Louis, on the first and third Wednesdays in each month.

The Engineers' Club of Philadelphia holds regular meetings at the House of the Club, 1122 Girard Street, Philadelphia.

The Engineers' Society of Western Pennsylvania holds regular meetings on the third Tuesday in each month, at 7.30 P. M., at its rooms in the Penn Building, Pittsburg, Pa.

The Engineers' Club of Cincinnati holds its regular meetings at 8 P. M. on the third Thursday of each month at the Club rooms, No. 24 West Fourth Street, Cincinnati.

The Civil Engineers' Club of Cleveland holds regular meetings on the second Tuesday of each month, at 8 P. M., in the Case Library Building, Cleveland. Semi-monthly meetings are held on the fourth Tuesday of the month.

The Engineers' Club of Kansas City meets in Room 200, Baird Building, Kansas City, Mo., on the second Monday in each month.

The Engineering Association of the Southwest holds regular meetings on the second Thursday evening of each month at 8 o'clock, at the Association headquarters, Nos. 63 and 64 Baxter Court, Nashville, Tenn.

The Civil Engineers' Society of St. Paul meets at St. Paul, Minn., on the first Monday in each month.

The Montana Society of Civil Engineers meets at Helena Mont., at 7.30 P. M., on the third Saturday in each month.

The Civil Engineers' Association of Kansas holds regular meetings on the first Wednesday in each month at Wichita, Kan.

The New England Water Works Association holds quarterly meetings in Boston at Young's Hotel.

The Canadian Society of Civil Engineers holds its regular meetings on each alternate Thursday, commencing with the 9th of October, at the House of the Society, 112 Mansfield Street, Montreal.

The Engineering Department of the Brooklyn Institute, Brooklyn, holds regular meetings, at 8 P. M., on the third Tuesday of each month. Until the Institute building is repaired, the meetings will be held in the rooms of the Young Men's Christian Association Building, 502 Fulton Street.

PERSONAL.

J. H. Robinson has been appointed as Building Inspector for Duluth, Minn.

Dunham & Paine, civil engineers, have moved their offices from Cleveland, O., to 150 Broadway, New York City.

W. P. Rounds, C. E., has been appointed Superintendent of the La Salle, Ill., Water-Works, and not Secretary, as recently stated.

Edward Tamsen, mechanical engineer, of Brooklyn, has accepted the position of Superintendent of the works of the Niagara Water Meter Company of that city.

The new Board of City Affairs, of Cincinnati, O., appointed by the Mayor, consists of Thomas G. Smith and Dr. Graydon, of the former Board, Gustav Tafel and Fechheimer. D. W. Brown, of the old Board, was elected clerk.

Max Reber, C. E., one of the staff of engineers of the Nicaragua Canal Construction Company, is visiting his home at St. Louis, Mo., after an absence of 18 months in Nicaragua. He will return to his post of duty in a few days, to be absent two years.

OBITUARY.

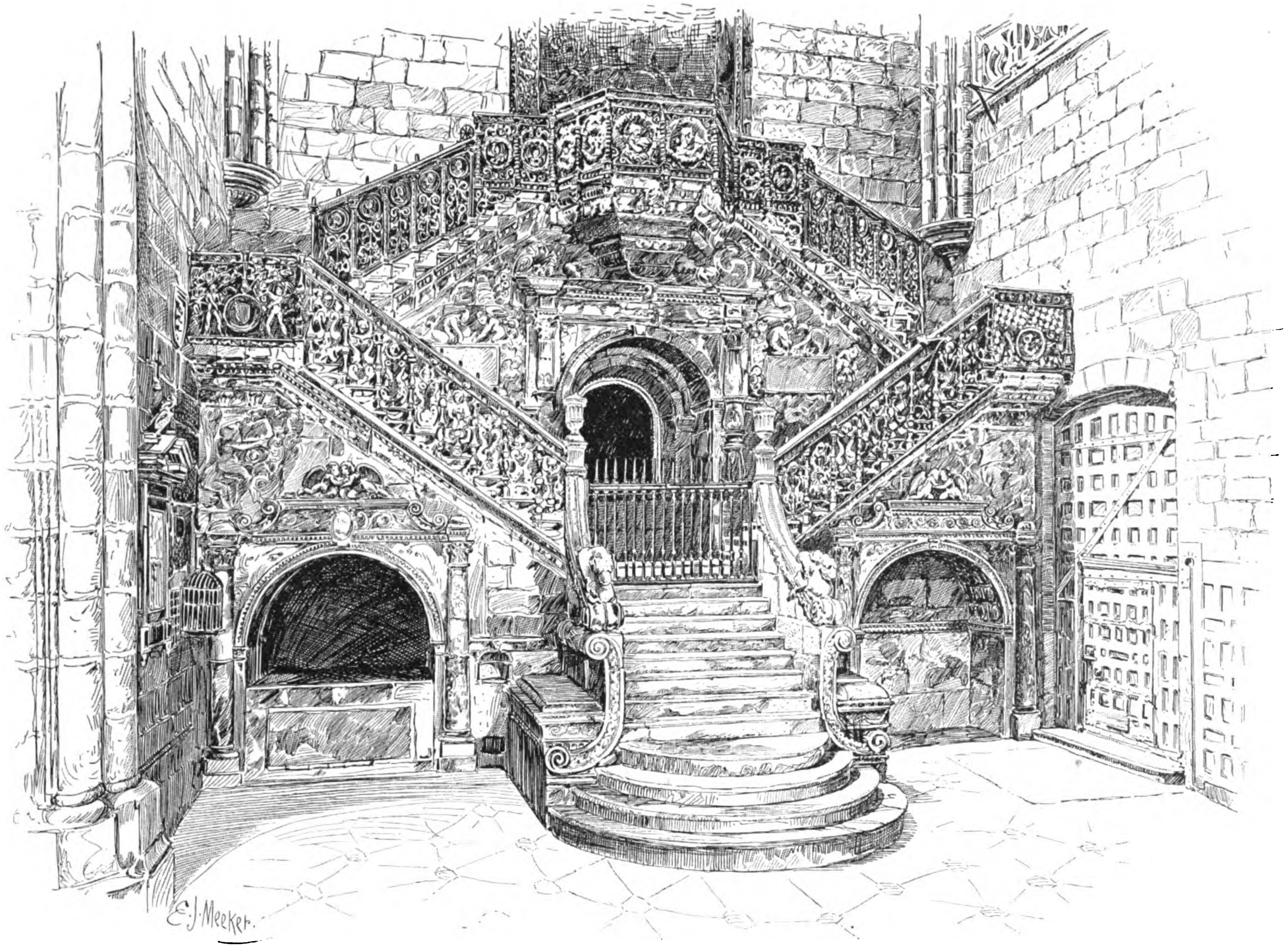
William J. Simmons, President of Eckstein Norton Industrial College for Colored Youths, died near Louisville, Ky., on October 30. Dr. Simmons was for ten years President of the Colored State University at Louisville.

Drury Underwood, contractor, and President of the Missouri and Kansas Interstate Fair and Exposition Driving Park Associations, was killed on October 28, at Kansas City, Mo., on the Chicago and Alton Railroad crossing.

Mr. William Washburn, architect, died in Boston on October 31, aged 82. He made a specialty of hotels, and the Fifth Avenue and Victoria Hotels of New York, the Adams House, Parkers', Tremont, American, Revere House, Young's Hotel, and Tremont Temple, Boston, and the City Hall, Charlestown, are examples of his work.

OUR ARCHITECTURAL ILLUSTRATION.

IN THE CATHEDRAL OF BURGOS, SPAIN.



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IN THE CATHEDRAL OF BURGOS—SPAIN.

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ENGINEERING SOCIETIES.

THE 273d meeting of the Western Society of Engineers was held at Chicago, on October 1, 1890. President L. E. Cooley in the chair, and some 60 members and visitors present.

The following members were elected:

Charles E. Hopkins, Charles V. Weston, Theodore Starrett, Jacob A. Harman, Henry E. Gamble, Ira Smith Dunning, L. C. B. Holmboe, Charles J. Morse, William E. Miller, Ridley H. Lawence, Harold A. Boedker.

In reply to a call from the President for reports of standing and special committees, Mr. Isham Randolph for the Committee on the Chicago Railway Problem, etc., stated that offices had been rented and that funds for the preliminary work had been received.

Mr. O. Chanute for the Committee on Bridge Legislation stated that the committee had had some meetings. It has entered upon the gathering of data, and has succeeded fairly well in getting some of them. The committee has undertaken to ascertain, first, what legislation concerning bridges has been had in foreign countries, and it has obtained the legislation in Great Britain, France, Austria and Germany, of which it will give an abstract in its report. It has also obtained the data concerning legislation heretofore proposed in the United States, and has also obtained data concerning the practice of the leading railroads in the United States, more especially in regard to bridge floors, which is considered the one important thing for legislation to touch upon. It will take some months for the committee to gather all the data it wants to present to the society, and it hopes that when it finally hands in its report it will have gathered all the information necessary to arrive at a correct opinion of the subject, and to judge as to what legislation is best, and what is possible to accomplish.

Mr. Isham Randolph then read an interesting paper on "Railroad Signaling and Interlocking."

A large part of the evening was devoted to a discussion of the subject of railroad safety appliances.

THE AMERICAN SOCIETY OF CIVIL ENGINEERS held a regular meeting on November 5, President W. P. Shinn in the chair. After the transaction of routine business, an informal statement was made of the report to the Board of Direction by the Nominating Committee, who presented the following nominations:

President, Octave Chanute, Chicago, Ill.; Vice-Presidents, John Bogart, New York, and Charles Hermany, Louisville, Ky.; Secretary, John C. Trautwine, Jr., Philadelphia, Pa.; Treasurer, George S. Greene, Jr., New York; Directors, Theodore Cooper, New York; Rudolph Hering, New York; E. P. North, New York; Clemens Herschel, New York, and S. Whinnery, Cincinnati, O.

The paper of the evening was on "Self Purification of Water in Flowing streams—A Biological Consideration," by Charles G. Currier, M. D The paper was illustrated by stereopticon and microscopic exhibits, and exhibits of specimens under culture, of various kinds of bacteria. Dr. Currier described the mode of culture and study of bacteria, and extensive tests and experiments he had conducted to determine their presence in river, lake and spring water throughout this continent and in Europe, and concluded that, when not subject to continued pollution throughout its course, a running stream tends to reduce the number of bacteria as it flows away from their source. Both dilution and sedimentation, and, in a slight degree, impact and oxidation, appeared to diminish the numbers of bacteria, and some chemical treatments were notably efficacious; but he recommended, primarily, the careful protection from pollution of water sheds and the sprinkling of dusty roads near exposed reservoirs.

The paper was discussed by C. B. Brush, W. E. Worthen, R. L. Harris, F. S. Washburn and others, and Dr. Currier was requested to return and resume the discussion at a subsequent meeting. Adjournment was followed by the usual collation.

The following candidates were declared elected:

As Members.—Francis Renatus Fava, Jr., Professor of Civil Engineering, Corcoran Scientific School, Columbian University, Washington, D. C.; Alexander Edward Kastl, First Assistant Engineer improvement mouth of Panuco River, Tampico, Mexico; John Nelson Ostrom, Bridge Engineer, New York City; James Ritchie, Civil Engineer Pittsburg Testing Laboratory, Pittsburg, Pa.

As Associate.—Henry Sylvestre Jacoby, Assistant Professor Civil Engineering, Cornell University, Ithaca, N. Y.

As Juniors.—Henry Lewis Davis, employed in City Engineer's department, New Haven, Conn.; Walter Lawton Dusenberry, Assistant Engineer to Engineer of Construction, Department of Public Parks, New York City; George Hebard Paine, with Union Switch and Signal Company, Swissvale, Pa.; Lee Treadwell, Engineer in Charge Pacific Short Line Bridge Company, Sioux City, Iowa; Arthur Lee Shreve, Assistant Engineer, City Engineer Department, Baltimore, Md.

INTERNATIONAL CONGRESS OF HYGIENE.

A CIRCULAR just issued by John S. Billings, M. D., directs attention to the fact that the Seventh International Congress of Hygiene and Demography will be held in London during the week beginning August 10, 1891.

The governments of all countries and municipalities, and all public health authorities, universities, colleges and societies occupied in the study of the sciences more or less immediately connected with hygiene, are invited to cooperate and appoint delegates to represent them at the congress. The Prince of Wales will preside.

A Committee of Organization has been formed, of which Sir Douglas Galton is Chairman and Prof. W. H. Corfield and Mr. Shirley F. Murphy are Honorary Secretaries. An exhibition of articles of hygienic interest will be held in connection with the congress. The last of these congresses was held in Vienna in 1887, and was attended by over 2,000 persons, and it is expected that the London meeting will be one of great magnitude and importance.

THE HENNEPIN CANAL.

THE Secretary of War has approved the report and recommendations of Captain W. L. Marshall, of Chicago, Engineer in Charge of the Illinois and Mississippi Canal. The River and Harbor Bill approved September 1, 1888, provides that the route of the canal shall commence at a point near Hennepin, the same to be located by the Secretary of War. The report recommends that the work begin near the mouth of Rock River. A large portion of the $5,000,000 appropriated by Congress for the work will be expended near this point in locating locks, dams, surveys, etc. A portion of it, the Secretary decides, will also be expended at Dixon, Ill.

HISTORY OF CINCINNATI'S WATER-WORKS.

PROBABLY no other department of the city of Cincinnati possesses a more interesting history than that of the Water-Works. The Cincinnati *Times-Star*, in a recent issue, refers to it as follows:

"The very earliest notice given of an attempt to supply the citizens with river water is that of 1802, when James McMahan fastened a cask to the middle of two long poles, and then hitched an ox in between (using the poles as shafts) and dragged water around the city. In 1806 William Gibson rigged up a cask on wheels, and with his water-cart hauled and distributed water for a living.

"In 1817 Jesse Reeder built a wood reservoir on the banks of the Ohio, near Ludlow Street. He filled it from a well which was dug at the south end of the reservoir. This well was connected with the river by an open ditch, and was dug down below low-water mark, so that it was always full. The well was curbed with wood and had a wooden roller at the top and bottom. Two tubes extended to the bottom of this well, and through the tubes ran an endless chain, which carried small leather buckets 20 inches apart. The chain was set in motion by the turning of the upper roller, and every time a bucket came up it emptied its contents into the wooden reservoir. This machine was nothing more or less than a chain pump propelled by a sweep wheel, with a blind horse attachment, the latter walking in a circle.

"The next pumping arrangement was on the site of the present Front Street works, and consisted of two divisions, one by the river and the other across the road, now called Front Street. The south works contained the lifting pumps, which raised the water from the river and forced it through wooden pipes into a tank in the north side works. From this tank the second pump delivered the water into the reservoir above it. Every part of the machinery was of wood. The pumps were run by horses or oxen, working on an ordinary tread-mill.

"This system was a great improvement on the water carts, but in 1824 Mr. Davies, the leading man in the Water-Works Company, was compelled to apply new power to his pumps. This new demand was on account of the increased consumption of water, and also on account of the leakage in the wooden pipes. Mr. Davies was so successful in his last venture that the new pumps only had to work three days in the week at first. The improvement that worked in this startling manner was a set of new pumps run by steam. The boiler and engine of a broken-down steamboat were bought by Mr. Davies and arranged for a pumping engine. This engine had one steam cylinder, with slide valve. The beam and fly-wheel were of wood, as were the two lifting pumps. Two iron force pumps operated on a level with the engine and forced the water up the hill into the reservoir. The whole arrangement was confined to one spot, the site of the present pumping house. The two lifting pumps were attached to the heavy wooden beam above by means of a long wooden lever. They had a 6-inch cylinder. The two force pumps were of 7-inch cylinder, and all the levers had a 4-foot stroke. This pump was used up to 1844. It was of 40 horse-power, and had a capacity of 1,200,000 gallons in 24 hours. The plant was valued at $40,000. It was remodeled and improved by Anthony Harkness in 1828, but its power would not admit of much forcing, consequently Mr. Harkness, in 1832, constructed a helpmate for the 'Vesta,' which he named 'Old Betsy.' This engine had a capacity of 3,000,000 gallons in 24 hours.

"The large expenditure for fuel for these two engines led to an inquiry as to how expenses might be curtailed. An engineer named Buford submitted a report in which he advocated the utilization of the water power from the Miami Canal as a substitute for the steam-pumping system. Council, however, failed to recognize the merits of the new system, and it was dropped.

"In 1844 the old steamboat engine, 'Vesta,' was abandoned, and all work was done by 'Old Betsy' A new engine was put up in 1846, at a cost of $75,000, by Messrs Yeatman & Shields. It failed to give satisfaction, and at one time proceedings were about to be instituted against the contractors. In 1851, another engine was put up. It was built by Harkness & Son for $30,000. In 1854, a duplicate of the above engine was constructed by Powell & Son for $35,000. The same year, 'Old Betsy,' after a service of 22 years, was abandoned. In February, 1861, work was commenced on the now famous big Shields engine. It took four years to complete it, and cost, up to January 1, 1867, $360,000. Its maximum capacity is 20,000,000 gallons. The total weight of castings for engine and pump was about 900 tons.

"September 1, 1869, auxiliary works were established to supply the hilltops. The pumps were located on Hunt Street and the water was delivered to the tanks on Mt. Auburn. At present Hunt Street has three double engines, two Worthingtons, two Warden and two Niles. Up to 1880 they have cost the city $184,475.

"In February, 1879, a western supply house was started at Price Hill. It has three engines, two Walden & Maxwell and one Worthington. They were started pumping in November, 1881. Only one engine is used at a time, at present, and ample provisions have been made for increased demand.

"In 1872 to 1874 two large Scowden pumps were put into the Front Street house. They cost $198,000 and have a capacity of $7,500,000 gallons each. The Wetherill pumps were added to the force, at the same place, about five years ago. In July, 1888, two new Worthingtons were put in in place of the old Shields engine that had been in use since March, 1847. The water-works have in operation also, besides the regular pumps, six new ones at the Front Street house. They are known as the auxiliaries and were put in this spring. In all there are 24 pumps either in constant use, or ready for use in case of need.

"The report of the first water-works, the elevated wooden reservoir erected by Jesse Reeder in 1820, in this city, was that the system of supplying the public from reservoirs was a failure, because of the proprietor's failure to get the patronage of the public, they urging that the water was exposed to the sun, and hence there were grave doubts as to its purity. This 'dead water' was discarded and people preferred to drive to the river and scoop up their own 'live water.' This failure ended the water-works of Jesse Reeder. However, this was only a private concern. On March 31, 1817, a charter was granted to the 'Cincinnati Manufacturing Company,' as follows: 'Section 1. Be it ordained by the Town Council of the town of Cincinnati, that the Cincinnati Manufacturing Company, their heirs, successors and assigns, shall be, and they are hereby vested with the exclusive privilege of conveying water, by tubes or otherwise, from the Ohio River through the streets, lanes and alleys and commons of the town of Cincinnati, for the purpose of supplying the inhabitants of said town therewith; which privilege may and shall be enjoyed by the said company, their heirs, successors and assigns exclusively as aforesaid for the term of 99 years from and after the passing of this ordinance.'

"For this ordinance the sum of $100 was to be paid to the city annually. The company, however, made a failure of their venture and asked for an extension of their charter to July, 1820. It was granted, and they issued the following advertisement looking to the securing of the wooden pipes through which the water was to be conducted: 'The subscribers will contract for the delivery at their water works of 1,000 logs of sound timber, either white pine or white oak.' This extensive contract broke the company up completely, and they transferred their rights to Samuel W. Davies, who pushed the first public water-works to a successful issue. Mr. Davies, however, failed to fulfill his contract, namely, the annual $100, and the people also became dissatisfied with his work. The following report explains itself: 'The committee appointed to examine the reservoir of the water-works, from which this city is supplied with water by Col. S. W. Davies, have performed that duty, and after a strict examination, report the reservoir to be in excellent order, the water being clear and pure, and in a wholesome state.' In October, 1823, a committee of Council formally complained of three things: 'First, the payment of money was in arrears; second, the proper number of penstocks had not been erected; third, the water was kept off during the night.' The report adds: 'This last violation has a tendency to seduce the citizens into a fatal security, while the devouring element spreads its devastating hand.' To prevent the wanton waste of water Council passed an ordinance January 7, 1824, which fined offenders $10 and costs for such offenses. Endeavoring to meet increasing expenditures vainly, Mr. Davies became financially embarrassed and offered to sell out to the city for $30,000. A committee reported favorably concerning the purchase and gave ample reasons for their opinion, in these words:

"'We believe that the city ought to own the waterworks. It is a work of so public a character that its management should be directed more to public interest than to individual emoluments We find that the reservoir is permanent and will contain upwards of 200.000 gallons of water, and may be enlarged at an expense of about $250 so as to contain 50,000 gallons more. Allowing 100 gallons per day to each family it will then supply 500 families. The pipes are of wood connected by iron and may be relied upon for fifteen to twenty years. We hesitate not to say that the whole work is executed in a manner creditable to the persons employed in it, and that it is an establishment of great value to the city. The expenses of raising the water at present is as follows, supposing the engine to run every day excepting Sundays: 30 bushels of coal at 8 cents, $2.40; two hands at $1.50, $3. Total, $5.40 per day, or $1,698.20 yearly. The present subscription from 254 subscribers is $2.832. There are on the line of the pipe 651 houses. Part of the power of the engine is now rented for a nail machine at $1 per day. The property has cost upwards of $40.000 and the owner has involved himself in debt to pay for it. We do not think that the city can suffer such an establishment to decay.'

"The question of purchase caused considerable excitement and was defeated by a vote of 294 to 25. The editor of the *Gazette* cautioned discretion, and said: 'If the city desired to purchase the works, the annual expenses of keeping them in repair should be ascertained, in order to know of the ability of the city to support such heavy expenditures without inconvenience.' The Cincinnati Water Company then bought the works in 1826, but it was no better, the reports duly complaining that the same rule existed of shutting off the water at night to prevent wastage, and that at times it stopped for days to be repaired. In December, 1831, the city was out of water for three weeks, owing to a fire which destroyed the pumps and part of the buildings. In February, 1832, Council decided to offer $150,000 for the works if the citizens should sanction the purchase. The citizens again voted against it, two to one. In 1846 the question of purchase was once more revived.

"Again nothing further was done. Then the water company advanced rates 20 per cent., and in the storm of public indignation which followed a vote was taken. It was a very decided one, and stood 1.573 for and 311 against. To appease the public clamor for cheaper water, Council went so far as to consider the advisability of abandoning the 'immense engine' for the water-power from the Miami Canal. Immediate steps were taken to consummate the sale, and it was ratified by Council June 17, 1839, the amount being $300,000 in city bonds. The first Board of Directors was composed of Edward Woodruff, E. Hinman, Q. Lovel, A. H. Ewing, W. S. Hubbelli Z. Martin. The following is the first annual report: 'Amount of water rent collected, $60,280.11; extension and improvement of works, $13,268.16; returned water rents, $1,839.77; current expenses, $15,344.44; amounts paid on bonds, building material, etc., $60,280.11; balance, being amount of receipts over expenses, $29,270.78.'"

THE completion of the St. Clair Tunnel has revived the project of a tunnel across the Straits of Northumberland to Prince Edward Island.

THE NEW YORK WORLD BUILDING.

PART II.—FOUNDATION PLAN AND ELEVATIONS; DETAILS OF PIERS AND WALLS; ELEVATIONS, SECTIONS AND PLANS OF DOME.*

FIGURE 10 is a foundation plan; Fig. 11 is an elevation of wall piers C and D, parallel to XI.-XI; Fig. 12 is a section and elevation of pier C at XII.-XII.; Figs. 13, 14 and 15 are sections at different points of the cellar retaining wall; Fig. 16 is an elevation of piers A and U from X.-X.; Fig. 17 is a section at Z Z, Fig. 16; Fig. 18 is a section of the retaining wall at IV. and V.; Fig. 19 is a section at Y Y; Fig. 20 is an elevation at U U; Fig. 21 is an elevation of piers P and Q from R R; Fig. 22 is a section through smoke-stack, etc., at S S; Fig. 23 is a section at VIII.-VIII.; Fig. 24 is a section at VI.-VI.; Fig. 25 is a section at X.-X.; Fig. 26 is a section at T T; Fig. 27 is a section at IX.-IX.; Figs. 28, 29 and 30 are sections, respectively, of column piers Q, T and E; Fig. 31 is a section and elevation of an interior pier. Fig. 32 is a section and elevation at A A, Fig. 31. All the other interior piers are similar to this.

Figures 33, 34, 35 and 36 are sections of the lower part of the front wall, and Figs. 33*a*, 34*a*, 35*a* and 36*a* of its upper part at piers F, E, K, N and O, respectively.

Figure 37 is an elevation of the dome, partly in section; Fig. 38 is a diagram of the framing of one panel of the dome walls; Fig. 39 is a plan of the second dome floor. A is Mr. Pulitzer's office; B is his private room; F is Colonel Cockerill's room; E E are assistant editors' rooms; C is the library.

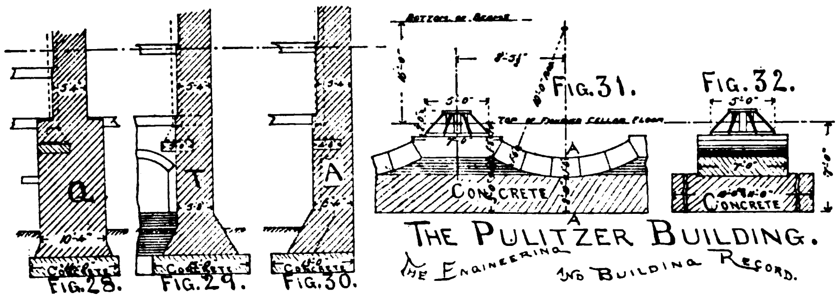


Fig. 28. Fig. 29. Fig. 30. Fig. 31. Fig. 32.

THE PULITZER BUILDING.
THE ENGINEERING AND BUILDING RECORD.

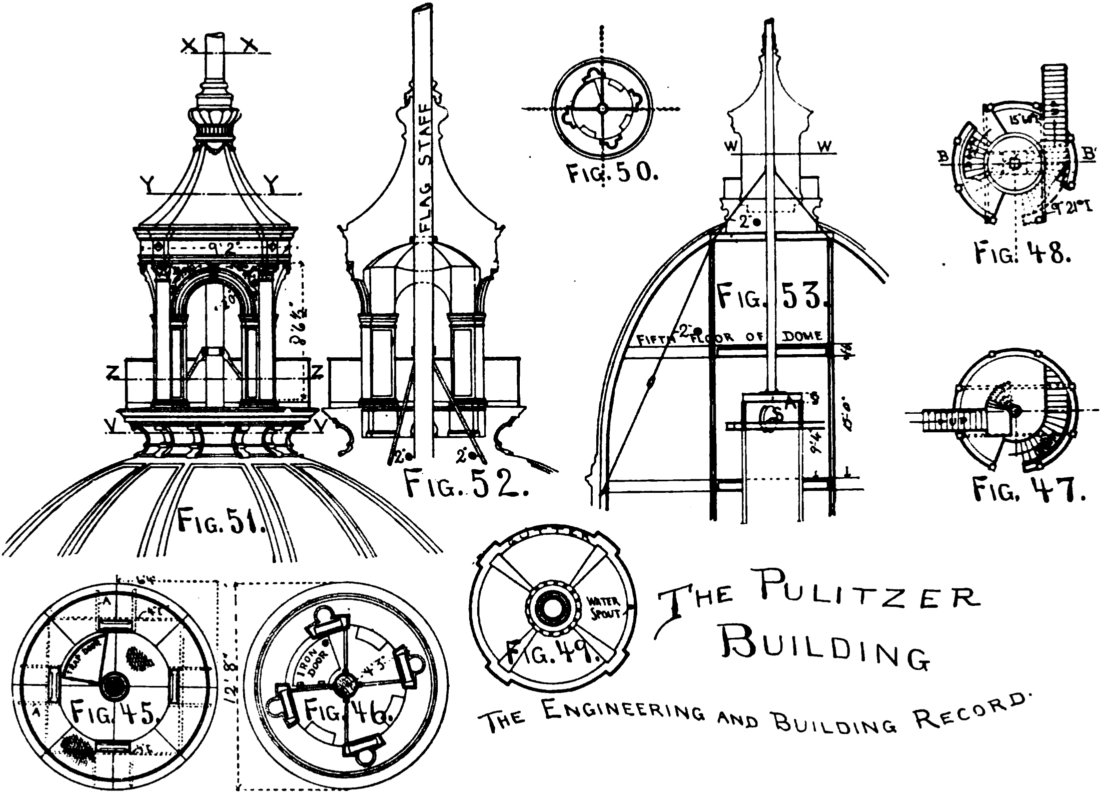


Fig. 45. Fig. 46. Fig. 47. Fig. 48. Fig. 49. Fig. 50. Fig. 51. Fig. 52. Fig. 53.

THE PULITZER BUILDING
THE ENGINEERING AND BUILDING RECORD.

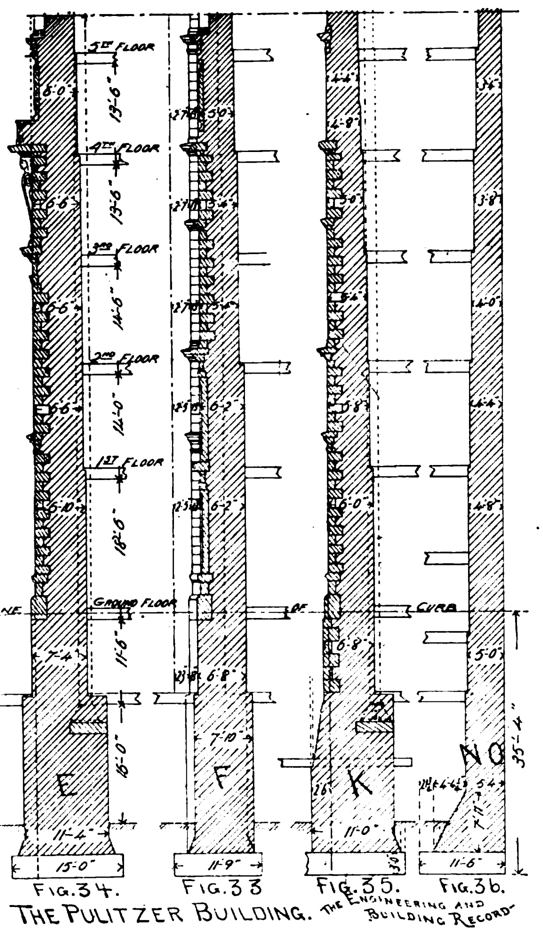
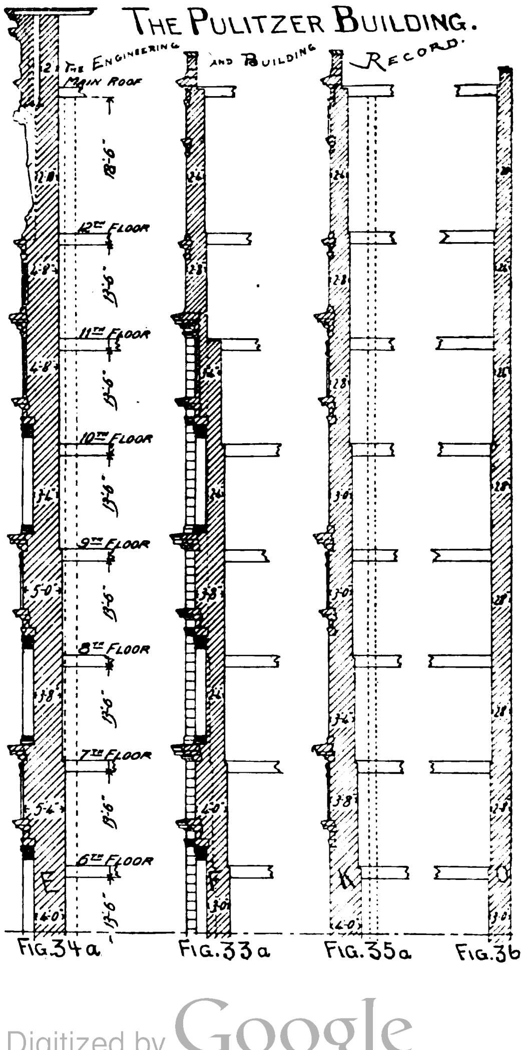


Fig. 34. Fig. 33 Fig. 35. Fig. 36.

THE PULITZER BUILDING. THE ENGINEERING AND BUILDING RECORD.



THE PULITZER BUILDING. THE ENGINEERING AND BUILDING RECORD.

Fig. 34a Fig. 33a Fig. 35a Fig. 36a

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* Part I.—General Description, Location, Perspective View, and Floor Plans was published November 1, 1890.

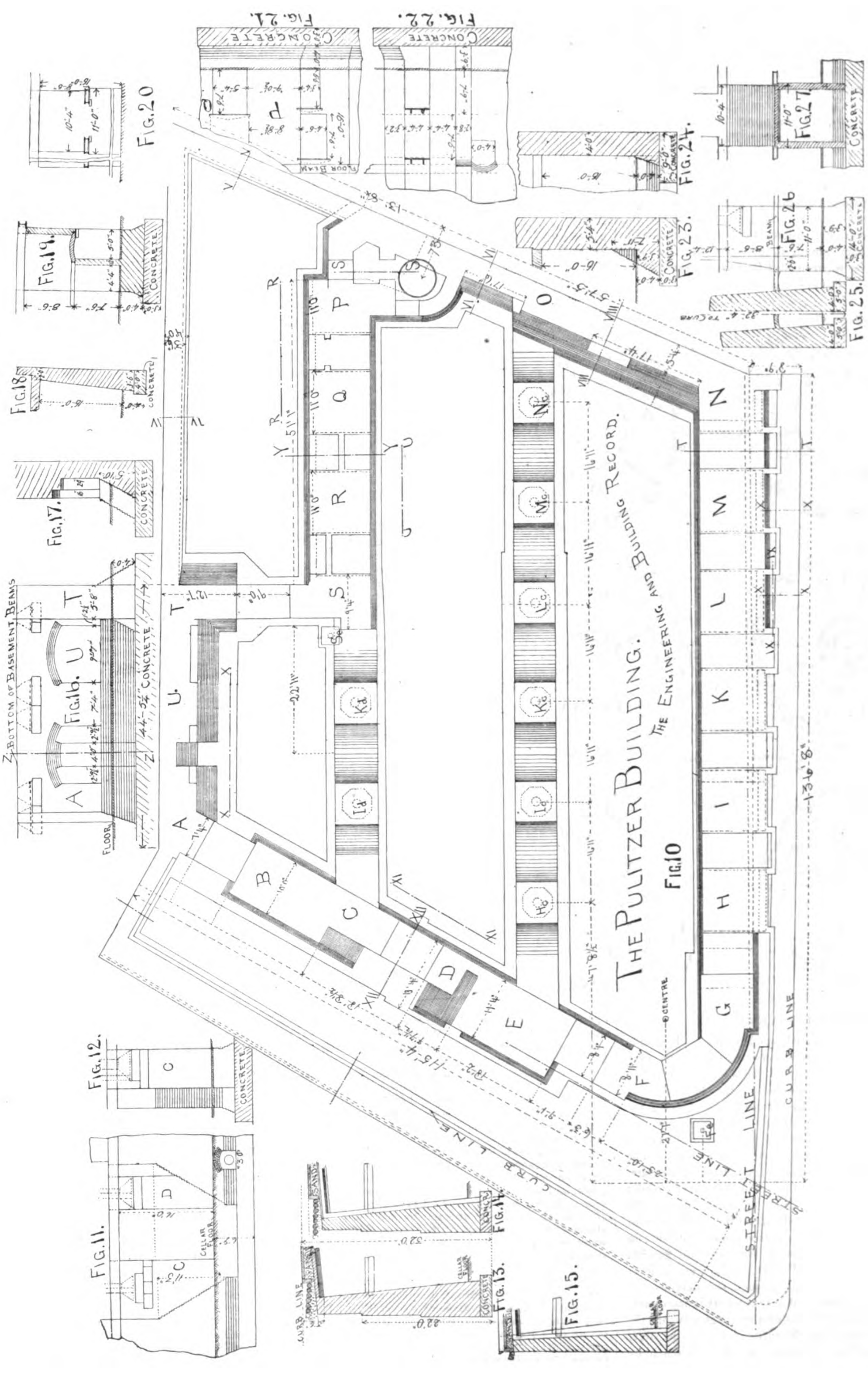

THE PULITZER BUILDING.
THE ENGINEERING AND BUILDING RECORD.
FIG. 10
CENTRE
A
B
C
D
E
F
G
H
I
K
L
M
N
O
P
Q
R
S
T
U
V
X
Y
Ka
La
Ha
Hc
Ic
Kc
Lc
Mc
Nc
CURB LINE
STREET LINE
131'-8"
115'-4"
FIG. 11.
CELLAR FLOOR
FIG. 12.
FIG. 13.
CURB LINE
FIG. 14.
SAND
FIG. 15.
FIG. 16.
Z-BOTTOM OF BASEMENT BEAMS
FLOOR
44'-5¼" CONCRETE
FIG. 17.
FIG. 18.
FIG. 19.
FIG. 20
FIG. 21.
FIG. 22.
FLOOR BEAM
FIG. 23.
FIG. 24.
FIG. 25.
FIG. 26
BEAM
FIG. 27
CONCRETE

Figure 40 is a plan of the Mezzanine floor which forms a second story only at D D, which is directly over the rooms B and E E F, Fig. 39. A and C are the upper parts of the high rooms A and C, Fig. 39. Figure 41 is a plan of the gallery in the city editor's room. Figure 42 is a plan of the third story. G G, etc., are private rooms for different members of the editorial staff; H is a general editorial room and A is a toilet room.

Figure 43 is a plan of the upper bracing and roof beams; Fig. 44 is a plan of the roof; Figs. 45, 46 and 49 are plans at Z Z, Y Y and X X, respectively, of Fig. 51; Fig. 47 shows the arrangement of stairs from the fifth floor to the roof; Fig. 48 shows the stairs to the lantern, and Fig. 50 is a plan of the lantern; Fig. 51 is an elevation, and Fig. 52 a section of the lantern, which will be illuminated by electricity. Figure 53 shows the flag-staff connection and beam framing in the top of the dome, and the elevator sheaves S, suspended from cross-beams A.

(TO BE CONCLUDED.)

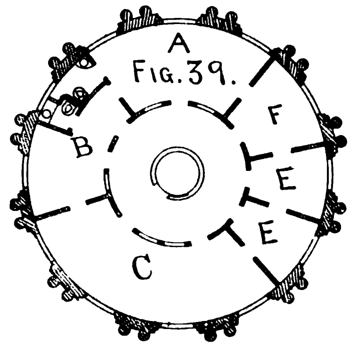


FIG. 39.

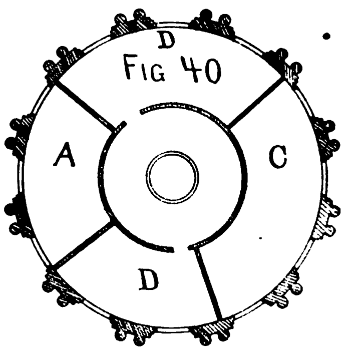


FIG 40

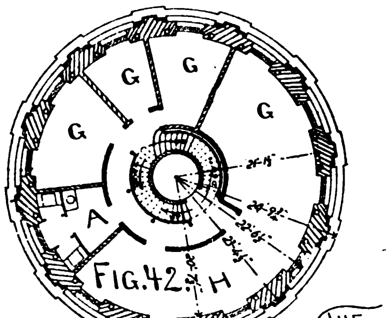


FIG. 42.

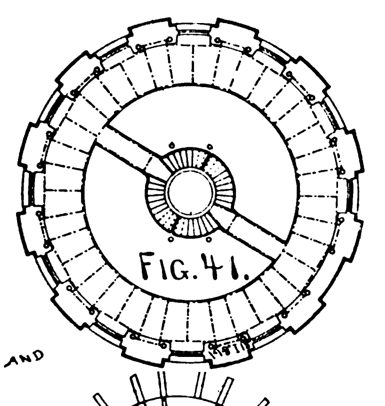


FIG. 41.

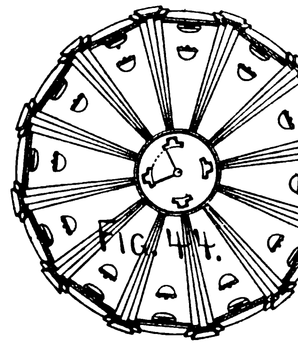
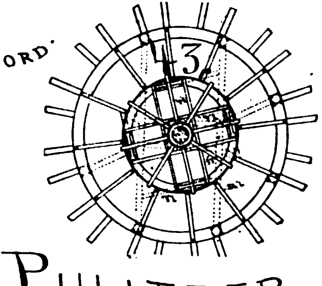


FIG. 44.



43

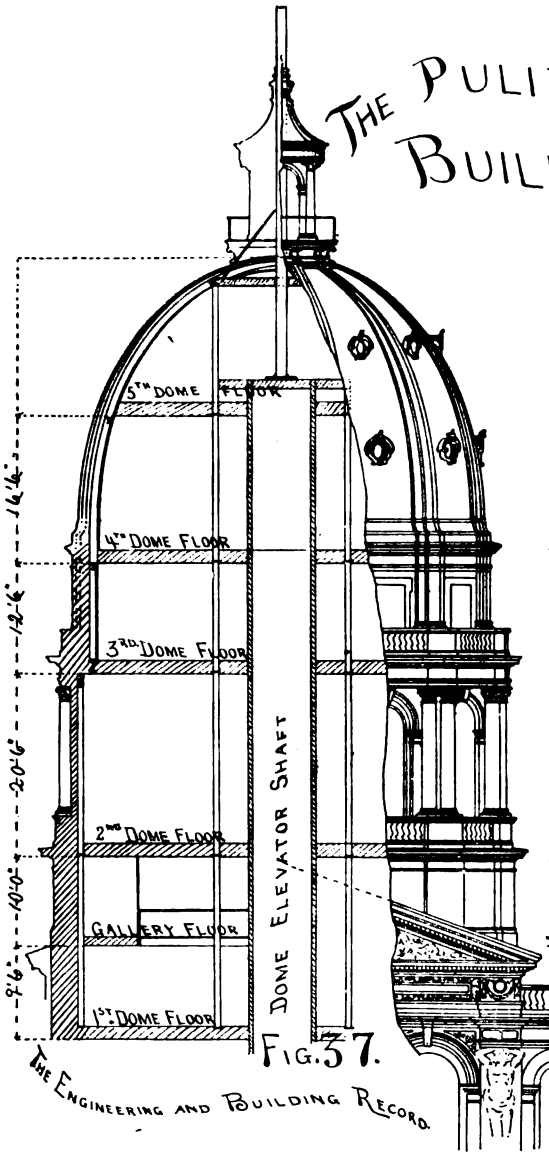


FIG. 37.

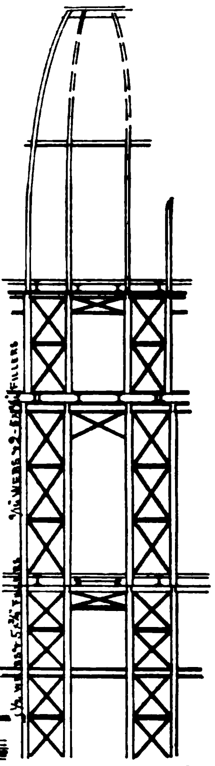


FIG. 38.

THE NILE'S TWO BIG DAMS.

IN the month of June last, what the London *Times* calls "the greatest engineering achievement which English enterprise and skill have as yet attempted on the banks of the Nile," was quietly brought to a termination. Sir Colin Scott Moncrieff, the Under Secretary of State for Public Works, has recently drawn up an account of the works that have been in progress since 1886 to put the Nile barrage into a thoroughly sound condition, and the following short account in the *Times* of what he states may not be without interest:

"The Nile barrage consists, as most people are aware, of two great dams or weirs placed across the river at the point where it divides into two branches, one flowing out into the sea at Rosetta and the other at Damietta. Each weir is a long bridge, the arches of which can be closed when required, so as to hold the water up, and at the sides are locks for the passage of boats. During low Nile the arches are closed, and the water above the barrage is raised and diverted into three main canals, which irrigate the whole of Lower Egypt. When the river is in flood the arches are opened, and every possible obstruction to the flow of the stream is removed.

"The barrage was begun in the year 1843, under the direction of Mougel Bey, a French engineer, and it was finished in 1861. The Rosetta barrage consisted of 61 arches, and its total length was 465 meters; the Damietta barrage, with a length of 535 meters, was constructed with 71 arches. The total cost of the work amounted to £1,800,000, a sum which does not take into account the enormous quantity of forced labor which was employed on its construction. The Rosetta barrage was fitted with gates, and was tried for the first time in 1863. Cracks soon appeared, and a serious subsidence occurred in 1867, after which date any attempt to make use of it was abandoned. During this period the maximum height of water held up was 5 feet 9 inches, and that was only for a short time. On the Damietta side the arches were never supplied with gates at all.

"On Sir Colin Scott Moncrieff's arrival in Egypt in 1883, one of the first schemes that came before him was a proposal to irrigate the whole of Lower Egypt by means of pumps, at an initial cost of £700,000 and an annual outlay of £250,000. Disregarding the opinions of experts, who all warned him that the barrage was a worthless failure, Sir Colin wisely decided that, before having recourse to extravagant expedients for irrigating the country, it was at least worth while to give the barrage a trial, and see whether something could not be made of it. It required a very high degree of moral courage to incur so heavy a responsibility. as the consequences of failure would have been extremely disastrous. The barrage, which even when new had not been considered strong enough to do the work required of it, had been absolutely neglected for 15 years. The timbers were rotten and the iron rusted. There were no officials competent to superintend its working. During the two following years, 1884 and 1885, the most unsound portions of the barrage were patched up at a cost of about £44,000, and during the season of low Nile an attempt was made to hold up the water by means of it. In the first year the level was raised by 7 feet 2 inches, and in the second year by 9 feet 10 inches. This enabled the canals to be flushed, and caused a very considerable increase of irrigation in Lower Egypt.

"It was, however, impossible to continue for an indefinite period a system which was only made to succeed by the incessant watchfulness of the superintending engineers. At any moment an accident might have stopped irrigation at the most critical season of the year, and the whole cotton crop, upon which the prosperity of Egypt is so largely dependent, might have been almost entirely destroyed. When, therefore, the great powers in 1885 gave their consent to a million being spent upon irrigation works, the first work undertaken was the putting of the barrage in a thoroughly sound state.

"The ground upon which the foundations of the barrage are laid consists of nothing more solid than alternate beds of fine river sand and alluvial mud. During low Nile, when the arches are closed, there is a difference of level in the water on either side, amounting in June, 1885, to nearly ten feet. Hence the water has a constant tendency to percolate under the foundations and establish a uniform level. In doing this it carries along with it particles of the mud and sand on which the barrage rests, and by degrees undermines the whole structure. The problem was, then, to build across the river a foundation either sufficiently deep or sufficiently broad to stop the water from passing underneath, or to compel what little did pass to travel so far either vertically or horizontally that its velocity would be checked. In this way not only would the water be unable to wash away the sand and mud, but it would even deposit the particles of sand and mud which it brought along with it, and thus the substratum would every year become more and more impermeable.

"After careful consideration it was decided to spread the foundations out horizontally, so as to form a broad water-tight platform, rather than to sink a deep wall of

LIVERPOOL PAVEMENTS.

CONSUL SHERMAN, located at Liverpool, England, in a report on the pavements, sewers etc., of that city, says that the Corporation of Liverpool has adopted the policy of constructing its public works in the best possible manner, and in this way has succeeded in reducing the cost of maintenance to a minimun. Since 1872 only impervious pavements have been laid, and Liverpool has now 250 miles of the best paved streets in the world. The wisdom of this is not only seen in the reduced death rate, which has declined from 27.2 per thousand in 1880 to 20.3 in 1888, but in the reduced cost of maintenance of the streets. In 1879 the estimated expenditure of the cost of keeping 226 miles of streets in repair was $136,080; in 1889 the estimated expense for the same was only $40 824 for 250 miles of pavement. Permission, he says, is never given for private parties to cut through the pavement of any street for any purpose. When such work is neccessary, the corporation will do it in its own thorough way, and the interested parties must pay the entire cost. All the street railway tracks are laid and owned and kept in repair by the city, and the company using them pays an annual rental of 10 per cent on their cost.

concrete in the river bed. The latter would have cost much more, and, moreover, it was feared that the result of making deep excavations close to the barrage might bring the whole structure down. Besides adding to the width of the foundations, it was necessary to give additional solidity to the whole work. For this purpose a solid bed of Portland cement concrete, four feet thick, was spread over the old flooring, and covered under the arches and down stream where the action was severest with a heavy pavement of dressed Trieste stone, and up stream with rubble limestone masonry. A line of sheet piling, 16 feet deep, was carried across the whole river 85 feet above the bridge.

"The preliminary stages of the work were begun on the 24th of March, 1886. An earthen coffer dam was built out into the river inclosing the twenty arches at the western end of the Rosetta barrage, which were the arches most seriously cracked. The water within this dam was pumped out, and it was then possible to examine and repair the old foundation. The work done in this first short season was more or less of an experimental character, and there was only time to partially repair six bad floorings. Work began in earnest in 1887, when it was resolved to complete the western half of the Rosetta barrage. One of the chief difficulties that had to be encountered was that the working season was necessarily a very short one. On account of the state of the river flood a beginning could never be made before the end of November. The portion of the barrage which was to be operated upon was first inclosed by great earthen banks forming a coffer dam all round. They had to be made in deep water, and this part of the work always took more than two months. Then the water inside had to be pumped out, and it was considered fortunate if the actual work on the foundations could be begun by the first days of March. It then continued without intermission day and night until the end of June, when the Nile began to rise again. There was not time in each season to repair more than the half of either barrage. The work was, therefore, spread over four years.

"A further difficulty was due to the fact that all the time the barrage was being mended, it was necessary to use it to hold the water up. From the pressure of the water outside springs were constantly breaking out in the floor of the portion from which the water had been excluded, and on one occasion in the last season of all there was a serious risk of the work being interrupted for the rest of the summer, owing to a disaster of this kind. Other difficulties were constantly presenting themselves, especially in the earlier stages of the work. Almost every day some new trouble had to be faced, some new expedient invented.

"By the middle of June of the present year the great work was practically completed. A few further operations had still to be done, but the barrage below the water line was finished. The outlay up to date has been £405,000, and what still remains to be done may bring this amount up to £420,000 as the cost of restoring the barrage. It is almost impossible to estimate with any degree of accuracy the benefits which have accrued, and will, now that the work is finished, accrue to a still greater extent to the country from the barrage. Sir Colin thinks that during the past five years, while the barrage was, as yet, incomplete, the annual value of the cotton crop alone has been increased by over £800,000. It would, however, be somewhat rash to attribute the whole of this to the working of the barrage, though it is evident that, in Sir Colin's opinion, that is a sufficient explanation of the fact."

Mr. Cope Whitehouse, having read the above, writes to the *Times* to correct one of the statements. He says:

"In the letter from a Cairo correspondent describing the great distributing dam repaired by Colonel Western, C. M. G., R. E., and his admirable staff, there is an error of some importance. It is stated that during low Nile 'the water above the barrage is raised and diverted into three main canals, which irrigate the whole of Lower Egypt.' The total cultivable area of Lower Egypt, according to the reports furnished me by Sir C. C. Scott Moncrieff, is about 5,000,000 acres. The cultivated area is 2,800,000 acres. The immense area, amounting to nearly one-half of the delta, cultivated in Pharaonic and Roman days, but neglected for the past 15 centuries, remains unaffected by the barrage, for the simple reason that the summer supply of water for three months of low Nile barely suffices for existing areas. (See Willcocks on Egyptian Irrigation, 1889) The barrage system is capable of handling a very largely increased supply, but the volume of water delivered must be increased by storage reservoirs, impounding a part of the Nile flood, from 20,000,000 cubic meters per day (8,000 feet per second) to at least 50,000,000 cubic meters before the statement of your correspondent can be justified."

THE LARGEST RESERVOIR.

THE *Indian Engineer* says that, omitting lakes, which are in many cases natural reservoirs, the largest reservoir or artificial lake in the world is the great tank of Dhebar, 20 miles southeast of Udaipur, Rajputana, which covers an area of 21 square miles. The masonry dam is 1,000 feet long by 95 feet high; 50 feet wide at the base and 15 at the top. In Southern India also, there are some immense reservoirs. That of Cumbum, is formed by damming the Gundlakamana River by a dam 57 feet high, thrown between two hills. This reservoir has an area of 15 square miles. The Sulekere Reservoir in Mysore is a very little smaller, and, next to Cumbum, is the finest in Southern India.

SEWAGE DISPOSAL AT WORCESTER, MASS.

THE sewage precipitation plant at Worcester, Mass., recently completed under the supervision of City Engineer Allen, and in which the principle of chemical precipitation is used, is described as consisting, mainly, of a series of large open tanks, solidly constructed of brick, and having a combined surface area of about ten acres. There is also a building in which are a mill for grinding the chemicals, and vats in which these chemicals, after being ground, are mixed with a small quantity of crude sewage. This mixture is then discharged into the stream which flows from the sewers into the brick basin, where some chemicals, chiefly lime, combine with some of the impurities, forming a coagulum, which, as it settles, carries with it to the bottom of the basin the other impurities, leaving the clarified sewage. This clarified sewage is then allowed to flow off into the river and the sludge is drawn off from below and deposited on land adjacent to the works, where it will be plowed under, and is expected to cause no detriment to the health or comfort of the neighborhood. The basins are so constructed that all may be used simultaneously, or the flow of sewage may be cut off from any one or more of them for removing the sludge, for cleaning or repairs.

The works have a capacity equal to the daily purification of 9,000,000 gallons of sewage, and the annual cost of their maintenance is estimated at about $20,000.

PRECAUTIONS AGAINST FREEZING OF FIRE APPARATUS.

THE advanced season lends special interest to a notice just issued by the Boston Manufacturers' Mutual Fire Insurance Company, calling attention to the precautions which are necessary to protect fire apparatus against cold weather during the coming winter. Not only is a large amount of damage done to fire apparatus by freezing, but there have been numerous instances in which cold weather has interfered with proper action of some portions of the apparatus, and these difficulties would have been to a large extent avoidable. It is not that the damage caused by frost may be limited to the portion of the apparatus injured, but in many instances breakages of this nature affect the whole fire protective system, and in some instances sufficiently to prevent its efficient use.

The notice in question points out that in the course of this precautionary work for the winter, all hydrants and valves should be carefully examined and oiled, preferably with a heavy mineral oil which will not corrode the brass. All hydrants on stand-pipes and all "Y" or branch hydrants should be opened after the pipes are emptied, to let out any entrapped water which may have leaked past the valve when the pipes were full, care being taken that the drip valves of the post hydrants are in good condition. The rotary pumps should be oiled, and, if exposed to freezing, turned backwards to empty them of water. The pipes exposed to freezing should be emptied, care being taken that the water should be let out from above the check valves, and that all persons who are in charge of such apparatus should know that the gate and drip valves are in order. The drip valves should be marked by an arrow showing the proper direction to open them.

At the last inspection trial of the fire apparatus, the hydrant houses should be looked into and arranged for the winter, attention being given to any lanterns kept hanging there ready for use, and, if necessary, make any changes so that the doors of such hydrant houses cannot be readily obstructed by ice.

If there are any automatic sprinklers in places liable to freezing, and which cannot be kept warm, the pet cocks should be opened after the main valve is closed, and the water drawn off at the drip pipe very slowly, in order that the sprinklers should not be rendered liable to leakage by a sudden change of pressure upon them: this may happen if the water is drawn off rapidly.

When it is necessary to close any sprinkler valves in this manner it is important that every member of the fire department of the mill should be made aware of the fact that these valves are closed, and that it is necessary to open them to provide for the operation of the automatic sprinklers in time of fire.

The necessity of bestowing especial care upon the valves to automatic sprinkler systems is urged upon the attention of every manager. They are frequently reported by the inspectors as shut when they should be open, and were believed to be open. Every valve to automatic sprinklers which is to kept open should be secured in such a position by a leather strap—not a chain—passing around the pipe and one of the spokes of the hand wheel of the valve, the ends of the strap held together by rivets or padlock.

It is preferable that this strap should be loose enough to permit the hand wheel to be moved half a turn, in order that the valve may be turned fully open at any time. It is recommended that such valves be kept a quarter to a half turn from being full open, so as to render inspection possible without removing the strap.

On new sprinkler installations it is recommended that all valves should be provided with an indicator showing whether they are open or shut.

This is one of the most important matters for the protection of manufacturing property, and it is only a matter of chance that the numerous instances of closed sprinkler valves have been revealed by the inspectors and not by fires.

PIPE LINES FOR HEATING AND LIGHTING LONDON.

A PAMPHLET recently issued in England, consists of an "open letter," addressed to Mr. Walter Wren by Mr. T. Howell Williams, on the question of the abolition of smoke, in response to a request made by the former gentleman for a detailed account of a scheme propounded by Mr. Williams for the prevention of fog in London.

Briefly stated, the scheme consists in the production of gaseous fuel at so low a price that it would be impossible in the future to burn coal economically in London. This would be accomplished by making two kinds of gas at the coal fields, closely adjacent to the coal pits; conveying the same, when manufactured, to London in separate systems of main pipes; storing it in convenient holders, and then distributing it for the two distinct purposes of heating and lighting—thus making it a matter of absolute impossibility that coal should be consumed with economy within the radius of the Metropolitan district for the purpose of heating, and preventing its import as a matter of profit.

THE TOKIO WATER WORKS.

CONCERNING the water supply of the city of Tokio, the following, from a recent issue of *The Japan Gazette*, will prove interesting:

"It is nearly 250 years ago that a large canal was constructed from Hamura, some 20 miles or so up the Tamagawa, to lead water to Yedo, and to irrigate the great plain on either side of its course. This canal is a bold piece of engineering work considering the crudeness of the surveying instruments—one might almost say the absence of all surveying instruments—in the country at the time. The water as it enters Tokio is pure, except that it holds some clay in suspension, originating in the sides of the canal, which are not stone lined. The water as it reaches the houses is, for the most part, anything but pure. It is distributed over the whole of the city in wooden pipes, which, for the most part, discharge the water into shallow wells. It is in both the pipes and the wells that the contamination takes place, there being no sufficient safeguard against the soakage of the highly contaminated water of subsoil of Tokio into both these. Moreover, the supply is not of course a high pressure supply. The want of improvement in the supply—or rather in the system of distribution—has been felt for some time, and, to our knowledge, some five or six schemes have been made by foreign and Japanese engineers during the last 15 or 20 years. Some three years ago a company proposed to undertake the work, offering terms that appeared generous enough, but they were not granted a concession, as the authorities were almost unanimously of opinion that such undertakings as the public supply of water should remain in the hands of the municipality. It was considered that in the case of Tokio the work would best come within the control of the City Improvement Commission. Accordingly, about two years ago, a sub-committee of this Commission was formed, with instructions to report to the Commission. Prof. W. K. Burton, of the College of Engineering, Imperial University, a member of the sub-committee, was entrusted with the work of getting out a draught plan of the proposed works. This rough draught was taken by Mr. K. Furuichi, Director of the College of Engineering, to Europe, where it was submitted to various experts in water supply. These, while expressing general approval of the scheme, suggested certain alterations in minor points. On the return of Professor Furuichi the whole question was re-considered by the sub-committee, and Professor Burton was instructed to prepare a revised plan, incorporating certain of the proposed alterations. The modified plan was adopted by the Commission, and received sanction from the Cabinet early this month.

"The population to be supplied at once is estimated at 1,300,000, but the works are to be capable of rapid extension to supply 1,500,000, and eventually 2,000,000. The quantity of water is to average 4 cubic feet per head per 24 hours—about 25 gallons. The work is greatly facilitated by the fact that the water is already brought to the vicinity of the city in a fair state of purity, so that all requiring to be done is to filter it, and to distribute it through iron pipes under pressure. The main works will be at Hamura, a district just outside the city on the northwest, at an elevation of a little more than 100 feet above sea level, where there will be settling reservoirs, filter beds, etc., covering an area of about 100 acres. The purified water will be distributed direct from there to the higher part of the city, pressure being obtained by steam pumps. There will also be two mains, each 42 inches in diameter, carrying water to two other pumping stations intended to supply that part of the town at a level only a little over that of the sea—that is to say, the larger and most populous parts of the city. It is proposed to construct one of these at Shiba, and the other on the elevation where the Imperial University stands. At each of the three pumping stations there will be a clean-water reservoir, holding a half-day's reserve of water. The pumps will pump into mains of diameters varying from 42 to 4 inches. The total length of the mains will be over 400 miles.

"Special attention has been paid to means for the extinction of fires. There will be several thousand fire hydrants, and the diameters of the mains and sub-mains have been so proportioned, that, in the case of a fire, all the hydrants around a burning building will throw water from under pressure. There has been so much variation in the rate of exchange lately, and the price of iron has fluctuated so much, we are told that it is impossible to estimate the price of the work other than approximately. We are told, however, that it will probably be a little on one side or the other of $7,000,000. About one-half of this will be for imported goods, the other half for materials bought and work executed in Japan."

WATER POWER AND ELECTRIC TRANSMISSION.

THE first practical demonstration of electric transmission of power for mining purposes in California has been inaugurated by the American River syndicate, in El Dorado County, an English organization, under the management of Mr. George Cullen Pearson.

According to the San Francisco *Mining Review*, the power station is located on Rock Creek, some 1,500 feet below the mine and mill and two miles distant in a straight line. The plant consists of an 8-foot Pelton wheel, which, running under a head of 110 feet at 100 revolutions with 5½-inch nozzle, has a maximum capacity of 130 horse-power. To this wheel is connected a 100 horse-power Brush generator, speeded at 900 revolutions, the current from which is carried to the mill through a single insulated copper wire, No. 3 B & S. gauge, the return being made by a wire of the same size, making a four-mile circuit. The power from the generator is communicated to the counter-shaft of the mill by a 70 horse-power Brush motor running at 95 revolutions.

The machinery operated consists of three centrifugal roller mills, a ten-stamp battery and a rock breaker The Pelton wheel under these conditions shows an efficiency of 86 per cent., while 85 per cent. of the power thus generated is available for duty at the mill, though only 70 per cent. was called for in the contract with the Brush Company. Sufficient power is taken from the main circuit to run incandescent lamps for lighting the works, the current being cut in by means of the Brush multiple series cut-out box, which admits of incandescent lights being operated by a high-tension current.

The company owning their own water right, the operating expenses of this plant are said to be almost nominal; only one attendant is required at the power station, and this not an electrical expert, but one of the company's employees. If the distance between the generating station and the mill were five or ten miles instead of two, it would simply have been a question of a larger expenditure for wire with a somewhat smaller percentage of power delivered.

This equipment has been in constant operation for five months, no interruption to the service of any moment having occurred during this time. The mills named are handling an average of 4,000 tons of ore per month, effecting, it is claimed, a saving of some 60 per cent. over the former method of working by steam power, estimating wood at 3.50 per cord, while the cost of maintenance is given about as six to one in favor of electricity.

THE Barrett Storage Battery Company, of Springfield, Mass., is reported as building an electric Motor car for street railroad service to be operated by the company's storage batteries. It is to be about 10 feet long, and is to be a locomotive, not a passenger car, simply taking the place of the horses. It will be furnished with 300 cells and two 20 H. P. motors. The mechanism is so arranged that the car can be propelled by either the overhead system or storage batteries.

BUILDERS' AND CONTRACTORS' ENGINEERING AND PLANT.

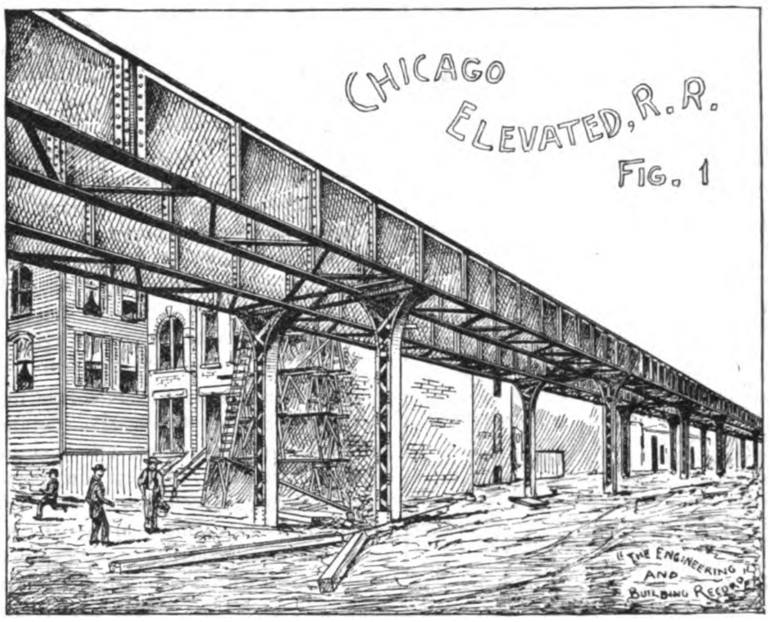
No. CIV.

(Continued from page 344.)

THE CHICAGO ELEVATED RAILROAD ERECTION.

FIGURE 1 gives a general view of the Chicago and South Side structure, whose standard longitudinal spans are 50-foot plate girders, with 4-foot web plates, ⅜ inch thick, 6"x4"x9/16" chord angles, and 4"x4"x½" vertical stiffeners.

There are, generally, no transverse girders, and the cross bracing is of 3x2½-inch L's. Each column is made of a pair of 15-inch 150-pound channels, latticed and spread 5 feet at the top to receive both girders of one track.


CHICAGO
ELEVATED, R.R.
FIG. 1
"THE ENGINEERING AND BUILDING RECORD"

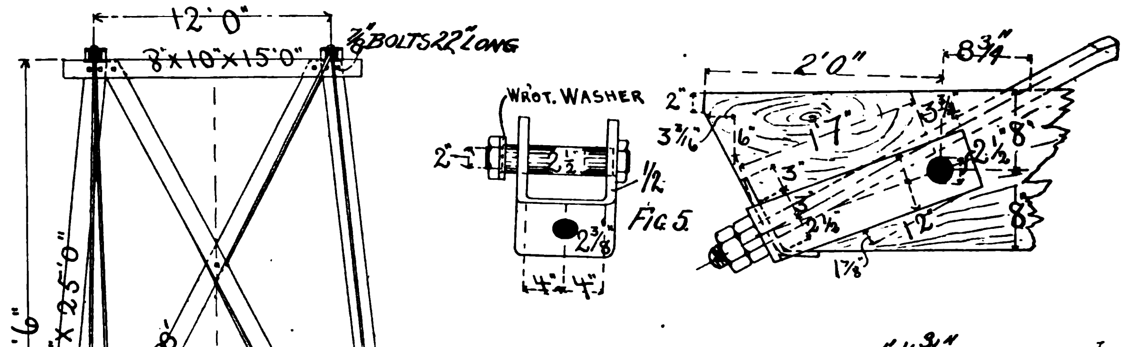


Figure 2 is an elevation, and Fig. 3 is a plan of the traveler designed and used for the erection of this work; Fig. 4 shows, in section and elevation, the right and left sides, respectively, illustrating the tower from X X and Z Z, Fig. 2; Fig. 5 is a detail of the connection at A; Fig. 6 shows the angle bearing at D; Fig. 7 shows the connection at C; and Fig. 8 is a detail of the saddle link at B, which rests on the tower and receives the truss rods on its two pins.

The traveler rolled on six wheels, to the end of the last erected girder I, Fig. 2, to which the following part G was anchored by bolts not shown. The two 60-foot booms F F could each swing nearly 180 degrees around their pivots H H, and by means of hoist E, carried by a trolly running along the boom and operated by steam hoisting gear, the columns could be picked up from their position alongside on the ground and set in place, and the girders put on top of them, and all securely held until connections were made.

The traveler was designed by the Keystone Bridge Company, of Pittsburg, Pa., who also built the iron work.

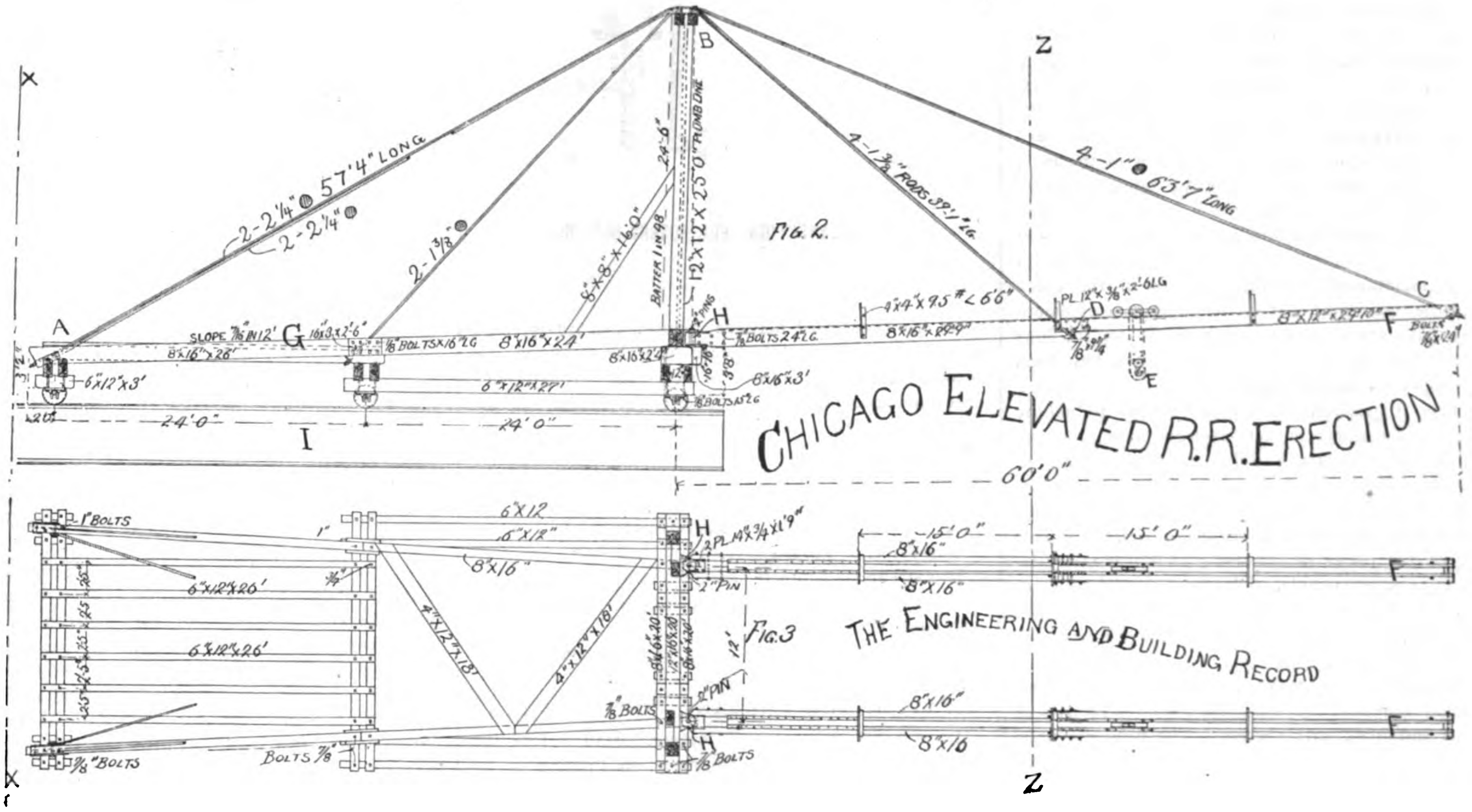
(TO BE CONTINUED.)

POWER TRANSMISSION BY COMPRESSED AIR.

SPEAKING of compressed air power transmission the London *Engineer* of recent date says:

"The success of the experiment in Paris, however, is the result in a large degree of the excessive cost of fuel in the French capital, and it has not, moreover, been applied to anything like purely industrial purposes. The compressed air has been used rather as a substitute for manual labor in a variety of small miscellaneous applications, than to the displacement of steam or gas power in workshops. The peculiar character of the Parisian industries has also been exceptionally favorable to any system of power transmission by reason of the large number of and individual smallness of the plants. Nevertheless, the Popp installation has produced several new applications of pneumatic power, which are not without significance for the future of the system. Prominent among these is the employment of compressed air for the working of lifts, in which use it is said to succeed even better than hydraulic power. Outside of Paris the most remarkable recent incident in the progress of compressed air as power is the success which the Mekarski pneumatic tramway engine has lately attained in France. The system has recently been adopted for the light line of the Nogentais Railway Company, is about to be employed at Bordeaux and St. Maur, and will probably be extensively utilized on the new agricultural and other tramways now being so largely constructed in France. The broadest view upon the future industrial possibilities of compressed air is, however, that expressed by Herr Georg Schimming, in a paper just read before the German engineers in their annual assembly at Halle. The success of the Popp Company's operations in Paris has been largely due to the association of the supply of compressed air with that of electricity; and Herr Schimming proposes that in Berlin and other German towns it shall be made a branch of the gas-making industry. His fundamental principle is that any method of utilising fuel which allows heat to be wasted, and residual products, to escape, to the extent inevitable when coal is burnt under steam boilers, is a serious loss of energy. He proposes, therefore, that fuel for all ordinary heating purposes should be burnt in the gaseous form, and that the glowing coke taken direct from the retorts in the gas works to the fires of steam boilers should serve to produce the entire motive power of a community in the shape of compressed air. Such an amalgamation of power, heat, and light supply in one central concern would, it is argued, produce an enormous economy in the cost of all three; though it is not said how the exact ratio between the requirements of the retorts and the steam boilers, which is an important feature in this economy, is to be always obtained. The proposal is, at all events, a hiut worth the notice of the gas companies.

THE first electric railroad in Switzerland is about to be opened at Boxholm. The overhead wire system is to be employed, power from a 50 horse-power turbine being used to drive two Wenstrom dynamos.



ANNUAL REPORTS.

SEVENTEENTH ANNUAL REPORT OF THE BOARD OF PUBLIC WORKS OF THE CITY OF GRAND RAPIDS, MICH., for the fiscal year ending April 30, 1890.

The pamphlet contains not only the report of the Board of Public Works, but also the reports of the City Engineer, H. A. Collar, and of the engineer of the pumping works and inspector of water waste. It appears that the average daily consumption of water for the year was 3,315,119 gallons, showing an increase of 22 per cent. as compared with last year. A new and larger pump was put in for high service, a stand-pipe was erected, filtration plant constructed and considerable extensions made in the distributing system.

ANNUAL REPORTS OF THE CITY OF KALAMAZOO, MICH., for the year ending March 31, 1890.

The report of George S. Pierson, City Engineer, states that the separate system of sewerage, which was inaugurated in 1880, has now a total extent of 14 miles, exclusive of connecting sewers. The cost of construction proper has been $75,797.03, an average cost per foot of $1.03.

The system has given good service the past year. There has been one stoppage. This occurred in a 6-inch line in the business part of the city. It has been the custom for several years past to lay laterals not less than 8 inches in diameter, except in the case of extensions of 6-inch line already laid. Six-inch lines, however, have never given any trouble in the residence part of the city.

During the past year all work upon the sewers has been done by the city—no contracts having been made except for house connections.

The cost of the work done during the year, by day labor, is as follows:

Size of Pipe.	Length.	Average. Depth of Cut.	Cost of Lineal Foot.
6 inch.	408 feet.	7.1 feet.	44.8 cts.
8 "	806 "	7.65 "	63.5 "
12 "	395 "	10 85 "	$1 46

A 12-inch main, 4,544 feet long, with a subsoil drain pipe 6 inches in diameter, except for 225 feet at lower end, where it was 8 inches, was also laid during the year. The average depth was 10.27 feet, and the total cost, including drain tile and 13 manholes, was $1.04 per lineal foot. The average cost of house connections was 37 cents per foot.

The report of George H. Chandler, chief engineer of the water-works, briefly reviews the condition of the Water Department, and is accompanied by a number of tables giving the pumping record for the year, amount of pipe laid, hydrants and gates set, location and sizes of water mains, etc. Stress is laid upon the importance of erecting a new pumping engine so as to enable the supply to keep up with the growing demand for water.

NINETEENTH ANNUAL REPORT OF THE BOARD OF WATER COMMISSIONERS TO THE CITY OF NEW LONDON, CONN., September, 1890.

The above contains, in addition to the usual annual report of the superintendent upon the subject of maintenance and repairs, a description of the work for additional supply, carried out from designs and under direction of the engineer, W. H. Richards. This consists of a new iron main nearly five miles in length, and of a water tower, hydraulic motor and pump for high service. The latter were fully described in THE ENGINEERING AND BUILDING RECORD of October 11. This form of hydraulic motor for high service is quite unique, none of the water used in the motor being wasted, as it is all turned into the low service, causing, of course, a little reduction of pressure in the latter. The one erected at New London is, we believe, the largest, and, with one exception, the only motor of its kind.

TACOMA, WASH., is to have new water-works, Charles G. Darrach, of Philadelphia, Pa., being the engineer in charge. A gravity supply system has been determined upon, and it is thought that everything will be ready to begin pipe laying early next year.

Correspondence.

Communications giving information or opinions on matters of general interest to the engineer, the architect, the contractor, or the municipal officer, will be welcomed in this column. Fairness will suggest that when communications are sent simultaneously to this and other journals we should be informed of it at the time. Anonymous letters will not be noticed.

LARGE SIZE VITRIFIED PIPE FOR SEWERS.

SPRINGFIELD, ILL., October 23, 1890.

To the Editor of THE ENGINEERING AND BUILDING RECORD:

SIR: The letter published in THE ENGINEERING AND BUILDING RECORD of October 18, from the City Engineer of Omaha, calls for a reply. Referring to my correspondence, he thinks I am "greatly at fault in recommending sewers 5 feet in diameter and, in some cases, very much larger, to be built of a single ring," and says: "I confess that I cannot see one single reason why a single ring sewer should be a better job than a sewer of the same size constructed of two rings." The idea I intended to convey was, that a single-ring sewer constructed with proper materials and workmanship, was far better than two rings with poor material and faulty construction.

If your correspondent will refer to Trautwine's Pocket Book, he will find that "a rather soft brick will crush under from 450 to 600 pounds per square inch, or about 30 to 40 tons per square foot, while a first-rate machine pressed brick will require about 200 to 400 tons per square foot." Assuming that good sewer brick will sustain a pressure of 200 tons per square foot, and the cement he uses sustains a tensile strain of 14.20 tons per square foot after 25 hours, can he demonstrate that a single ring of a calibre of 5 feet, in clay subsoil and thoroughly constructed is unsafe? The truth is, there is but little weight on the crown, and comparatively little thrust at the spring of the arch after the trenches are filled and the earth becomes thoroughly compact, all that is needed, therefore, is that the best material be used and the best workmanship secured, so as to make the sewers as impervious as possible.

If our public works were constructed with the best materials and workmanship, politics eliminated, we would witness fewer failures and more enduring structures.

For myself, I would much prefer a 12-inch wall constructed as it should be, than a 16-inch wall as it is usually constructed.

W. D. CLARK.

THE Croton Aqueduct, supplying water to New York City, is now practically completed and is in permanent use. All the work left to be done upon it is superficial, and will not require the flow of water to be stopped again, unless possibly for an hour or two.

THE sub-committee of the Philadelphia Council Committee on Railroads, having under consideration the bills granting privileges to three street car companies to erect poles and overhead wires for the purpose of running cars by electric traction, recently gave a public hearing on the subject. The overhead wire and the storage battery systems were discussed without reaching a final decision.

DOMESTIC PLVMBING HEATING LIGHTING & VENTILATION ENGINEERING

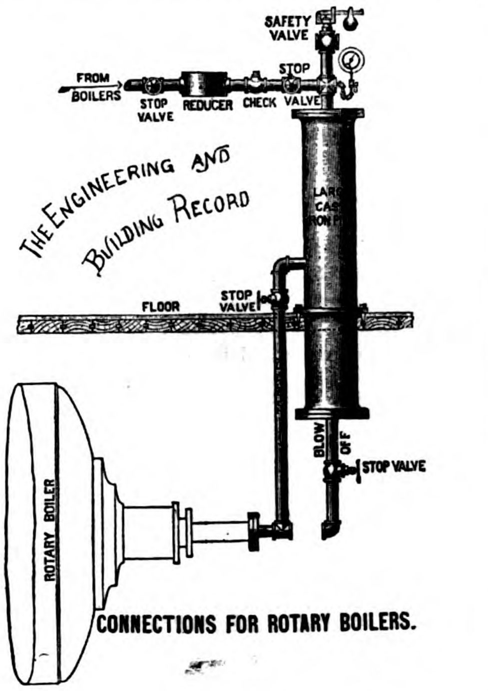
CONNECTIONS FOR ROTARY BOILERS.

WHEN rotary boilers, as used in paper mills, are supplied with steam direct from the steam generating boilers, a great deal of trouble is sometimes caused by the digesting liquor flowing back through the steam supply pipes into the boilers, and into the pipes supplying steam for other purposes, whereby much damage is done to stock in process of manufacture.

This flowing or working back, as explained by *The Locomotive*, is caused by fluctuations in the steam pressure at the boilers. For instance, steam is at 60 pounds per square inch on boilers and rotary; there comes a sudden demand elsewhere for steam, or the fires have to be cleaned, and the pressure falls with comparative suddenness to 40 pounds per square inch in the boilers; the great body of stock and liquor in the rotary is at a pressure of 60 pounds, and temperature due to this pressure; the radiation of heat from the shell of the rotary is not sufficient to reduce the steam pressure as fast as it falls in the boilers, and as a consequence the stored up heat generates steam which flows out of the rotary toward the boilers, and takes along a share of the liquor. Also, when the level of the liquor is above the center of the main journal or steam inlet, as it is always supposed to be when working, the greater pressure of steam in the rotary will force the liquor back through the pipes to an extent depending on the difference of pressures, the length of time it is maintained, and the condition of the check valves in the steam pipe. It is the experience of manufacturers that a check valve will not wholly stop the flowing back of the liquor, and even two or three have been put in without curing the trouble.

Of course, if a separate boiler could be used to boil the rotaries, and no other connections were made to it, the flowing back of the liquor would do no especial harm in many cases. There have been cases, however, where the grease contained in the rags and stock under treatment, and which found its way back into the boilers, has caused burning of the plates of the shell. But it is rarely desirable, or even practicable, to devote a special boiler to the duty of boiling the rotaries, hence some other means must be adopted to prevent damage to stock from the above-described cause.

The annexed cut, reproduced from *The Locomotive*, shows an arrangement that has been tried on rotaries in numerous instances, with success. The principle upon which the apparatus is based, is the use of a reduced pressure in the rotary, so that whatever the pressure in the boilers that in the rotary shall always be considerably less, and thus guard against the possibility of a backward flow of steam and liquor from it toward the steam boilers. The steam coming from the boiler passes through a reducing-valve of any approved make, by which its pressure is reduced to whatever may be considered necessary for the work to be done in the rotary. After being reduced in pressure the steam passes through a check-valve, and then through a stop-valve. It then enters the top of a arge iron pipe, from the side of which a pipe leads off to the rotary. A steam gauge is attached to the large pipe, and likewise a safety-valve, weighted, say, to five pounds more than the reducing-valve is set at. This is to prevent the possibility of the full boiler pressure coming on the rotary, even if the reducing-valve should cease to operate. The stop-valve between the rotary and the large iron pipe should be first closed, when shutting the rotary off, for the following reasons: If the valve between the steam generators and the reducing-valve were shut first, the supply of steam would, of course, be cut off from all points beyond, and the rotary and all the pipe between it and the valve which was shut would begin to cool off by radiation. But owing to the fact that the pipes have a much greater amount of radiating surface in proportion to the volume of steam which they will hold than the rotary has, they will cool off much quicker; and since they are in free communication with the large body of steam and hot water in the rotary, the pressure will be kept up by a flow from the rotary into the pipes. Or we might express the action thus: The steam being shut off the pipes cool quickly, the steam condenses and forms a vacuum; the large body of steam in the rotary has not time to condense, hence the higher pressure in the rotary causes the liquor, and more or less stock, to "back up" into the pipes. The consequence is that the check-valve and safety-valve become clogged with stock and dirty liquor, and if, as would most likely be the case after the operation had been repeated a few times, the check-valve failed to close tightly, the reducing-valve and steam-gauge would be found in the same condition. Where no stop-valve has been used between reducer and rotary, rags have been found tightly forced into the nipple of the steam-gauge, being obliged to pass back through both check and reducing-valves in order to get there.



CONNECTIONS FOR ROTARY BOILERS.

The use of the stop-valve between the rotary and the reducing apparatus and its connections prevents all this trouble. If care is taken to *shut this valve first* when the rotary is to be blown off, no steam, liquor or stock can get back beyond it to clog the safety-valve, check-valve, reducing-valve, or steam-gauge.

It will be understood that the large cast-iron pipe shown in the cut acts as a receptacle or trap for any liquor and stock that may be carried back, the blow-off at the bottom serving to remove all such material from the pipe.

HEATING NEW ENGLAND COTTON MILLS.

IN a paper on "Steam Heating," read before the American Society of Civil Engineers, on October 15, by Mr. W. E. Worthen, the history of the heating of New England cotton mills was reviewed in an interesting manner.

According to Mr. Worthen the earliest cotton mills were heated by hot air furnaces, one at each end of the mills. The mills were about 150 feet long by 50 feet wide, with furnaces at each end with brick flues opening into each story. The furnaces were cast-iron boxes with corrugated top and sides, cast in one piece, and of length to admit cord wood of the usual 4 foot lengths without sawing. The furnaces were inclosed in small brick buildings, arched over with brick, and to protect the mortar joints of this arch from the weather it was covered with sheet lead. As the lead expanded from the heat beneath and from the sun, it hung down from the eaves in fringes, and as it had not cohesive strength enough to draw the fringes back in cooling they hung there till cut off from time to time. Eventually the lead parted at the ridge.

Hot air furnaces with brick flues were put into the houses of the mill agents, and the first church consecrated in 1824 was an example of a closed hot-air circulation. The furnace was placed beneath the center of the church, with the usual hot air chamber of brick, and the cold air duct drew from the end of the church just inside of the doors and the hot air was delivered into the center through an aperture directly above the furnace. At this time wood was the only fuel.

Steam was introduced about 1836. Boilers were placed in the old hot air furnace houses, and the steam pipes were 3 to 6-inch cast iron pipes suspended from the ceilings. The steam and drip connections were of small wrought iron pipe. It has been very difficult to find out when wrought-iron pipe was first introduced. Mr. Worthen gathered from Morris, Tasker & Co., of Philadelphia, that "the butt welded pipe was first made in this country about the year 1830 to 1832." In the early editions of "Appleton's Dictionary of Mechanics," under the head of forging, it is stated: "Musket barrels, when made entirely by hand, were forged in the form of long strips about a yard long and 4 inches wide, but taper both in length and width, which were bent round a cylindrical mandrel until their edges slightly overlapped; they were then welded at three or four heats by introducing a mandrel within them instantly on their removal from the fire. When illumination by gas was first introduced, in a large way, by Aaron Manby, Esq., then of the Horsley Iron Works, old musket barrels were employed for the conveyance of gas. The breech ends of the musket barrels were broached and tapped, and the muzzles were screwed externally to connect the two without detached sockets. From the rapid increase of gas illumination the old gun barrels soon became scarce. This led to a series of valuable contrivances for the manufacture of wrought-iron tubes, commencing with Russel's patent in 1824, under which the tubes were first bent up by hand hammers and swages to bring the edges near together. They were welded between semicircular swages, fixed respectively in the anvil, and the face of a small tilt hammer, worked by machinery, by a series of blows along the tube, either with or without a mandrel. The tube was completed on being passed between rollers with half-round grooves which forced it over a conical or egg-shaped piece at the end of a long bar to perfect the interior surface."

Mr. Worthen adds that in a communication, in 1882, of the late Robert Briggs, Mem. Am. Soc. C. E., to the Institution of Civil Engineers, of which he was also a member, it is stated that the late Joseph Nason of Boston and New York was originator, improver and adapter of much that is essential and now implicity followed in the general arrangement and details of the apparatus employed in the American practice of heating buildings by steam Mr. Worthen states that he knew Mr. Nason very well, and recollects about 1840 he returned from England and endeavored to introduce Perkins' system of heating by hot water circulation through small pipes. He attempted to heat one of the dye kettles of the Merrimac Print Works in this way, but it did not prove a success; but he put hot water apparatus into the houses of some of the agents of the mills, which worked well. He soon turned his attention to steam heating, with the results as given above by Mr. Briggs. With regard to the Perkins system of heating with hot water, there is in the "Journal of the Franklin Institute" for September, 1887, a quotation from a letter from Jacob Perkins written in 1836: "My son Anger is doing well with his patented apparatus for heating by hot water. The system of heating by hot water and steam is being abandoned and the old apparatus removed from various public buildings to give place to the new. This is the case in the British Museum, where Anger has given great satisfaction. It would seem incredible, but it is a fact, that in this apparatus a stream of hot water, which is not thicker than your little finger, carries the heat 700 feet and then returns to the boiler at a temperature of 100 degrees. The boiler is a coil of tubes of the same diameter with the conducting pipe."

The steam pipes as placed in the mills by Mr. Nason were arranged along the inside of the wall and were at first trombone coils; that is, the circulation was through a single pipe, returning by a single half turn or return bend, and so continuously from one end to another according to the number of pipes required. Afterwards branch tees or manifolds were introduced, expansion being provided for by right-angle bends in the pipes at the end of the room. Afterwards these bends were turned up vertically making a miter branch with the branch T horizontal. At present the Boston Manufacturers' Mutual Fire Insurance Company recommend the placing of the coils of steam pipes for heating purposes overhead in mills in almost all cases.

When the steam was first introduced to heat the mills, as already remarked, the small hot-air furnace buildings were used as boiler houses. The boilers themselves were vertical, they were fired by watchmen who had many other duties and carried thick fires, and the feed-water was supplied automatically by balanced floats, which drew water from cisterns in the attics of the mills, supplied by three and five throw, single plunger pumps, driven by the water-wheels. These pumps and cisterns were also used for mill and fire service.

The Merrimack Manufacturing Company, of Lowell; Mass., was among the first to use steam first for power at the cotton mills and afterwards the exhaust for their print works, for the purposes of heating, boiling, etc.

ELECTRIC MOTORS.

(Continued from page 348.)

THE EXCELSIOR MOTOR.

The motor shown in Fig. 23 is made by the Excelsior Electric Company, 115 Broadway, New York. It is made for both arc and incandescent light circuits.

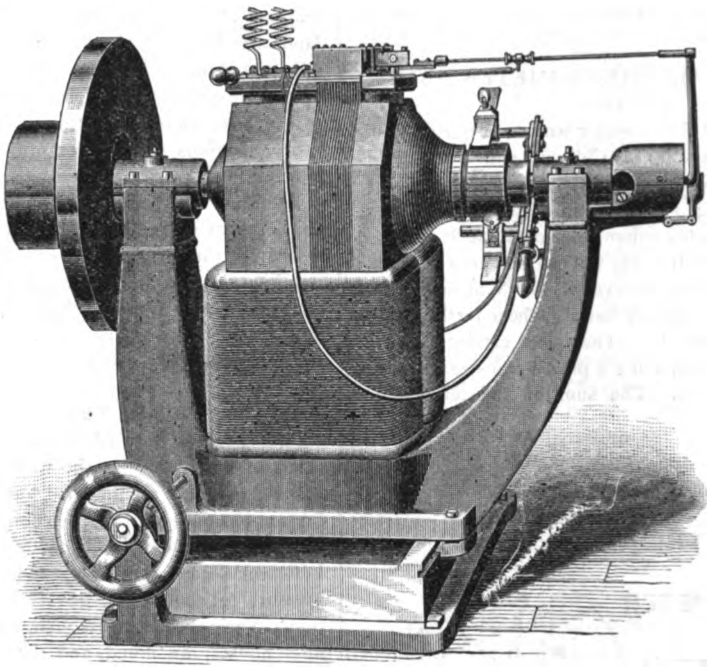


Fig. 23.—MOTOR MADE BY THE EXCELSIOR ELECTRIC CO., NEW YORK.

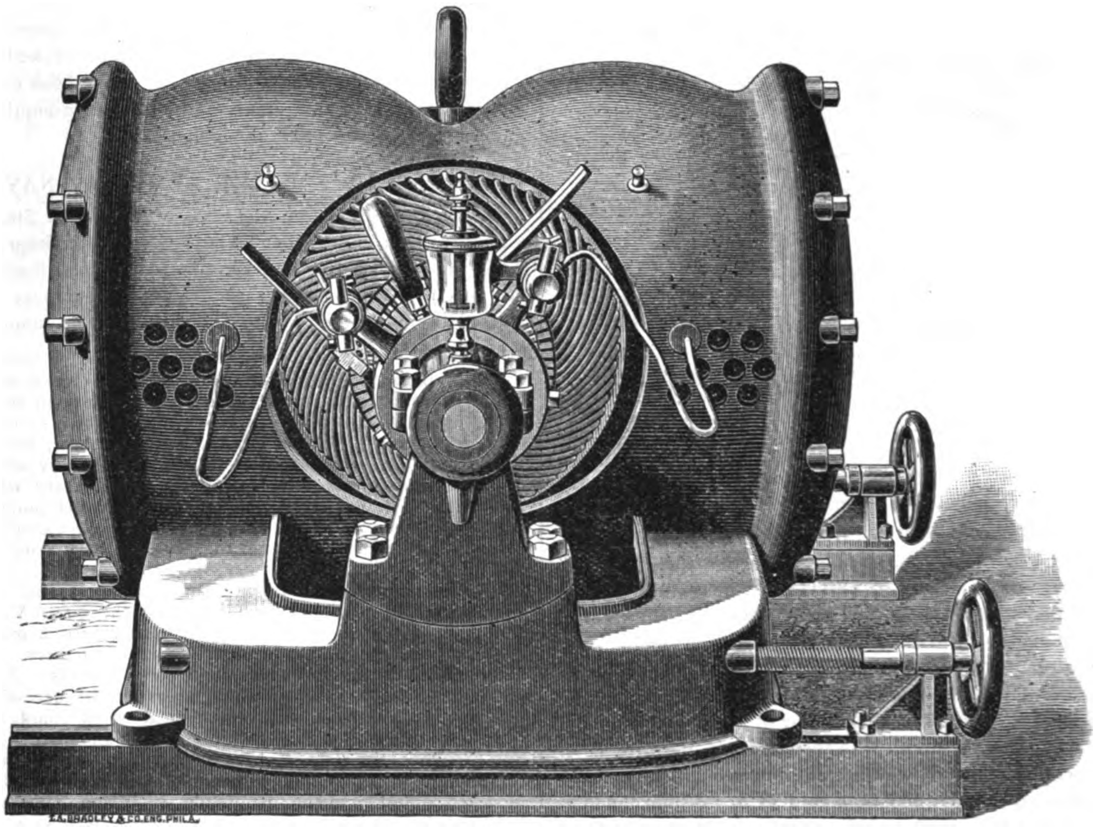

E.A. BRADLEY & CO. ENG. PHILA.

Fig. 24.—MOTOR MADE BY THE WENSTROM CONSOLIDATED DYNAMO AND MOTOR CO., BALTIMORE.

In the arc light circuit, or constant current, motor regulation is effected by a centrifugal governor which controls the strength of the field magnets by cutting out the successive layers of wire in the coils as the load decreases, and cutting them in when it increases. The two main bearings of the motor shaft and the ball and socket bearings of the governor are provided with oil chambers, from which the oil is led to the wearing surfaces by means of felt strips. The armature and field magnet coils are connected in series. The motor is mounted on an adjustable base, and should be given a dry situation.

In the incandescent circuit, or constant potential motor, the armature and field magnet coils are in derived circuit or multiple arc, as it is termed. As the motor is supplied with current under a constant electro-motive force or pressure, it keeps uniform speed at all loads up to the maximum for which it is designed.

In order to prevent an excessive rush of current through the motor, which would take place on account of the low resistance of the armature and the absence of any counter electro-motive force, an artificial resistance must be inserted before starting and withdrawn as soon as the motor has attained sufficient speed. This resistance and a double-pole cut-out switch are mounted in a box accompanying each motor.

The interruption of a large current by means of a metallic switch produces sparks which will corrode the contact points, rendering the switch unreliable. The switches have therefore been provided with carbon contacts, which are kept closed automatically till the metallic contacts are opened. The spark will then appear at the carbon points, where it can do no harm.

The arc light circuit motors are made in sizes from ½ horse-power up to 15 horse-power, and the incandescent circuit motors range from 1 to 40 horse-power.

THE WENSTROM MOTOR.

The Wenstrom Motor is made by the Wenstrom Consolidated Dynamo and Motor Company, of Baltimore, Md., the general agents for the United States being Chadbourne, Hazelton & Co., 416-420 Walnut Street, Philadelphia, Pa. Figure 16 represents a side view.

Generally described, the motor consists essentially of a cylindrical body of cast-iron, closed with heads of the same metal, and resting on a substantial bed-plate. Within, and concealed from view, are four pole pieces projecting toward the armature, on two of which are wound the magnetizing or field coils. The armature is said to be of such construction that great proximity, without touching, exists between the faces of the pole pieces and the surface of the armature. This is claimed to permit a saving in the electrical energy used in the magnetization of the fields, shortening the path, and thereby facilitating the passage of the magnetic lines of force across what in some other forms is a wide air space. The compactness of the motor and its convenient shape for handling, and the fact that the field coils are entirely contained within the iron body of the machine, obviate any risk of damage or breakage under ordinary circumstances in transportation or otherwise. All parts are made readily accessible for inspection or repairs. The armature can be taken out by simply removing one bearing. The field coils which are wound on the heads of the machine, can easily be removed by unbolting those heads. Another claim made for the Wenstrom motor is that a high electro-motive force can be obtained at a comparatively low speed, and that, in consequence, considerable counter-shafting may, in some cases, be dispensed with.

The motors are made in sizes from ½-horse-power up to 100-horse-power for various kinds of work. At present the company are building a number of motors for traveling crane use.

(To be continued.)

LIGHTING THE STREETS OF LONDON.

M. E. Walcott, writing in the London *Architect*, says that in 1661 the streets were directed to be lighted with candles or lanterns by every householder or occupier fronting the main road from nightfall to 9 P. M., the hour of retiring to bed. In the last year of King Charles II.'s reign, one Edward Heming obtained the right of lighting the streets with lanterns placed over every tenth door, from six on moonless evenings until midnight, between Michaelmas and Lady Day. During the reign of Queen Anne, in July, 1708, Mr. Michael Coke introduced globular glass lamps with oil burners, instead of the former glimmering lanterns. In 1716 an Act was passed which enjoined every householder to furnish a light before his door from 6 to 11 o'clock at night, except on evenings between the seventh night of each new moon and the third after it reached the full. In a few years a company was formed to light the streets from 6 o'clock until midnight, each householder who paid poor rates being required to contribute for this purpose six shillings a year. Gas at its introduction, in the beginning of the present century, presented such a novel spectacle to the eyes of the Foreign Ambassadors, that they were vain enough to imagine that the brilliant lamps were only a part of a general illumination to celebrate their arrival.

UNBURNT GASES OF GAS STOVES AND BURNERS.

At the last meeting of the British Association for the Advancement of Science Mr William Thompson presented a paper on the above subject.

Mr. Thompson had originally attempted directly to determine the amount of monoxide, which everybody knows is a dangerous poison; but this proved to be beset with too many difficulties, and the experiments refer to the determination in the combustion gases of unburned carbon and hydrogen, in whatever form they may exist. The flue gases were passed through two U tubes filled with surphuric acid; then through two similar tubes containing soda lime; these would absorb water and carbon dioxide, leaving hydro-carbons, hydrogen, and carbon monoxide to pass through a red hot glass tube filled closely for 15 inches with copper oxide. The coal gas employed was previously dried, and side by side with the experiment were determined the water and carbon dioxide present in the air.

The only burner in which perfect combustion was effected was in paraffin oil lamps when the flame was not turned on full; when the flame was turned on full, unburned gas was liberated to the extent of twelve parts of carbon and three parts of hydrogen for every 1000 parts of carbon completely burned. The next nearest approach was in an Argand burner, also when not turned on full; no carbon and only .25 of a part of hydrogen escaped then, whilst the fully turned-on burner let escape .1 part of carbon and 2.5 of hydrogen. Next in point of perfect combustion ranks Bray's ordinary flat flame burner; here 12 carbon and 1 hydrogen escape. Heating stoves gave much less satisfactory figures, one with three luminous flat burners discharged 97 C and 12 H; eight Bunsen burners playing in a Fletcher stove on fancy ironwork, 146 C and 7 H; twenty Bunsen burners heating asbestos projecting from a fireclay brick, 57 C and 20 H; and a stove in which the burned gases rise to the top of an iron chamber filled with pipes (through which cold air is passed to be heated), and from the bottom of which the gases escape after having considerably cooled, discharged 226 C and 28 H. Smoke particles were not observed in any of these cases, but they would not effect these figures, nor would acetylene and ethylene. The combustion in cooking stoves should carefully be inquired into for sanitary reasons.

Notes and Queries

on Domestic Engineering.

Communications relating to the practical details of plumbing, heating, lighting and ventilation will be welcomed in this column. The writer's true name and address must always be given, but an assumed name may be used for publication if preferred.

PIPING FOR HOT WATER RADIATORS ON BOILER LEVEL.

A. T. ROGERS, New York, writes: "This question has been asked me two or three times within a few weeks, as a test question:

"Supposing a building to be heated by hot water, in which it is necessary to place one or more radiators on the same floor as the heater and others on upper floors, and in which doors, etc., prevent the running of the return pipes along the wall above the floor. If the return pipes drop below the floor, there is produced a pocket of colder water below the bottom of the heater, which will tend to lie stagnant. How will you overcome it?

"The solution proposed by the questioner was this: From the point where the flow-pipe drops to the radiators on the lower floor run a single 1-inch pipe up to the level of the expansion tank, this will give a head which will overcome the stagnant pocket before mentioned.

"Now, to speak plainly, I don't see it. I think that the single pipe running upwards is a waste of material, for no head is produced by it that was not already there, due to the height of the expansion tank. But if the main for the lower floor be run up full size to just below the level of the tank, with an air-cock or air-pipe at its highest point, and then run down again to the radiators, we have a high column of cooler water overbalancing a column of warmer water, and which would tend to overcome the cold pocket below the heater. Upon my suggesting the double pipe, as above, my questioner rejected it because of the expense, substituting the single 1-inch pipe. I have never heard of a job done as he suggested, but have seen a job near New York where this condition exists, and where the connection is like this—upward from the horizontal main at 45 degrees, then horizontal, then vertically downwards to radiator. I have not seen this job work, but am told by the fitter who did the work that the radiator on the lower floor worked as quickly as any on upper floors.

"I have seen jobs where the return has risen from the radiator to pass over doors, etc., dropping again to the heater, and when the descending leg of the syphon was the longer the circulation was generally good. In all such cases as those I have mentioned care is needed to favor difficult branches as against those having straight upward runs.

"I should like to hear the experience of others, as these are somewhat frequent problems."

[A dip, or a "trap," below a doorway, or in crossing a hallway or other passage, is a very common occurrence in hot water apparatus. They should be avoided if possible, but when unavoidable they may be used, and, unless an air pocket is formed that will become air-bound, they offer very little obstruction to the flow of the water. A very feeble circulation may be stopped or further impaired by it, but a good circulation, with ample diameter of piping, will go on unless the air stops it.

A 1-inch pipe, run from the stagnant pocket to the expansion tank, cannot increase the head and will not help the circulation directly. It may act as an air-pipe, however, in some particular case and the person finding the circulation improved attribute the result to the wrong cause. A pipe carried up and down again as you propose will add something to the force of circulation. Its value, however, is overrated, as the "down" side must have nearly the same temperature as the "up" leg if the circulation is rapid. In special cases it helps, but a well-designed job will not be benefited by it. Carrying the return pipe over obstacles is not good. It can be done, however, but care must be taken to take off the air at every point.]

Novelties.

Devices are described under this head purely and strictly as news; because believed to be new and calculated to interest readers.

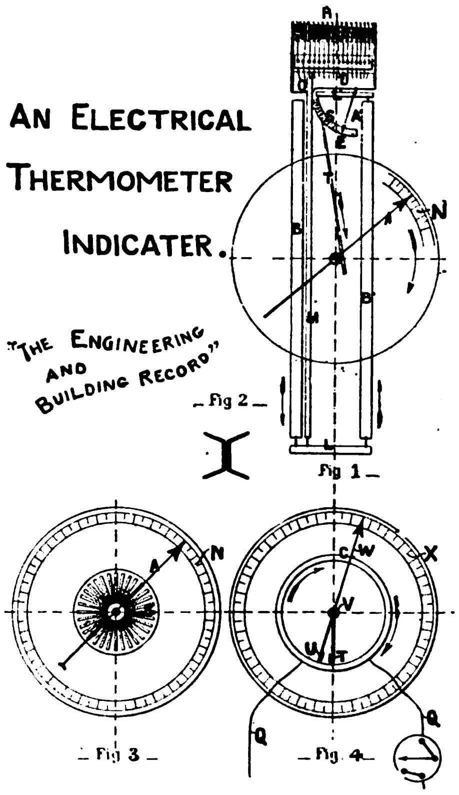
In no case is pay accepted, directly or indirectly, for publishing a novelty notice.

As the subjects are selected for their supposed novelty and interest merely, it will, of course, be understood that the selection does not imply indorsement.

AN ELECTRICAL THERMOMETER INDICATOR.

A SPECIAL form of thermometer with an electrical indicator has been invented by M. Chibout, and is described in the Paris *Genie Civil*, substantially as follows:

Two bars B B', Fig. 1, with a stiff cross section, Fig. 2, are made of some highly expansible metal, such as rolled zinc. One of the bars B is fixed at one end to a bed-plate O, and at the other end to the lever L, which, at its opposite extremity, carries the second bar B', whose farther end is connected to the lever L'. The latter carries a bar T, provided with a rack engaging a pinion whose axis carries the indicator needle A. The sum of the temperature elongations (of bars B and B') is multiplied by the levers L and L', and moves bar T in the direction shown by the arrow, and indicates it, still further magnified, by the needle A. An arc S has insulated copper points corresponding to the graduations of the scale R, and is traversed by a needle A', attached to lever L', and adjusted to maintain on it a position exactly corresponding to A on the arc N. When A' touches any of the copper points E it completes the circuit with the corresponding wire D of a set of circuits R, which are connected with the indicator. The latter may be placed at any distance, and is shown in Fig. 4, where C is a circular solenoid receiving, through wires Q Q, the current from circuits R.



There are at R as many circuits as there are degrees of graduation on the Scale N, each circuit having a different resistance, and, therefore, sending a current of different intensity through C when contact is made at E; U and T are bars of iron, the latter fixed and the former attached to needle W, pivoted at V. When the electric current passes through C, U and T become magnetized and repel each other proportionately to the strength of the current. The needle W, is, therefore, easily adjusted so as to take the same relative position on its scale X that A' does on S, and indicates the same reading as is shown on the thermometer scale N.

Figure 3 shows a simpler arrangement, where the arc S is concentric with the thermometer dial, and its needle A is supplied by needle A, Fig. 1. In Fig. 1, M is a rigid bar forming part of bed-plate O, and the fulcrums and connections of the bars and levers are made of thin, metal plates, indicated by black lines.

The arrangement is claimed to be susceptible of increased sensitiveness by changing the form of solenoid C.

BOOK NOTICES.

NOTES ON GAS-LIGHTING AND GAS-FITTING. By William Paul Gerhard, C. E. 50 pages. Size 5x7 inches.

The above pamphlet is reprinted from detached papers, previously published by the author. The sanitary, economic, scientific and mechanical aspects of the subject and its general conditions, and the main features of ordinary practice in this country and in England, are discussed at some length, and accompanied by numerous hints to builders. They are followed by a form of specification for gas piping, and a score of suggestions to gas consumers, about the use of gas and fixtures and the precautions suitable for ordinary conditions or emergencies.

Attention is called to the importance of good work, and the necessity of having it carefully laid out and thoroughly tested; to the arrangement of pipes and valves, and the requirements for them; to making joints, supporting and exposing pipes, draining them, and methods of testing. The matter bearing on this last point is reprinted from THE ENGINEERING AND BUILDING RECORD, Vol XI., page 501. The author also describes English practice by quoting from William Easie, sanitary engineer. Considerable space is devoted to the cause and effect of gas leaks, to which, besides the waste, danger of explosions and sickness are attributed. Various precautions against fire are recommended. The composition of gas, its combustion and the conditions of illumination, are discussed. Different forms of burners and globes, and the use of pressure regulators and governor burners receive attention. Various defects, frequent in the gas fitting of common houses, are noted, and the specifications cover the pipes, joints, valves, stop-cocks, risers, outlets, location of distribution pipes, method of fastening, height of brackets, length of nipples, pressure test and inspection. A table of the size and greatest length of pipe allowed to supply up to 500 burners, is also given. The book concludes with an estimate of average burner consumption and hints for the reduction of high gas bills.

ELECTRICIANS FOR THE ARMY AND NAVY.

LIEUTENANT BRADLEY A. FISKE, of the United States Navy, gave an address on "The Modern Electrician in Time of War," before the New-York Electrical Society last week. After showing the value of electricity as applied to modern warships, the lecturer said, among other things.

"I propose the formation of a corps of naval and military electricians to assist the Army and Navy in their work. Such a corps might exist in every principal seaport town on the coast, the principal corps, of course, being the one with headquarters in New York. Electricity being now a recognized factor in both naval and military war, and requiring expert electricians for its full development, there would seem to be just as much reason for an electrical corps in the National Guard of the State of New York as for infantry, artillery, or cavalry.

"Those members volunteering for naval work would be equally useful. The ordnance officer at the Navy Yard would constantly find himself overwhelmed with a mass of work which he would be utterly unable to carry out without the assistance of some such corps as this. And for the reason that electrical engineers are of necessity mechanicians, a great deal of technical work could be intrusted to them, such as the arrangement and fitting of gun-carriages, the storage of ammunition, the assembling of guns, etc. Their more immediate and obvious field, however, would be in the installation and fitting of electric lights, motors, telegraphs, telephones, and other electrical appliances, on board the vessels of war, constantly called into requisition. In the matter of fitting out merchant steamships their usefulness would be at once apparent. Now, as the work of fitting out ships with electric and ordnance equipment calls for technical knowledge and experience of a high character, it is obvious that a corps of well-trained technical men, such as is here suggested, would be more than useful; it would be necessary."

A GIGANTIC pendulum has been suspended from the center of the second platform of the Eiffel Tower at Paris. It consists of a bronze wire 380 feet long, with a steel globe weighing about 198 pounds at the end. Its object is to exhibit the rotation of the earth by the Foucault method.

THE MAINTENANCE AND OPERATION OF WATER-WORKS BY PRIVATE COMPANIES.

(Continued from page 326.)

8. SHUT-OFF ORDER. Color, pink. Record No. 913.

If water is to be shut off for any purpose other than in case of accident, repair, or change of connections or fixtures, when the licensed plumber or foreman of the service department may do it without a permit, a shut-off order must be given to the Inspector, who will shut off the service, read and note the number of the meter, if there is any, and return the order to the office, dated and signed.

Transcripts will then be made from it to the rate and other necessary books, and the order filed away according to the stop number.

9. SHUT-OFF BOOK. 13¼ inches long, 8 inches wide. 180 pages. Horizontal rulings, 3 to the inch. Record No. 938.

This book will be used to note the times of turning on or shutting off any stop.

Fill in in the left-hand column the stop numbers in regular numerical order, using every third line only. There will then be twelve numbers on a page, and each number will have three lines and twelve double columns for the entry of different dates of turning on or shutting off any stop. Also give owner's name and page in Rate Book.

When any stop is turned on for the first time, enter the date in the first half of the first double column, and, if it is ever shut off, note the date and the reason in the other half of the first column; then, by following down this column, all stops that are shut off can be seen at a glance. If the stop is ever turned on or shut off again, enter the date in the next column, and so on.

To indicate the reasons for shutting off any stop, use the following letters:

P, for penalty, or failure to pay bills or conform to the rules and regulations.

V, for vacancy.

R, for request of owner, by reason of temporary absence or otherwise.

D, for dead—*i. e.*, the stop is permanently out of use, by reason of the building being moved, burned, or for other reasons.

If the ownership changes, cross out the old name and insert the new one.

10. REPAIR NOTICE. Color, blue. Record No. 914.

Whenever the water is to be shut off from any section of the works, large or small, for an hour or more, notice must be given to each party having connection with the works by leaving one of the "repair notice" slips at the door as long in advance as possible.

In case of accident, when no notice can be given in advance, the Inspector must go at once to each house having hot-water boilers connected with the works, and give the necessary instructions in regard to the same, and prevent damage.

11. RECORD BOOK. 13¼ inches long, 8 inches wide. 334 pages, containing 1,000 records. Record No. 934.

Each page will contain the records for three premises; and the diagrams will be filled in as indicated, together with such changes, alterations, etc., as may be necessary from time to time.

The records will be made according to the stop numbers, three on a page.

If more than one book is needed on any one works, the stop numbers will continue from one to another, and each book will be numbered on the back and side, giving the range of the numbers it contains.

12. METER BOOK. 13¼ inches long, 8 inches wide. 180 pages. Horizontal ruling, 3 to the inch. Record No. 939.

Use this book to keep a record of each meter received.

Give a proportionate number of pages to each size used, commencing with the smallest. Then again divide these pages proportionately among the different kinds of meters in use, heading as many pages as needed with the name of the meter or the maker's name, whichever it is known by commercially, and the size of the meters on that page. Then, under the appropriate size and name, enter each meter in the order of its shop number. If any meter should be received out of the order of its shop number enter such number in red ink, so it may readily catch the eye. All meters should be entered as soon as received, whether set or not. The pages left blank will answer for additions or any new meters that may be introduced. On the first page of the book make a list or index of pages where different sizes and makes commence.

Leave three lines between each entry, so as to give four lines for each meter, which will provide ample room for all the different changes which any meter will probably be subjected to.

When meters are set or removed, enter the proper data in the different columns, as indicated.

13. METER READING BOOKS. 4 inches by 7 inches. 180 pages each and index. Record No. 935.

These books are to be used by the persons reading the meters to note the name of the owner, location of the premises, name, size, and number of the meter, date of reading, and the reading.

In large works, several books may be necessary, each one covering a certain section of the works, and the readings taken and entered in the natural order in which the meters will be read, without regard to alphabetical or numerical order.

In small works, one book will be sufficient. Each book provides for 32 readings of each meter.

Each book should be indorsed on the outside with its number, the number of the division of the works for which it is used, and the date when the first reading was had.

Each page will be numbered, and the index in the front of each book will refer thereto.

This index should be arranged by streets, in the order which experience shows to be the most convenient for progress in reading, the order of the street numbers to be preserved in filling in (either backward or forward, as necessary), with an extra line between each name (unless adjoining property), so that any new meter can be properly placed.

[To be pasted in front of "Meter Reading Book."]

DIRECTIONS FOR READING METERS.

Observe carefully whether the dial indicates cubic feet or gallons, and so note in the proper heading in the book.

Observe the arrangement of the dials, and begin to read at that dial which indicates the least quantity, unless that dial should represent but 1 cubic foot or 1 gallon, in which case disregard it.

The figures at the top of each dial represent the maximum reading of that dial, thus, a dial having the figures 10,000 over it means that one full revolution of the pointer indicates 10,000 cubic feet or gallons, as the meter may read, and each subdivision of the dial represents 1,000 cubic feet or gallons.

Read the first or smallest dial, and set down in the right-hand column the figure which the pointer has last past. In the second column set down the figure on the next largest dial which the pointer has passed, and so on.

14. INSPECTOR'S BOOK. 4 inches wide, 7 inches long. 216 pages. Horizontal ruling, 3 to the inch. No special ruling, but a head line. Each page numbered. Record No. 936.

To be used as a pocket memorandum book by the Inspector to note size, kind, location of fixtures on any premises, and anything else which is necessary to be remembered and reported to the office.

Entries will be made in successive order without regard to alphabetical or numerical arrangement; and, as soon as the same is reported to the office or otherwise attended to, be crossed off of the book.

Each entry should be properly dated and signed by the party making the inspection.

15. COMPLAINT BOOK. 8 inches by 13¼. 270 pages. Record No. 937.

In the Complaint Book enter all complaints from customers, or reports of matters needing attention. All entries to be dated, and name of party making report, or complaint, entered.

This book should lie on the Superintendent's desk, and be accessible to all.

It should be frequently examined by the Superintendent, and every entry attended to as soon as possible, either by the Superintendent or by such other person as he may designate.

When any matter has been attended to and finally disposed of, a minute, stating what was done and by whom, should be made opposite the original entry.

(TO BE CONTINUED.)

CONTRACTING INTELLIGENCE

For works for which proposals are requested see also the "Proposal Columns," pages i-ii-370

WATER.

For Additional Water Items see Proposal Columns.

PITTSFORD, VT.—The Town Clerk at this place writes: "Nothing has been done regarding the water-works project except to introduce a bill into the Legislature of Vermont granting a charter incorporating the Pittsford Aqueduct Company. The bill has passed the House, reported to the Senate and referred to the General Committee."

NORTH KNOXVILLE, TENN.—A committee, with Mayor Gratz as Chairman, has been appointed at this place to draw up an ordinance granting a franchise to a company, which proposes to establish a system of water-works at this place.

SIOUX CITY, IOWA.—The Water-Works Committee has reported that it is necessary to proceed at once with the projected water-works extensions, the cost of which, the committee estimates, will be $20,000. City Engineer Wingeland can furnish particulars.

KEY WEST, FLA.—Reports say that the charter of the Key West Water Supply Company has expired, and that steps will be taken by the city to establish a water-works system of its own.

PLAINFIELD, N. J.—Reports say that the franchise and property of the Plainfield Water-Works Company has been bought by the Plainfield Water Supply Company, and that the latter corporation has awarded contracts for the completion of the water works by next spring.

OTTAWA, ONT.—The residents of Rideauville, a suburb of this city, have petitioned the water-works company, asking that they may be allowed to connect with the city water mains. The request has been granted. For additional particulars address the Rev. L. N. Chanpeau, as above.

WHEATLAND, IA.—An additional water supply is projected for this place. Address the town clerk for particulars.

GEORGETOWN, COL.—A special election has been called here, November 12, for the purpose of voting bonds to the extent of $36,000 to construct new or purchase the present water-works at this place.

BLUFFTON, ALA.—The water-works system projected for this place will soon be established.

CATONSVILLE, MD — The Catonsville Water Company will, it is reported, issue $30,000 of bonds for improvements, etc.

MOUNT TABOR, ORE.—The Mount Tabor Water and Light Company has been incorporated. The directors are: Messrs. J. H. Smith, J. C. Moreland and others.

GRENADA, MISS.—The citizens of this place are soon to decide upon the issuance of $20,000 of bonds for the construction of water-works. The Mayor can furnish particulars.

ZANESVILLE, O.—Reports say that the taxpayers of this place will vote next month upon the question of spending $175,000 for the improvement of the water-works.

BELVIDERE, ILL.—The officials of this place will advertise for bids for putting in a water-works system, the intention being to begin operations soon.

LA GRANGE, GA.—It is reported that the officials of this place will ask the next Legislature for authority to issue bonds to the amount of $50,000, the proceeds of which to be applied to the construction of water-works.

WOONSOCKET, R. I.—This place has appropriated $25,000 for the extension of the water system to Manville, a suburb.

STOCKTON, CAL.—The Stockton Water Works Company has been incorporated with a capital stock of $500,000. Address W. S. McMurty, Los Gatos, for particulars.

LEXINGTON, NEB.—By telegraph to THE ENGINEERING AND BUILDING RECORD, November 7, 1890. "The opening of proposals for constructing the water-works system here has been postponed until November 20."

(Continued on page 368.)

CONTRACTING NEWS DEPARTMENT.

A WEEKLY RECORD

OF SPECIAL INTEREST TO CONTRACTORS, BUILDERS AND MANUFACTURERS OF ENGINEERING AND BUILDING SUPPLIES.

THE ENGINEERING AND BUILDING RECORD,
277 Pearl Street, New York.
November 8, 1890.

CONTRACTING INTELLIGENCE.

Our readers will oblige us by notes, clippings, or any information which will put us in the way of obtaining early and reliable news for our "Contracting Intelligence." *Information of importance sent to us exclusively, and not elsewhere published will be liberally paid for.*

Persons who make any use of the information they find in these columns we trust will not omit to mention THE ENGINEERING & BUILDING RECORD as the source

WATER.

FOR ADDITIONAL WATER ITEMS SEE PRECEDING PAGE.

ATLANTA, GA.—At a meeting of the General Council, held November 4, the contract for furnishing a quantity of cast-iron pipe and special castings was awarded to the Howard-Harrison Iron Company, of Bessemer, Ala., at the following figures: Pipe, $22.24 per ton; special castings, 22½ cents per pound. The award was made with the proviso that the bonds for the proposed improvement are issued. In connection with the award it was stated that the furnishings contracted for would be required for either of the two schemes contemplated.

LANCASTER, PA.—The Water Committee of the Common Council has recommended that water meters be used in connection with the water-works service, in order to prevent the excessive waste which, it is said, prevails at present.

WATER-WORKS.—See our proposal columns for information regarding water-works and water-works furnishings at the following places: San Angelo, Tex.; Lexington, Neb.; Topeka, Kan.; Ellsworth, Kan.; Galt, Ont.; Chambersburg, Pa.; Harrison, O.; Chester, S. C.; Chambersburg, S. D.; Huron, S. D.; Norfolk, Va.

SEWERAGE.

For Additional Sewerage Items see Proposal Columns

ATLANTIC CITY, N. J.—Reports say that the sewerage company at this place will put in a new 5,000,000 gallon pump.

KNOXVILLE, TENN.—The cost of the proposed system of sewerage for this city according to plans just submitted, is $210,000. Chairman Gleason, of the Board of Public Works, can furnish information.

MARQUETTE, MICH.—Improvements are to be made to the sewerage system of this place.

BRUNSWICK, GA.—Several miles of sewers are to be added to the system of this city.

CHICO, CAL.—Plans for a sewerage system for this place are now being prepared.

MINNEAPOLIS, MINN.—City Engineer Rinker has been directed to advertise for proposals for furnishing the city with 2,000,000 sewer brick.

ATLANTA, GA.—Extensions to the sewerage system of this city have been authorized by the Common Council, the cost of which will be $95,000. Address Alderman Haas for particulars.

MERIDEN, CONN.—The sewerage committee recommends that immediate steps be taken towards establishing a system of sewers. Mayor Page can furnish particulars.

GRAND RAPIDS, MICH.—Numerous sewer extensions are to be made at this place.

SEWERS.—See our Proposal Columns for information regarding sewer construction at the following places: Suspension Bridge, N. Y., Victoria, B. C.

BRIDGES AND IRON STRUCTURES.

For Additional Bridge Items see Proposals Columns.

ALLEGHENY, PA.—A bridge is to be erected over Lacock Street, this city, by Messrs. Marshall, Kennedy & Company.

NASHUA, N. H.—Efforts are being made to establish another bridge over the Nashua River, at this place. The City Clerk can furnish particulars.

CINCINNATI, O.—Reports say that a scheme is about to mature to erect another bridge between this city and Covington. Address the Mayor, as above, for particulars.

GENEVA, N. Y.—There is a movement to substitute arched bridges for all bridges now crossing the creek, in this city.

SCRANTON, PA.—The bridge question continues to be agitated at this place with chances greatly in favor of establishing the proposed structures.

LANCASTER, PA.—The County Commissioners have decided to make extensive improvements to the bridge at Eden, over the Conestoga.

ATLANTA, GA.—The Mayor has appointed a committee to investigate the subject of erecting a bridge over Forsyth Street, and particulars can be obtained by addressing Alderman Hirsch, as above.

SPOKANE FALLS, WASH.—The City Clerk of this place has been authorized to advertise for the stone work on the Monroe Street bridge. Address Alderman Natbohm for particulars.

BOSTON, MASS.—The abutments for Dean Street bridge, at Brookline, have been let to D. H. Cram, for $8,331. The superstructure will be built by the B. & A. R. R.

WHITESBOROUGH, TEX.—The County Commissioners of Grayson County have been asked to build a bridge at this place.

BRIDGES.—See our Proposal Columns for information regarding bridge construction at the following places: Joliet, Ill.; Zanesville, O.; Columbus, O.; Marble Falls, Tex., Willimansette, Mass.; Hamilton, O.; Philadelphia, Pa.

NEW DEPOTS.

BASIC CITY, VA.—The Norfolk and Western Railroad will erect a depot at this city, to cost $25,000.

HUNTINGTON, W. VA.—The Ohio River Railroad Company will soon erect a new depot at this place.

CINCINNATI, O.—The "Big Four" Railroad Company will build a large freight depot on the old Union Base Ball grounds at the foot of Bank Street. Engineer Read, of the Central Union Depot and Railroad Company, will have charge of construction. The proposed cost is $150,000.

CHURCHVILLE, PA.—This place is to have a new depot.

SOUTHAMPTON, PA.—A new depot is to be erected at this place.

STREET-WORK AND PAVING.

HELENA, MONT.—Considerable street work is contemplated for this city. Address Mayor Bradford, for details.

LINCOLN, NEB.—Considerable street paving is to be done in this city.

GAINESVILLE, TEX.—Street improvements, to cost $30,000 are to be made in this city.

MINNEAPOLIS, MINN.—Oak Grove Street, about eight blocks long, will be paved with asphalt.

LANCASTER, PA.—Considerable street paving is to be done at this place, the particulars of which can be had by addressing the City Clerk, as above.

McKEESPORT, PA.—Numerous streets of this city are to be paved, graded and otherwise improved.

GAS AND ELECTRICITY.

BAY CITY, MICH.—It is proposed to increase the capacity of the electric light plant at this place, at an expense of $900. Address the Mayor for particulars.

DAYTON, KY.—The officials of this place have decided to establish an electric lighting plant at once.

PUYALLUP, WASH.—Electric lights are to be introduced at this place.

GRAPEVILLE, PA.—An electric light plant is to be erected at this place by the Electric Supply Company.

SANTA FE, N. M.—This place is to introduce a system of electric lights at once. Address the Hon. T. B. Catron, as above, for particulars.

LOCK HAVEN, PA.—The Lock Haven Electric Light and Power Company is about to establish a plant at this place. Address J. E. Kelly, as above.

MARION, PA.—An extensive gas plant is to be established at this place, at a cost of $50,000. Address M. C. Watson, for particulars.

LA GRANGE, GA.—Electric lights will soon be introduced at this place.

WARSAW, N. Y.—The Board of Trustees has granted an electric lighting franchise to George C. Otis and Elmer E. Rowe.

ELECTRIC RAILWAYS.—New electric railways are projected and improvements are to made to those already established at the following places: Lowell, Mass.; Helena, Mont.; College Point, N. Y.; Little Rock, Ark.; New Utrecht, N. Y.; Rochester, N. Y.; Cairo, Ill.; Wilkesbarre, Pa.; Nebraska, Va.; Chicopee, Mass.; Meriden, Conn.; Ogden, Utah; Jamaica, N. Y.; Philadelphia, Pa.; Atlanta, Ga.; Ottawa, Ont.

NEW CORPORATIONS.

RIVERSIDE, CAL.—The Gage Canal Company has been incorporated at this place, with a capital stock of $500,000. Address Mathew Gage for particulars.

ASTORIA, ORE.—The Astoria Electric, Power and Transit Company has been incorporated at this place; capital stock, $150,000. Address A. P. Sharpstein, as above, for particulars.

BIDS OPENED.

MINNEAPOLIS, MINN.—The contract for the remodeling of the Holly Flour Mill has been awarded to the E. P. Allis Company, of Milwaukee, at $40,000.

GOVERNMENT WORK.

MARE ISLAND, CAL.—The following bids for doing certain dredging work at the navy yard were received by N. H. Farquhar, Chief of Bureau, October 28: William H. Beard, Brooklyn, N. Y., 17½ cents per cubic yard; R. G. Packard, New York, 22 cents per cubic yard. Contract awarded to the lowest bidder, Wm. H. Beard; 10,000 cubic yards to be dredged.

WASHINGTON, D. C.—The following proposals for the construction of two life saving stations, one on Fenwick Island, Del., and the other near Ocean City, Md., were opened November 5 by Horace L. Piper, Acting General Superintendent. The figures given are as follows: 1, Fenwick Island; 2, Ocean City; 3, price for both. Bidders: A. A. McCullough, Norfolk, Va., 1, $9,000; 2, $9,000; 3, $17,500. A. F. Blossom, New Bedford, Mass., 1, $5,714; 2, $5,714; 3, $11,428. J. H. Coster, Jefferson, Tex., 1, $5,390; 2, $5,390; 3, $10,780. Isaac F. Rotan, Philadelphia, Pa., 1, $6,900; 2, $5,900; 3, $12,800. Lilliston & Nock, Accomack C. H., Va., 1, $5,663; 2, $5,363; 3, $11,026. Hudson & Dillon, Philadelphia, Pa., 1, $5,100; 2, $4,961; 3, $10,061. Wm. H. Virden, Lewes, Del. 1, $4,850; 2, no bid, 3, $9,700. Rowland A. Robbins, New York, 1, $4,793; 2, $4,683; 3, $9,293.

PORT ROYAL, S. C.—The following proposals for the construction of a timber dry-dock at the naval station, at this place, were opened November 1 by the Navy Department: Justin McCarthy, Washington, D. C., $418,915; R. G. Packard, New York, $471,000; J. E. Simpson & Co., New York, $497,539; Charles J. Stalbrand, Charleston, S. C., $326,000. No bids were received on the Department's advertisement for a floating dock at same station, and a re-advertisement will be necessary.

WASHINGTON, D. C.—The following proposals for the construction of a bathing room, for the male workhouse, have been opened by the District Commissioners: J. R. Young, Washington, D. C., $7,423; James L. Parsons, Washington, D. C., $7,494; Halliday & Richardson, Washington, D. C., $7,378; James Hughes, Washington, D. C., $8,970; D. T. Mocaber, Washington, D. C., $8,279; A. W. Sweeney, Washington, D. C., $8,558; John H. Bird, Washington, D. C., $7,404. Appropriation for this work is $5,850, and the Inspector of Buildings will curtail the specifications so that the lowest bidder can get the contract.

NEW BEDFORD, MASS.—The following proposals for the erection and completion, except heating and approaches, to the United States Custom House and Post Office at this place were opened November 5 by the Supervising Architect of the Treasury Department: E. Irving Bell, Portland, Conn., $90,850; Samuel C. Hunt, New Bedford, Mass., $97,000; George W. Gay, New Bedford, Mass., $102,000; Darlington Bros., Worcester, Mass., $99,656; Justin McCarthy, Washington, D. C., $109,209.

INDUSTRIAL.

MOUNT HOLLY, N. J.—Reports say that the project to construct a ship canal across New Jersey, from the Delaware River to the Atlantic Ocean, is meeting with considerable success. The exact route has not been settled, but it is thought it will pass near this place and enter the ocean near Shark River.

BUILDING INTELLIGENCE.

NEW YORK.

W s Madison av, 118 w 84th st, br flat; cost, $52,000; o, R B Lynd; a, J H Duncan.

412-18 East 91st st, br factory; cost, $240,000; o, J J Schillinger; a, A Zucker.

S s 90th st, 100 w 1st av, 4 br tens; cost, $56,000 all; o, Sauer & Gross; a, F Wimnenmer.

N e cor Lewis and Rivington sts, br shop; cost, $26,000; o, M Ash; a, Schneider & Herter.

Cherry st, n w cor Pelham st, br factory; cost, $26,000; o, Weil & Mayer; a, Schneider & Herter.

345 W 16th st, br flat; cost, $19,000; o, H W Deane; a, M V B Ferdon.

7th av, e s, bet 52d and 53d st, br warehouse; cost, $450,000; o, Manhattan S & W Co; b, Marc Eidlitz & Son.

305 E 122d st, br flat; cost, $16,000; o, Mary E Barry; a, A Spence.

1807-09 Park av, 2 br and s flats and stores; cost, $20,000 each; o, W H McCarthy; a, A Spence.

73d st, s s, 95 w West End av, 3 s dwells; total cost, $85,000; o, D C McKinlay; a, C True.

95th st, n s, 150 w 10th av, 11 s dwells; cost, $15,000 each; o, Lottie H Baird; a, Harding & Gooch.

98th st, n s, 268.6 e 10th av, 3 br and s dwells and 4 5-story flats; total cost, $200,000; o and b, J W Hutton; a, M V B Ferdon.

125th st, s s, 200 w 6th av, iron bldg; cost, $40,000; o, E D Farrell; a, J P Leo.

Amsterdam av, n w cor 147th st, br and s flat; cost, abt $30,000; o, P Sackman; a, H Van Benschoten.

Webster av, n e cor 179th st, 3 br and fr dwells; cost, $3,500 each; o, S D Bonfils; a, C W & A A Stoughton.

ALTERATIONS—NEW YORK.

179-81 E 124th st, br store; cost, $12,000; o, E Rothschild; a, W H Holmes.

130-34 Cedar st, rear, interior alterations and walls altered for connection with extension; cost, $25,000; o, P Ballentine & Sons; a, C A Gifford.

BROOKLYN.

McDonough st, s s, 200 e Reid av, 3 br and s dwells; cost, $4,500; o, Henry B Hill; a, Hill & Son.

Flatbush av, s s, 115 w Livingston st, 1 br store; cost, $15,000; o, Jesse C Woodhull; a and b, C B Fish.

South 2d st, s s, 100 w Driggs st, 1 b s ten; cost, $10,000; o, David Brown; a, W H Gaylor.

55th st, n s, 225 e 3d av, 5 fr (brick filled) dwells; cost, $2,500 each; o, Wm Best; a, H L Spicer & Son.

N s Union st, 312 e 6th av, 2 br dwells; cost, $11,000 all; o, D Buckley; a, W M Coots.

S s St Marks av, 200 e Vanderbilt av, 3 br dwells; cost, $25,000 all; o, Ellen T Martin; a, Amizi Hill.

E s North Henry st, 103 s Van Cott av, 12 fr dwells; cost, $13,200; o, C Engert; a, F J Berlenbach, Jr.

BUILDING INTELLIGENCE.

BROOKLYN—Continued.

N s 34th st, 160 e 3d av, 4 fr dwells; cost, $18,000 all; o and a, J F Kentana.

N s 21st st, 125 e 6th av, 10 fr dwell; cost, $20,000; o, Jas R Robb; a, Wm Wirth.

S s Lexington av, 71 w Throop av, br dwell; cost, $8,000; o, D S Beasley; a, J E Dwyer.

S s Lexington av, 50 w Throop av, br dwell; cost, $8,000; o and a, same as above.

W s Douglass av, 150 w 5th av, 3 br dwells; cost, $10,500 all; o, E A Wovley; a, R Dixon.

S w cor 43d st and 4th av, br dwell; cost, $34,000 all; o, city of Brooklyn; a, Geo Ingram.

W s 4th av, 70 s 43d st, br dwell; cost, $15,000; o and a, same as above.

S s Macon st, 22 w Howard av, 4 br dwells; cost, $19,200 all; o and a, C Lincoln.

E s Clinton av, 100 s Willoughby av, br dwell; cost, $45,000; o, C M Pratt; a, W B Tubby.

W s Throop av, 26 n Pulaski st, 4 br dwells; cost, $16,000 all; o, G B Stoutenburg; a, F L Hine.

N w cor Throop av and Pulaski st, br dwell; cost, $10,000; o and a, same as above.

BALTIMORE, MD.—W s Fayette, e of Charles, 3-story br back bldg; o, Mrs M E Black.

BEVERLY, N. J.—Henry Van Brunt will erect an addition to his fertilizing factory at this place.

BOSTON, MASS.—10 and 12 Brookford st, 2 fr dwells; cost, $8,000; o, F R Bodwell; b, M Scullion.

465–487 Medford st, br bakery; cost, $75,000; o, U S Baking Co; a, Shepley, Rutan & Coolidge; b, Johnson Bros.

A st near Richards st, br stable; cost, $20,000; o, Handy & Waterhouse; a, M D Safford.

Leland st, 4 fr dwells; cost, $18,000; o, a and b, Geo M Fernald.

Peter Parley road, fr stable; cost, $7,500; o, F A Peters; a, Jas S Lee.

400 Hanover st, br tenement; cost, $8,000; o, John Feeney; a, H Smith; b, Orne & Lawrence.

BIRMINGHAM, ALA.—1st av and 21st st, br block; cost, $15,000; o, Woodrow & Clark.

2d av, bet 18th and 19th sts, br dwell; cost, $8,000; o, Thompson, Hutchinson Bldg Co.

22d st, bet 2d and 3d avs; br dwells; cost, $10,000; o, as above.

8 av, bet 19th and 20th sts, br dwell; cost, $15,000; o, as above.

6th av and 17th st, br school; cost, $40,000; o, as above.

20th st, bet Avs C and B; br dwell; cost, $15,000; o, J T Beasley.

CULPEPPER, VA.—This place is to have a new $10,000 school building.

CAMDEN, N. J.—Cooper st, E 11th st, 3 br dwells; o, Jas S White.

N e cor 4th and Elm st, br store; o, Thos Sevron.

333 Kaighn's av, br store; o, John W Mathews.

S s Mount Vernon st, above 6th st, br dwell; o, J E Hartman.

DETROIT, MICH. — Gratiot av opposite Sylvester st, 2 to 5-story br brewery; cost, $50,000; o, Coppits & Melchiers; a, Spier & Rohms; b, not let.

Ferry av bet Russell and Dequindre sts, 3-story br foundry; cost, $35,000; o, Peninsular Car Co; a, John Scott & Co; b, not let.

Cor Cass and Prentiss avs, 3-story br and s res; cost, $35,000; o, M McAtow; a and b, same as above.

227 Catharine st, 3-story br storehouse; cost, $10,000; o, Wm Darmstaetter; b, Individual contracts.

Cass av bet Willis and Canfeld avs, 2-story br res; cost, $7,000; o, Wm Allison; b, same as above.

365 21st st, 3-story br manufactory; cost, $7,000; o, Diamond Match Co; b, M Shall & Son.

EASTON, PA.—Northampton st, 2 stores and office bldg; cost, $10,000; o, Mrs S B Clemens; a, John M Stewart.

BUILDING INTELLIGENCE.

ELIZABETH, N. J.—A club house is to be erected on Grand Street by the Elizabeth Club. Address Mayor Rankin for particulars.

GALVESTON, TEX.—Broadway, bet 24th and 25th sts, pressed br stable; cost, $15,000; o, Geo Sealy; a, N J Clayton & Co; b, H Pritchard & B Hamilton.

HOLYOKE, MASS.—Maple st, br apart bldg; o and b, Watson Ely & Son.

JOHNSTOWN, PA.—Cor Front and Railroad sts, fr bldg; cost, $7,600; o, Ryan Estate, a, J T Kengy; b, William Lloyd & Son.

Cor Clinton and Washington sts, br bldg; cost, $7,000; o, J M Shumaker; a, Emmet Lucas; b, Wm Smith.

KNOXVILLE, TENN.—Commerce st, br bldg with s trimmings; cost about $30,000; o, R S Payne; a, Disemakes, of Nashville; Beaver & Hoffmaster, of Knoxville, Supt's; b, contract not let.

KENSINGTON, PA.—Hosiery mill; o, Wm Sullivan & Co.

LAWRENCE, MASS.—New mills; o, Washington Mills Co.

New mills; o, Arlington Mills Co.

LYNN, MASS.—A school building, to cost $38,600, is to be erected here.

NASHUA, N. H.—3-story br mill; o, Nashua Boot and Shoe Co; b, not let.

Br addn to foundry; o, Nashua Iron and Brass Foundry Co; b, not let.

NEW BEDFORD, MASS.—Cotton mill; o, Bennett Mfg. Co.

NASHVILLE, TENN.—East Nashville, 2-story br bldg· cost, $6,000; o, H Alexander; a, R E Grubbs.

N Market, 4-story s bldg; cost, $16,000; o, Craigheat; a, George W. Thompson.

N Market, 5-story s front bldg; cost, $25,000; o, M Burns; a, same as above.

Buildings costing $12,000; a, R E Grubbs.

PAULSBOROUGH, N. J.—Two churches are to be erected at this place. Address the Rev. Haisley, for particulars.

PHILADELPHIA, PA.—N s India st, e Marshall st, 8 dwells; o, John S Kelly.

E s 8th st, s Cambria st, 10 dwells; o, M L Hirst.

S s Frankfort av, w P R R, warehouse; o, Robt Foerdner.

E s Frankfort av, n Allegheny av, factory; b, W Jones.

2744 Germantown av, storehouse; o, Thos Bateley.

E s 6th st, n Vine st, 6 dwells; o, John Maginnis.

4238–4240 Lancaster av, 2 dwells; o, Jas W Saunderson & Son.

S e s Binst av, bet 74th and 75th sts; 2 dwells; o, P J Conroy.

E s 18th st, s Tioga st, church; b, Benj Walker.

N s Severington st, e Pechine st, church; b, Chas Vogt.

W s Darien st, n Somerset av, 37 dwells; o, Jno M Sharp.

S s Powelton av, e 41st st, stable; o, Benj Hoover.

S e cor 44th and Locust sts, 7 dwells; o, Thos Marshall.

E s Carlisle st, 22 dwells; o, D M Bleyler.

W s Hancock st, s Somerset st, br shop; o, Wm Steele & Son.

W s Amber st, n Allegheny av, factory; o, Elizabeth Jones.

W s Main, s Jackson st, shop and dwell; o, Wm Steele & Son,

S w cor Woodbine st and Sprague av, 6 dwells; b, O'Brien & Bros.

S w cor Ruscourt and Newbold sts, 2 dwells; b, John Priestley.

N s Sedgeley st, e 27th st, 22 dwells; o, O A Guenther.

N e cor Keystone and Vincent sts, 2 dwells; o, Kolliner Bros.

N s Glennock st, w Minch st, 4 dwells; o, P E Costello.

BUILDING INTELLIGENCE.

PHILADELPHIA, PA.—W s Prune st, n Race st, 4 dwells; o, Chas Roth.

Angora, 61st and Butterwood sts, s dwell; o, Geo Callaghan.

1432 Randolph st, addn to factory; o, O'Neil & Kline.

S s Clearview st, e Washington av, 26 dwells: o, W J Bell.

S s 48th st, e Gray's av, 4 dwells; b, Isaac Wood.

N w cor Seargent and Jasper sts; stable; b, Robt N Bowers.

Rear s e cor Hancock and Berks sts, store; b, Geo Doring.

W s 2d st, n Susquehanna st, 7 dwells; b, D C Schuler.

W s 2d st, n Somerset st, mill; b, Geisinger & Hale.

W s Hicks st, n Lehigh av, 4 dwells; o, W G Serrill.

S e cor Mundell and Sydenham sts, dwell; o, same as above.

Thompson and 30th sts, repairs to brewery; b, Philip Haibach.

N e cor 11th and Orford sts, addition to brewery; b, Chas Auchter.

E and w s Harmony st, n Wharton st, 12 dwells; b, W Marshall.

S s Riley st, near Green Lane, addition to factory; b, Harry Wanklin.

S s Chelton av, w Chew st, dwell; b, C S Johnston.

S s Carpenter st, e 24th st, 5 dwells; b, Thos McCouch.

McClellan and Moore st, w 6th st, 6 dwells; b, Jno O'Donnell.

S s Moore st, w 19th st, 12 dwells; b, Montgomery & Baxter.

E s Jeannette st, n Manyunk av, dwell; b, F T Sheldrake.

E s Ditman st, n Washington av, mission building, b, W S Roberts.

E s 13th st, s Cambria st, addition to school; b, M McManus.

Mercy st, w 12th st and vicinity, 11 dwells; b, C B Prettyman.

E s Tongshue st, n Tulip st, store; o, as above.

N s Dittmar st, w Minch st, 2 dwells; o, as above.

S s Delaware av, electric station.

E s Thompson st, n Lehigh av, 5 dwells; o, John H Garden.

W s 10th st, n Colowa st, factory; o, Geisinger & Hale.

Cook st, w Memphis st, foundry; b, Geo W Stewart.

S s Cedar st, n High st, 8 dwells; o, Thos J Carman.

S s Brown st, w 38th st, 12 dwells; o, Chas Bateson.

W s 2d st, n Somerset st, mill; o, Geisinger & Hale.

W s Ohio st, e 12th st, factory; o, Robt Murray & Son.

N s Canby st, e 13th, bakery; b, James Price.

READING, PA.—5th and Spruce, 2-story dwell; cost, $16,000; o, Mrs Archer; a and b, L Focht.

8th and Washington, s church; cost, $13,000; o, Olivet Church, Rev Chapman; a, Mr Lansdale.

RAYNOR, TEX.—The sum of $40,000 is to be expended by the local Methodist Society in the erection of a college.

STONINGTON, CONN.—Silk mill; o, Atwood Machine Co.

SOMERS POINT, N. J.—A store and several blocks of cottages are to be erected here by A F Kappella.

SOUTH BEND, IND.—Messrs. James and Joseph Oliver, of this city, propose that if the citizens of South Bend will purchase for them a site in the heart of the city, the same to not cost them over $120,000, they will erect thereon a hotel costing $300,000. It is to cover the quarter of a square, be five stories high, and built of native field stone.

SPRINGFIELD, MASS.—Cor Worcester av and Plainfield st, br factory; o, Hampden Corundum Wheel Co; b, Kelley & Mellen.

BUILDING INTELLIGENCE.

SYRACUSE, N. Y.—A school, to cost $28,000, is to be erected at this place.

ST. LOUIS, MO.—Lindell and Vandeventer avs, br dwell; cost, $10,000; o, H G Knapp; b, S L Jones.

23d and Eugenia sts, 2 br dwells; cost, $7,000 each; o and b, John Farrell.

2d and Walnut sts, br warehouse; cost, $25,000; o, H H Haenssler; b, sub-let.

McPherson and Lindell avs, br dwell; cost, $12,000; o, J A Speller; b, Jno Low.

S w cor Fairfax and Pendleton avs, br dwell; cost, $19,000; o, P Nolan; b, M Connolly.

ST. PAUL, MINN.—Margaret, near Hope, 1-story br church; cost, $32,000; o, St John's German Lutheran Congregation.

Holly, near Arundel, 2-story fr dwell; cost, $7,000; o, C H Worthen.

Selby, near Hamline, 2-story fr dwell; cost, $7,000; o, Ivey Bros.

5th, near Rosabel, 5-story br store; cost, $100,000; o, C W Hackett Hardware Co.

Ansel Oppenheim will erect a $40,000 office building at the corner of 6th st and Minnesota.

Architect Oscar Cobb has reported that the acoustic properties of the Council chamber can be remedied for $5,090; with modified plans at $4,000.

WALPOLE, MASS.—Bleachery and dye works; o, R S Gray & Co.

WHEELING, W. VA.—Plans are being prepared for a church, two hospitals, and masonic hall.

WINDSOR LOCKS, CONN.—4-story cotton mill; o, J R Montgomery & Co.

WASHINGTON, D. C.—1635 16th st, 3-story br bldg; cost, $25,000; o, G A Sheehan; a, W B Gray; b, J McGregor.

P st, bet 14th and 15th, 2-story br bldg; cost, $8,000; o and a, J H Green.

124-47 22d st, 4 2-story br bldgs; cost, $10,000; o, S Norment; a, J H Grant.

2123-33 Ward Place, 6 2 story br bldgs; cost, $10,000; o and a, same as above.

820-28 12th st, 5 2-story br bldgs; cost, $9,000; o and a, W R Coon.

94 permits less than $7,000 in value.

WILMERDING, PA.—The Methodist Church people of this place are about to erect a new church.

BUILDINGS.—There is nothing over $7,000 in value to report at the following places: Clinton, Iowa; South Bethlehem, Pa.; Fitchburg, Mass.; Wheeling, W. Va.; Pasadena, Cal.; Harrisburg, Pa.; Montclair, N. J.; Ogdensburg, N. Y.; Charleston, S. C.; Worcester, Mass.; Geneva, N. Y.; Canton, O.; Topeka, Kan.; Wilkesbarre, Pa.; Dayton, O.

READERS of **THE ENGINEERING AND BUILDING RECORD** interested in the Contracting News Department of that paper are respectfully requested to examine those columns every week, and advise the Editor of any item which they may find that, in their judgment, is of no value to any one other than the person mentioned.

POSITIONS WANTED.

TOO LATE FOR CLASSIFICATION.

DRAUGHTSMAN, SPEAKING FRENCH AND German, desires employment. Have worked in architect's office in Paris and Zurich. Address OTTO WAGNER, Park Lodge, Forest Hill, London, S. E.

WANTED—A POSITION AS LEVELER OR transitman. Large experience in subdividing and grading, formerly employed by the Nicaragua Canal Company. Address J. M. KENYON, No. 171 Broadway. 24

A YOUNG MAN OF 22, WHO HAS HAD FOUR years of practical and theoretical knowledge of civil engineering, surveying and sewerage work, desires a position. Good references. Address LOUIS NIEDERMEYER, 1304 West Sixth Street, Cincinnati, O.

PROPOSALS.

(Continued from page ii.)

NOTICE TO CONTRACTORS.

TENDERS WILL BE RECEIVED UP TO 4 o'clock P M. on the 17th of December next, at the office of the undersigned, for the Construction of **SEWERS** for the Corporation of the City of Victoria, B. C.

For particulars of plans and specifications apply at the City Hall, Victoria, on or after the 15th day of November next ensuing.

Five per centum of the approximate amount of the work tendered for will be required to be deposited with a tender to insure its consideration This may be done either in Cash or by Certified Cheque on some bank in British Columbia. All Cash or Certified Cheques to be returned to unsuccessful tenderers.

Estimated cost of sewers, $300,000.

The lowest of any tender not necessarily accepted.

By order
WELLINGTON J. DOWLER,
City Clerk's Office, C. M. C.
Victoria, B. C., Sep. 29, 1890. 26

To Contractors.

DEPARTMENT OF PUBLIC WORKS,
BUREAU OF SURVEYS,
PHILADELPHIA, Nov. 6, 1890.

PROPOSALS FOR CONSTRUCTING wrought-iron western **APPROACH** to Walnut Street bridge will be received by Louis Wagner, Director of the Department of Public Works, at this office until 12 o'clock noon, MONDAY, November 17th, 1890.

Proposals must be accompanied by a certificate that a bond for $500 has been filed in the Department of Law, Sixth and Locust Streets.

Blue print copies of the plans on exhibition here may be obtained by those first applying, upon payment of Five Dollars to the Receiver of Taxes. J. MILTON TITLOW,
Prin. Assistant Engineer.

PROPOSALS FOR DREDGING.—U. S. Engineer Office, Duluth, Minn.-Sealed proposals, in triplicate, will be received at this office until 2 o'clock P. M., December 6, 1890, and then opened, for **DREDGING** in the harbor of DULUTH, MINN., on west side of Rice's Point. Preference will be given to articles of domestic production or manufacture, conditions of quality and price being equal The attention of bidders is invited to the Acts of Congress approved February 26, 1885, and February 23, 1887, Vol. 23, page 332, and Vol. 24, page 414, Statutes at Large. The United States reserves the right to reject any and all bids. All information may be obtained at this office. JAMES B. QUINN, Major, Corps of Engineers. 26

PROPOSALS FOR DREDGING AND PIER WORK.—U. S. Engineer Office, Duluth, Minn —Sealed proposals, in triplicate, will be received at this office until 2 o'clock P. M., December 6, 1890, and then opened, for **DREDGING**, and for repairs to breakwater at GRAND MARAIS, MINN. Preference will be given to articles of domestic production or manufacture, conditions of quality and price being equal. The attention of bidders is invited to the Acts of Congres-, approved February 26, 1885, and February 23, 1887, Vol. 23, page 332, and Vol. 24, page 414, Statutes at Large. The United States reserves the right to reject any and all bids. All information may be obtained at this office. JAMES B. QUINN, Major, Corps of Engineers. 26

WRECK OF THE SCHOONER "JOSIAH Whitehouse."—Engineer Office, U. S. Army, Newport, R. I., November 1, 1890.—To whom it may concern. Whereas the navigation of Vineyard Sound is obstructed and endangered by the wreck of the schooner "Josiah Whitehouse," lying about N. by W. ½ W. 3¾ miles from Gay Head Light-house: Notice is hereby given to all persons interested in said vessel, her cargo and all other property therein, that if, within thirty [30] days from the date of this advertisement, they shall not have signified to me their intention and taken preliminary steps to remove said wreck, etc., as soon as practicable, the same will be considered as abandoned and derelict, and it will be removed by the United States under authority of law. Sealed proposals, in triplicate, for the removal of so much of said **WRECK** as forms an obstruction to navigation, will be received at this office until 12 o'clock noon on MONDAY the first day of December, 1890, and then opened. The attention of bidders is invited to the acts of Congress approved February 26, 1885, and February 23, 1887, Vol. 23, page 332, and Vol. 24, page 414, Statutes at Large. The United States reserves the right to reject any or all proposals and to waive any informalities. Full information furnished on application. By authority of the Secretary of War. W. R. LIVERMORE, Major of Engineers. 26

BREAKWATER AT NEW HAVEN, CONN.—Engineer Office, U S Army, Room 74, Army Building, 39 Whitehall Street, New York, November 1. 1890.—Sealed proposals, in triplicate, for construction of a breakwater at NEW HAVEN, CONN., will be received at this office until twelve (12) o'clock noon, on TUESDAY, December 2, 1890. The attention of bidders is invited to Acts of Congress approved February 26, 1885, and February 23, 1887, Vol. 23, page 332, and Vol. 24. page 414, Statutes at Large. Further information can be obtained at this office. D. C. HOUSTON, Colonel of Engineers. 25

PROPOSALS.

REMOVAL OF SHOALS BETWEEN SISTER Islands and Cross-over Light, Saint Lawrence River, New York.—U. S. Engineer Office, Burlington, Vt., November 8, 1890.—Sealed proposals, in duplicate, addressed to the undersigned, will be received at this office until 11:30 A. M., December 9, 1890. and then publicly opened, for blasting and removing 247 cubic yards of rock, more or less, from two **SHOALS** between Sister Island and Cross-over Light, Saint Lawrence River, N. Y. Attention is invited to the Acts of Congress approved February 26, 1885, and February 23, 1887, Vol. 23, page 332. and Vol. 24, page 414, Statutes-at-Large. Detailed information can be had on application. M. B. ADAMS, Major of Engineers. 23-24-1

U. S. ENGINEER OFFICE, BURLINGTON, Vt., November 8, 1890.—Sealed proposals, in duplicate, addressed to the undersigned, will be received at this office until 11:30 A. M., December 9, 1890, and then publicly opened, for furnishing 182,886 feet, b. m., of hemlock timber; 9,600 feet, b. m., of white pine timber; 3,000 cubic yards of rubble stone; 7,750 cubic yards of large stone, 1 to 5 tons weight; 1,208 pounds of screw and washer bolts; 546 pounds of ring bolts; 23.441 pounds of drift bolts, and constructing 300 linear feet of extension and repairing 1,225 linear feet of old superstructure to the **BREAKWATER** at Plattsburgh Harbor, New York. Preference will be given to materials of domestic manufacture or production, conditions of quality and price (import duty included) being equal. Attention is invited to the acts of Congress approved February 26, 1885 and February 23. 1387, Vol. 23, page 332, and Vol. 24, page 414, Statutes-at-Large. Detailed information can be had on application. M. B. ADAMS, Major of Engineers. 23-24-1

PROPOSALS FOR STONE.—U. S. ENGINEER Office, 507 West Chestnut Street, Louisville, Ky., October 21, 1890.- Sealed proposals, in duplicate, will be received at this office until 1 P.M. (local time) on THURSDAY, the 20th day of November, 1890, for furnishing stone for the **CONSTRUCTION** of a **LOCK** in the WABASH RIVER. near Mt. Carmel, Ill The attention of bidders is invited to Acts of Congress of February 26, 1885, and February 23, 1887, Vol. 23, page 332, and Vol. 24, page 414, Statutes at Large. Preference will be given to stone of domestic production, conditions of quality and price being equal. The right is reserved to reject and all bids. Specifications and printed forms for proposals will be furnished on application to the undersigned. EDW. MAGUIRE, Captain of Engineers. 24

PROPOSALS FOR DREDGING.—U. S. ENGINEER Office, 601 Eighteenth Street, N. W., Washington, D. C., October 17, 1890.—Sealed proposals, in triplicate, for **DREDGING** in the Potomac River at Washington, D. C., will be received at this office until 12 M. on TUESDAY, November 25, 1890. The attention of bidders is invited to the Acts of Congress approved February 26, 1885 and February 23, 1887, Vol. 23, page 332, and Vol. 24, page 414, Statutes-at-Large. For specifications, forms of bid and other information, apply at this office. PETER C. HAINS, Lieut.-Col. of Engineers. 24

PROPOSALS FOR DREDGING.—UNITED States Engineer Office, Mobile, Ala., October 20, 1890.—Sealed proposals for **DREDGING** in MOBILE HARBOR, ALA.; BILOXI HARBOR, MISS, and PASCAGOULA RIVER, MISS., will be received at this office until 12 o'clock M., THURSDAY the 20th day of November, 1890, and opened immediately thereafter in presence of bidders. Specifications, general instructions to bidders, and blank forms of proposal will be furnished on application to this office. The attention of bidders is invited to the Acts of Congress approved February 26, 1885, and February 23, 1887, Vol. 23, page 332, and Vol. 24, page 414, Statutes at Large. A. N. DAMRELL, Major of Engineers, U. S. A. 23

U. S. ENGINEER OFFICE, ROOM 62, ARMY Building, New York, October 15, 1890.—Sealed proposals, in triplicate, will be received at this office until 12 o'clock, noon, WEDNESDAY, November 19, 1890, for the following work: I. For the construction of new DIKES; II., for rebuilding and repairing existing dikes; III., for dredging in the Hudson River between New Baltimore and Troy, N Y. Amount available, $105,000. The attention of bidders is invited to Acts of Congress, approved February 26, 1885, and February 23, 1887, Vol. 23, page 332, and Vol. 24, page 414, Statutes-at-Large, and the River and Harbor Act of September 19, 1890, Sections 6 to 12. For specifications, blank forms, and all information, apply to the undersigned. G. L. GILLESPIE, Lieut.-Col. of Engineers. 24

OFFICE CONSTRUCTING QUARTERMASTER, Fort Thomas, Ky., October 27, 1890.—Sealed proposals, in triplicate, subject to usual conditions, will be received at office of Constructing Quartermaster, U. S. A., FORT THOMAS, KY., until 11 A. M., November 27, 1890, and then opened, for construction there, of a **HOSPITAL** and hospital steward's quarters, and for the steam heating apparatus for the hospital. and for the plumbing of each building. The United States reserves the right to reject any or all bids, or parts thereof. Plans and specifications to be seen at this office, with full instructions as to bidding. Envelopes containing proposals should be marked, "Proposals for Hospitals, etc.," and addressed to 1st Lieutenant R. B. TURNER, 6th Inf'try, A. A. Q. M., U.S.A.

U. S. ENGINEER OFFICE, 905½ EAST MAIN Street, Richmond, Va., October 13, 1890.—Proposals for **DREDGING** and excavating rock from the channel of the James River near RICHMOND, VA., for the construction of mattress dykes and jetties, will be received until noon of December 9, 1890, and then opened. Attention is invited to Acts of Congress approved February 26, 1885, and February 23, 1887, Vol. 23, page 332, and Vol. 24, page 414. Statutes at Large. Information can be had on application to Mr. C. P. E. Burgwyn, 905½ E. Main Sreet, Richmond, Va. WM. P. CRAIGHILL, Colonel, Corps of Engineers, U. S. A. 23

PROPOSALS.

PROPOSALS FOR IMPROVING ENTRANCE to Galveston Harbor.—U. S. Engineer Office, Galveston, Tex., October 25, 1890.—Sealed proposals, in duplicate, will be received at this office, until 12 o'clock, noon, 90th Meridian time, December 27, 1890, and then opened for delivery of materials in place for improving the entrance to GALVESTON HARBOR, TEX. Preference will be given to materials of domestic production or manufacture, conditions of quality and price (import duties included) being equal. The attention of bidders is invited the Acts of Congress approved February 26, 1885, and February 23, 1887, Vol. 23, page 332, and Vol. 24, page 414, U. S Statutes at Large. For blank forms, for proposals and all necessary information, apply to CHAS. J. ALLEN, Major, Corps of Engineers. 22-23-24

NOVEMBER 6, 1890.

SEALED PROPOSALS WILL BE RECEIVED at the office of the Supervising Architect, Treasury Department, Washington, D. C., until 2 o'clock P. M., on the 4th day of December, 1890, for all the **LABOR AND MATERIAL** required for the excavation, concrete foundations, stone and brickwork of the basement and area walls, first floor iron beams and girders and columns in basement, for the U. S. Court-House, Post-Office and Custom-House building at BAY CITY, MICHIGAN, in accordance with the drawings and specification, copies of which may be had at this office or the office of the Superintendent at Bay City, Mich. Each bid must be accompanied by a certified check for $200. The Department will reject all bids received after the time herein stated for opening the same; also, bids which do not comply strictly with all the requirements of this invitation. Proposals must be inclosed in envelopes, sealed and marked "Proposal for the Excavation, Concrete Foundations, Stone and Brickwork and Ironwork for the Basement and Area Walls for the U. S. Court-House, Post-Office and Custom-House at Bay City, Mich.," and addressed to JAS. H. WINDRIM, Supervising Architect. 24

OCTOBER 25, 1890.

SEALED PROPOSALS WILL BE RECEIVED at the office of the Supervising Architect, Treasury Department, Washington, D. C., until 2 o'clock P. M., on the 20th day of November, 1890, for all the **LABOR AND MATERIALS** necessary to complete the approaches, mailing platform, post-office lookout, etc., for the U. S. Court-House and Post-Office building at PITTSBURG, PA., in accordance with the drawings and specification, copies of which may be had on application at this office or the office of the Superintendent. Each bid must be accompanied by a certified check for $300. The Department will reject all bids received after the time herein stated for opening the same; also, bids which do not comply strictly with all the requirements of this invitation. Proposals must be inclosed in an envelope, sealed and marked, "Proposal for the Approaches, Mailing Platform, Post-Office Lookout, etc., for the U. S. Court-House and Post-Office building at Pittsburg, Pa.," and addressed to JAS. H. WINDRIM, Supervising Architect. 23

OCTOBER 24, 1800.

SEALED PROPOSALS WILL BE RECEIVED at the office of the Supervising Architect, Treasury Department, Washington, D. C., until 2 o'clock P. M., on the 18th day of November, 1890, for all the labor and materials required for the **JOINERY WORK, WOOD FLOORING**, etc., for the U S. Court-House and Post-Office building at PITTSBURG, PA., in accordance with drawings and specification, copies of which may be had on application at this office or the office of the Superintendent. Each bid must be accompanied by a certified check for $500. The Department will reject all bids received after the time herein stated for the opening of the same; also, bids which do not comply strictly with all the requirements of this invitation. Each proposals must be inclosed in an envelope, sealed and marked, "Proposal for the Joinery Work, Wood Flooring, etc, for the U. S. Court-House and Post-Office building at Pittsburg, Pa.," and addressed to JAS. H. WINDRIM, Supervising Architect. 23

OCTOBER 28, 1890.

SEALED PROPOSALS WILL BE RECEIVED at the office of the Supervising Architect, Treasury Department, Washington, D. C., until 2 o'clock P. M. on the 25th day of November, 1800, for all the **LABOR AND MATERIALS** required for the erection and completion of the U. S. Court House, Custom-House and Post-Office building at BROWNSVILLE, TEX., in accordance with the drawings and specification, copies of which may be had on application at this office or the office of the Superintendent at Brownsville, Tex. Each bid must be accompanied by a certified check for $500. The Department will reject all bids received after the time herein stated for opening the same; also, bids which do not strictly comply with all the requirements of this invitation. Proposals must be inclosed in an envelope, sealed and marked, "Proposal for the Erection and Completion of the U. S. Court-House, Custom-House, and Post-Office building at Brownsville, Tex." and addressed to JAS. H. WINDRIM, Supervising Architect. 23

DREDGING, Chicago, Ill.—Proposals are wanted until November 16, for doing dredging in Calumet River, Illinois and Indiana, and in Calumet Harbor, Ill. Address Captain W. L. Marshall, Corps of Engineers, U. S. A., as above.

DREDGING. New York City. — Proposals are wanted until November 19, for dredging and blasting Middle Ground, off Sunken Meadow, East River, N. Y. Address Lieut.-Col. G. L. Gillespie, U. S. A., as above.

DREDGING, New York City. — Proposals are wanted until November 21, for dredging in Newtown Creek, N. Y.; Gowanus Bay, N. Y.; and Raritan Bay, N. J. Address Lieut.-Col. G. L. Gillespie, U. S. A., as above.

PROPOSALS.

OCTOBER 25, 1890.

SEALED PROPOSALS WILL BE RECEIVED at the office of the Supervising Architect, Treasury Department, Washington, D. C., until 2 o'clock P. M., on the 19th day of November, 1890, for all the **LABOR AND MATERIALS** required to furnish and fix in place complete the low pressure, return circulation, steam heating and ventilating apparatus, and to complete the plumbing of the U. S. Court-House, Post-Office, etc., building at WINONA, MINN., in strict accordance with the drawings and specification, copies of which may be had on application at this office or the office of the Superintendent at Winona Minn. Each bid must be accompanied by a certified check for $300. The Department will reject all bids received after the time herein fixed for opening the same; also, all bids which do not comply strictly with all the requirements of this invitation. Proposals must be inclosed in envelopes, sealed and marked, "Proposal for Low-Pressure, Steam Heating and Ventilating Apparatus, and for completion of the Plumbing of the U. S. Court-House, Post-Office, etc., building at Winona, Minn," and addressed to JAS. H. WINDRIM, Supervising Architect. 23

NOVEMBER 5, 1890.

SEALED PROPOSALS WILL BE RECEIVED at the office of the Supervising Architect, Treasury Department, Washington, D. C., until 2 o'clock P. M. on the 3d day of December, 1890, for furnishing all **LABOR AND MATERIALS** required for the erection and completion (except heating apparatus and approaches), of the U. S. Court-House and Post-Office building at HELENA, ARKANSAS, in accordance with the drawings and specification, copies of which may be had on application to this office or at the office of the Superintendent at Helena, Arkansas. Each bid must be accompanied by a certified check for $500. The Department will reject all bids received after the time herein stated for opening the same; also, bids which do not comply strictly with all the requirements of this invitation. Proposals must be inclosed in an envelope, sealed and marked, "Proposal for the Erection and Completion of the U. S. Court-House and Post-Office building at Helena, Arkansas," and addressed to JAS. H WINDRIM, Supervising Architect. 24

ROAD WORK, Stapleton, S. I.—Proposals are wanted until November 17, for macadamizing, grading, etc., certain roads in Richmond County. Address Charles M. Todd, Clerk pro tem, Tompkinsville, S. I.

BREAKWATER, New York City.—Proposals are wanted until December 2, for the construction of a breakwater at New Haven, Conn. Address Col. D. C. Houston, U. S. A., as above.

POST-OFFICE, Ottawa, Ont. — Proposals are wanted until November 18, for the erection of a post-office at Carleton Place, Ont. Address A. Gobiel, Secretary Board of Public Works, as above.

HARBOR IMPROVEMENTS, Chicago, Ill.—Proposals are wanted until November 19, for dredging in the Calumet River and Harbor. Address Captain W. L. Marshall, Corps of Engineers, U. S. A., as above.

PIPE, Topeka, Kan.—Proposals are wanted until November 10, for furnishing a quantity of cast-iron pipe. Address George H. Pearson, Consulting Engineer, as above.

SEWERS, Suspension Bridge, N. Y.—Proposals are wanted until November 18, for the construction of certain sewers. Address Leander Scott, President Board of Sewer Commissioners, as above.

BROKEN STONE, New York City.—Proposals are wanted until December 1, for furnishing 41,000 cubic yards of broken stone and 62,000 barrels of Rosendale cement. Address Lieut.-Col. G. L. Gillespie, U. S. A., as above.

METAL WORK, San Francisco, Cal.—Proposals are wanted until December 4, for furnishing the materials, labor, etc., of the metal work for the Northwest Seal Rock Light Station, California Address Major W. H. Heuer, U. S A., as above.

WATER-WORKS, Ballinger, Tex.—Proposals are wanted until January 1, 1891, for the construction of a system of water-works. Address Mayor B. S. Taylor, as above.

BRIDGE, Sheboygan, Wis.—Proposals are wanted, no date specified, for furnishing specifications for a swing iron bridge. Address C. V. Boley, City Engineer, as above.

BRIDGES, Hamilton County, O.—Proposals are wanted until November 22, for the construction of three iron bridges. Address the Board of County Commissioners, as above.

BRIDGE APPROACHES, Roanoke, Va.—Proposals are wanted until November 14, for the erection of the approaches to the bridges at Randolph, Henry and Park Streets. Address the Committee on Bridges, as above.

WATER-WORKS, Harrison, O.—Proposals are wanted until November 24, for the construction of a system of water-works at this place. Address Mayor J. A. Graft, as above.

RIPRAP STONE, Charleston, S. C.—Proposals are wanted until November 18, for furnishing about 50,000 tons of riprap stone on the South Jetty, at this place Address Captain Frederic V. Abbot, U. S. A., as above.

DREDGING, Charleston, S. C.—Proposals are wanted until November 21, for dredging in Wappo Cut, S. C., Brickyard Creek, S. C., and between Estherville and Minim Creek, S. C. Address Captain Frederic V. Abbot, U. S. A., as above.

LIGHTING, Jersey City, N. J.—Proposals are wanted until December 1, for lighting the public streets of this place for one year from December 1. Address G. F. Robinson, Clerk of the Board of Police Commissioners, as above.

DREDGING, Charleston, S. C.—Proposals are wanted until November 20, for dredging about 40,000 cubic yards of material at this place. Address Captain Frederic V. Abbot, U. S. A., as above.

THE ENGINEERING & BUILDING RECORD
AND
THE SANITARY ENGINEER.

A JOURNAL FOR THE ENGINEER, ARCHITECT, MECHANIC, AND MUNICIPAL OFFICER.

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SPECIAL OFFERS.

DOUBTLESS many of our subscribers have a friend or friends who think of subscribing to THE ENGINEERING AND BUILDING RECORD for the coming year, and as every paper, however successful it may be, desires to increase the number of its subscribers, the following offers are made, to hold good during October, November and December, 1890:

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THE ENGINEERING AND BUILDING RECORD,
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RIGID SPECIFICATIONS.

WHILE the necessity of having specifications for any contract work sufficiently rigid to insure proper construction is too evident to need argument, it is not infrequently the case that an engineer requires too much in them, more, in fact, than it is possible to enforce.

This overloading with unnecessary requirements may come from an honest but mistaken idea that good work can only be secured by minutely detailed and excessively rigid specifications, and the engineer tries from his experience to meet every possible contingency by a series of cast-iron clauses. Again, an inexperienced engineer, or one having little experience in the particular line of work covered by the specifications, may borrow them from others without appreciating that many of the conditions do not properly apply to the work he has in hand. It also may be said that, while it is quite necessary to leave to the absolute decision of the engineer a certain share of disputes that may arise, classification of work, payment for extra work, etc., it is undesirable to give him any more of such absolute power than is avoidable—undesirable for the engineer as well as for the contractor

Such rigid specifications are, primarily, unfair to the contractor. To insure good work he should have a living profit, and should not be compelled to lose the whole of it, and even more, by finical requirements and objections that really add nothing to the quality of the work. It may be said, it is true, that the contractor has the specifications to bid from, and makes his bid with his eyes open; but if all the bidders made up their estimates with the intention of endeavoring to carry out honestly all the conditions of such specifications, and running the risk of losses from the crotchets of the engineer, the cost of the work might be quite unnecessarily increased, and probably the engineer's estimate exceeded. What really happens is that the bidders discount their chances to evade these rigid clauses, and any man putting in a bid, with the intention of endeavoring to fulfill them to the letter, would have no chance whatever in the competition. Reputable contractors, in such cases, frequently refuse to bid, and the coast is left clear for the irresponsible men who gamble on their chances of evading everything undesirable in the specifications, and who intend to make money out of their work at any cost. If the engineer allows these rigid and unnecessary clauses to become a dead letter, he destroys the force of the whole instrument, and it becomes difficult for him to draw the line and enforce the legitimate conditions. If he attempt a strict enforcement, there are too many contractors that will take any measures to avoid losing money, and perhaps try to justify themselves with the fact that these rigid clauses in specifications are generally evaded, or are dead letters; in fact, they would consider themselves very harshly treated if the engineer attempted to compel them to conform to them.

The engineer or his assistant cannot be upon the ground constantly. He may have plenty of inspectors, but their pay is moderate, and they may be venal. It is much cheaper for the contractor to double or treble their pay to wink at violations of the specifications than to conform to them. In masonry, especially, it is frequently very easy to conceal bad work, at least for the time. The recent bad work in the masonry of the Washington Aqueduct and Croton Aqueduct tunnels is a familiar and somewhat trite illustration of this fact, although it is not claimed that in these instances the fault lies at all with the specifications.

Make the specifications plain and clear, but do not encumber them with what it is evident will be difficult or impossible to enforce. Respect the rights of the contractor as well as those of the owner, and do not treat him as an enemy to be thwarted, unless he shows an intention to cheat and skimp the work. Finally, *insist* that the specifications be carried out to the letter.

ACCURATE CITY SURVEYS.

THE necessity of obtaining accurate surveys and maps of large cities, and even for those of moderate size, is one of great importance, increasing with their growth in population and valuation of property.

With accurately determined and properly located reference points and a well constructed map, street and property lines can be definitely re-located at any time and in any contingency, lines of new streets can be readily established, questions of drainage and sewerage more easily studied, and any of the numerous municipal problems, constantly arising, more satisfactorily solved. And with a system of carefully checked standard bench marks the work of the engineer is greatly diminished, as well as made more reliable in all city improvements, private as well as public, and the work of the different engineering departments of the city harmonized. In one city, at least, the different departments of city works have not only their own set of bench marks, but even different datum planes, a source of endless confusion.

The report of the Sewer Commissioner of St. Louis, Robert E. McMath, M. Am. Soc. C. E., noticed in another column, shows that there, at least, they are fully alive to the advantages accruing from accurate work of this description. A thoroughly conceived official survey of the city is now in progress, using as a base line one of the triangulation lines of the United States Coast and Geodetic Survey, and from this covering the city with a series of triangles. In this way the absolute geographical position of all the points of the city triangulation, and the true azimuths of the connecting lines are determined and recorded for public use. In connection with this survey, levels of precision are run and numerous bench marks established, which will become standard benches for all classes of city work. A list of the bench marks, as far as determined, giving a detailed description of their location and their elevation above the city directrix, is appended to the report, making them readily available for private as well as public work. For topography, stadia measurements are taken and elevations obtained by vertical angles.

In the triangulation, transits reading to 5 or 10 seconds are used, and, where possible, all angles of each triangle are measured. Four double sets of angles, positive and negative, and with the telescope both direct and reversed are taken by repetition, equivalent to 40 single measurements of each angle. The average closure of the triangles has been a little over 4 seconds; the discrepancy in length of sides from 1 in 80,000 to 1 in 180,000. In addition to determining the geodetic latitudes and longitudes of each point, its co-ordinates from the intersection of the nearest minute lines of latitude and longitude are also computed. For the levels, which are duplicated in opposite directions, the limit of error of closure has been taken at $0.0208\sqrt{D}$ (D being the distance in miles). Any levels giving an error exceeding this are repeated. The average closure per mile has been 0.013 feet. In the stadia work the computations, as far as carried, indicate a closure as good as one in 800.

Similar methods of survey have been pursued in some other cities, and it is to be hoped that such accurate work, and especially the connection of the surveys with those of the United States Coast and Geodetic Survey where possible, will become more general.

BRIDGE BUILDING OVER NAVIGABLE WATERS.

Projectors of bridges over navigable waters are in trouble.

It is thought that a recent act of Congress will seriously interfere with bridges now being constructed.

The Act may also compel the modifications of plans of bridges to be built in the future. This Act was adopted in September last. In substance, it gives the Secretary of War the power to require the removal of any bridge, no matter under what charter built, which may be deemed an obstruction to navigation; and that no bridge shall be started or erected in any navigable stream unless the plans are first submitted to and approved by the Secretary of War.

The river men at Pittsburg, recently took steps to object to bridges now under course of construction across the Monongahela and Ohio Rivers. They claim that the bridge of the McKeesport and Bessemer road and the wagon bridge projected at McKeesport do and will obstruct navigation, and the Secretary of War will be asked to so decide and order a change of plans. The bridge at Ceredo over the Ohio River will also be the subject of similar complaint.

It is held by the river men that under this act no false work or piling or any substance can be erected in the channel of a navigable stream to support portions of a bridge under construction, and that therefore all new bridges must be either of the cantilever type or built under some other plan which offers no obstruction.

NOTES.

The University of Wisconsin, at Madison, began work this year with 1,000 students enrolled. The facilities for the prosecution of scientific studies are said to be excellent, and the instruction furnished of a high class.

At the meeting of the Boston Society of Civil Engineers to be held on November 19, 1890, the subject of "Roads and Road Making" will be taken up for general discussion by the members. The discussion will be opened by a paper by Prof. C. F. Allen, and Messrs. E. W. Howe, W. E. McClintock, A. F. Noyes, and others, have signified their intention of taking part in the discussion.

The work of constructing a new water-power canal on the Canadian side at Sault Ste. Marie, Ont., with Lake Superior as a reservoir, has been commenced. The necessary permission was recently obtained from the Dominion Government. Local capitalists, assisted by the city corporation, have undertaken the project. The canal is to be half a mile long, 12 feet deep and 50 feet wide, and will afford water-power for manufacturing purposes.

The corner stone of the Masonic Temple, at Chicago. Ill., was laid on the 6th inst. The building will probably be the greatest Masonic structure in the world.

The final competition of plans for the new building to be erected by the American Fine Arts Society at New York will take place to-day. Three competitors won premiums at the original competition. They were H. J. Hardenbergh, Edmund B. Wells, and Babb, Cook & Willard. The three were directed to submit new plans, to be handed in to-day. These plans are now complete, and the society will consider them in private and announce the final result at the opening of the annual exhibition in December.

MEETINGS OF ENGINEERING SOCIETIES.

The American Society of Civil Engineers holds its regular meetings on the first and third Wednesday in each month, at the House of the Society, 127 East Twenty-third Street, New York.

The Boston Society of Civil Engineers holds its regular meetings at the American House, Boston, at 7.30 P. M., on the third Wednesday in each month.

The Western Society of Engineers holds its regular meetings at No. 78 La Salle Street, Chicago. at 7.30 P. M., on the first Wednesday in each month.

The Engineers' Club of St. Louis holds regular meetings in the club's room, Laclede Building, corner Fourth and Olive Streets, St. Louis, on the first and third Wednesdays in each month.

The Engineers' Club of Philadelphia holds regular meetings at the House of the Club, 1122 Girard Street, Philadelphia.

The Engineers' Society of Western Pennsylvania holds regular meetings on the third Tuesday in each month, at 7.30 P. M., at its rooms in the Penn Building, Pittsburg, Pa.

The Engineers' Club of Cincinnati holds its regular meetings at 8 P. M. on the third Thursday of each month at the Club rooms, No. 24 West Fourth Street, Cincinnati.

The Civil Engineers' Club of Cleveland holds regular meetings on the second Tuesday of each month, at 8 P. M., in the Case Library Building, Cleveland Semi-monthly meetings are held on the fourth Tuesday of the month.

The Engineers' Club of Kansas City meets in Room 200, Baird Building, Kansas City, Mo., on the second Monday in each month.

The Engineering Association of the Southwest holds regular meetings on the second Thursday evening of each month at 8 o'clock, at the Association headquarters, Nos. 63 and 64 Baxter Court, Nashville, Tenn.

The Civil Engineers' Society of St. Paul meets at St. Paul, Minn., on the first Monday in each month.

The Montana Society of Civil Engineers meets at Helena Mont , at 7.30 P. M., on the third Saturday in each month.

The Civil Engineers' Association of Kansas holds regular meetings on the first Wednesday in each month at Wichita, Kan.

The New England Water Works Association holds quarterly meetings in Boston at Young's Hotel.

The Canadian Society of Civil Engineers holds its regular meetings on each alternate Thursday, commencing with the 9th of October, at the House of the Society, 112 Mansfield Street, Montreal.

The Engineering Department of the Brooklyn Institute, Brooklyn, holds regular meetings, at 8 P. M., on the third Tuesday of each month. Until the Institute building is repaired, the meetings will be held in the rooms of the Young Men's Christian Association Building, 502 Fulton Street.

OBITUARY.

James Gregory, a well-known brass and copper founder and finisher, of New York, died on the 6th inst.

Prof. Milton B. Goff, Chancellor of the Western University, died on the 8th inst., at Allegheny, Pa. During the visit of the British Iron and Steel Institute last month the Chancellor broke a leg by a fall at Homestead. Pneumonia developed itself afterward, and his death was looked upon as a certainty some days ago. Professor Goff was born in Allegheny City, December 17, 1831.

PERSONAL.

J. B. Norris has resigned his place as Superintendent of Water-Works at Huntington, W. Va.

H. J. Stanley, formerly Chief Engineer for Cincinnati, has been reappointed by the new Cincinnati Board of Affairs, vice, J. C. Stewart, removed.

Andrew Rosewater, formerly City Engineer of Omaha, Neb., has been selected by President Harrison to be a member of the Electrical Board in the District of Columbia.

Charles H. Leddie, M. Am. Soc. C. E., residing at St. Louis, Mo., was recently elected Vice-President and General Manager of the Greenville Water and Electric Light Company, of Greenville, Tex.

The President of Mexico has appointed Señor Don Leandre Fernandez to represent the Government of Mexico in the International Railway Commission. Señor Fernandez is an eminent civil engineer of that country.

Chief Engineer George R. Johnson, U. S. N., having reached the age of retirement, 62 years, will be succeeded as inspector of machinery on Government work at the Columbian Iron Works, by Chief Engineer George W. Roche, who is at present a member of the Naval Board to test coil boilers.

OUR ARCHITECTURAL ILLUSTRATION.

RESIDENCE AND STABLE ON BEACON STREET, BOSTON, MASS.

SHEPLEY, RUTAN & COOLIDGE, ARCHITECTS, BOSTON, MASS.

ENGINEERING SOCIETIES.

A meeting of the Western Society of Engineers was held on November 5, at their quarters, 78 La Salle Street, Chicago. President E. Cooley in the chair, John W. Weston, secretary, and about 50 other members attending. Three applications for membership were received.

The Society formally indorsed the course of its representatives, O. Chanute, D. J. Whittemore, E. L. Corthell and C. L. Strobel, who attended the convention of local societies of United States and Canada, in Chicago, on October 14 and 15, at which it was decided to hold at Chicago, during the World's Fair, an international engineering congress. In this convention a letter was read from F. R. Hutton, New York, Secretary of the American Society of Mechanical Engineers, saying he would have the circular report regarding the congress "presented to our council at a meeting just in advance of the Richmond convention, opening November 11," and would submit the same to the society at large."

Other similar indorsements were read, and the chair said that congratulations seemed in order, that practical steps were being taken to secure a successful world's congress of engineers, and he took under advisement the appointment of three gentlemen to represent this society, as also a local standing advisory committee of three, as recommended by the committee.

Messrs. Lundy, Alexander and Carner were appointed a committee on the annual entertainment, and Messrs. Corthell, Gottlieb and Artingstall, former presidents of the Society, a committee to nominate officers to the December meeting.

Then a paper was read by Mr. L. P. Morehouse on "The State *vs.* the Railroads." He said that with the progress of socialism there will be an increased willingness to allow the Federal Government to assume powers not exercised before. One acquisition by the Government will be the telegraph system, and another, the railroad system of the country. The solution of the railroad problem was imperative in the interest of the people. The time was passed when the idea could be maintained that the railroads could conduct their business independently of the State. Created by the State, they could be regulated in every respect by their creator, and it was reasonable that the public should be protected from what must be always, more or less, a monopoly.

At a meeting of the Engineers' Club, of Philadelphia, held on November 1, 1890, the Secretary presented a report from the committee which had been appointed to represent the club at the convention of representatives of the engineering societies, held in Chicago, with reference to the part the engineers of this country should take in the coming World's Fair in Chicago. This committee consists of President H. W. Spangler, Chairman, and Messrs. Wilfred Lewis and E. V. d'Invilliers.

It was decided that the club would contribute $500, and that members be invited to each send a contribution of not less than $1 to this fund.

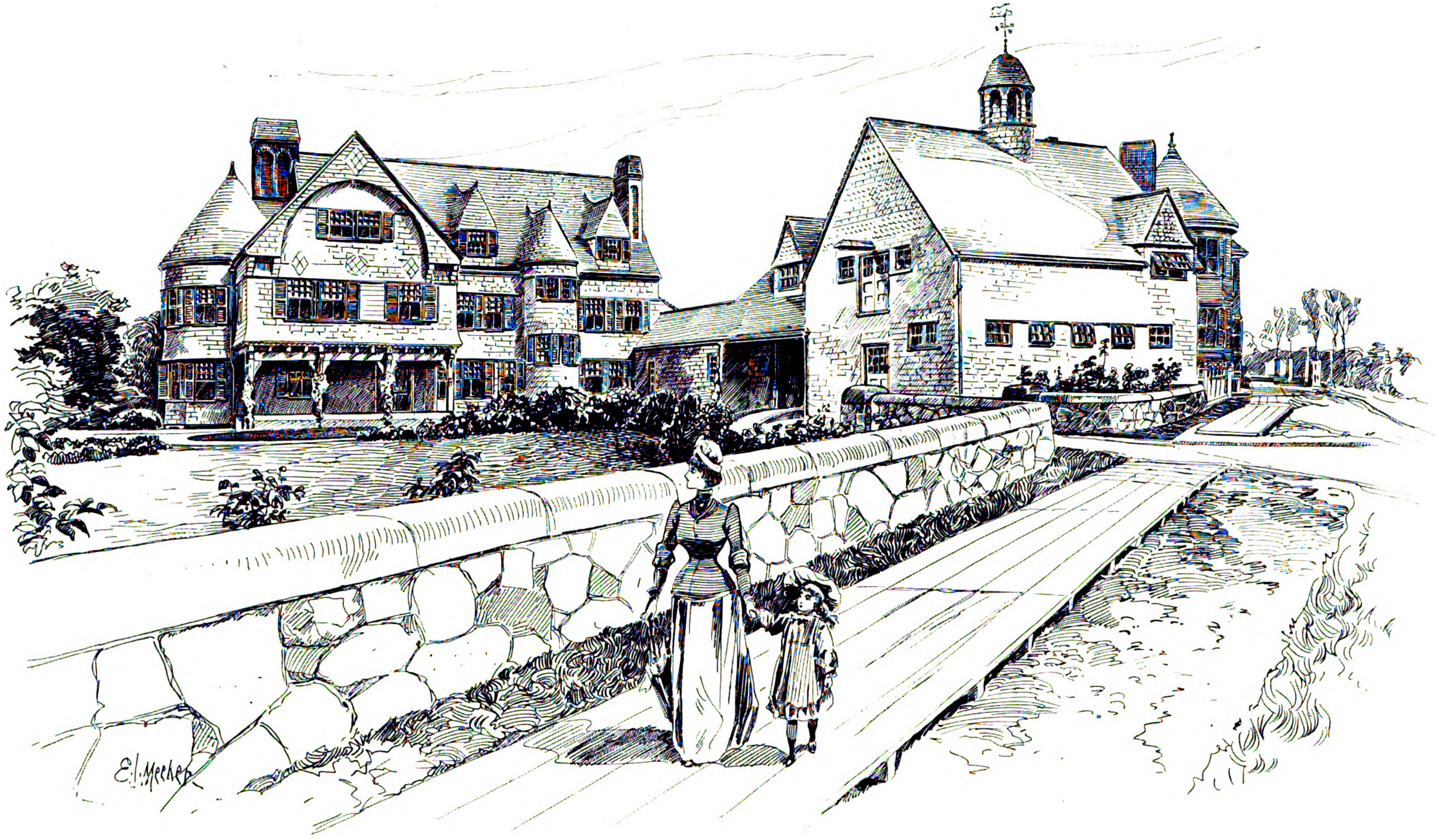
Mr. Benjamin Franklin presented a paper upon "The Application of Drain Tiling to the Improvement of Ground for Residences."

There was some discussion of this paper. Mr. Howard Hurphy noted a case where drain tiling had been used by him around a private residence in order to relieve the flooding and dampness in the cellar.

The Secretary presented, for Mr. Harvey Linton, a paper upon "Topographic Surveying," with photographic illustrations. The Secretary presented, also, the resignations from active membership of Messrs. Wm. H. Burr, Wm. O. Dunbar and Edward I. H. Howell.

According to the London *Builder*, the foundation stone of the great tower to be erected at Douglas, Isle of Man, was laid on October 21 by the Earl of Lathom. The tower is to comprise six floors, to be used severally as a theatre, dancing saloon, concert hall, bazaar, shops, and the topmost has an observatory. The tower will be as high as St. Paul's Cathedral, the estimated cost is about $400,000, and it is expected that it will be completed by the midsummer of 1892.

W. H. Sayward, of Boston, Secretary of the National Builders' Exchange, made an address in Minneapolis, Minn., before the members of the Building Exchange. Mr. Sayward dwelt on the advantages of builders' exchanges, and the necessity of organizing for the protection of rights, and of working together in harmony.



THE ENGINEERING AND BUILDING RECORD ILLUSTRATED SERIES.

RESIDENCE AND STABLE, ON BEACON STREET, BOSTON.

SHEPLEY, RUTAN & COOLIDGE, ARCHITECTS.

NEW YORK, VOLUME XXII.

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THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS.

RICHMOND, VA., MEETING.

(From a Staff Correspondent.)

ABOUT a hundred members and guests of the American Society of Mechanical Engineers left New York by special train on Monday evening, November 10, and arrived at Richmond on the following morning.

After establishing themselves at headquarters many of them inspected the electric street car system, the tobacco manufactories, and other industrial plants. In the afternoon the first session was opened. About 150 members and ladies were present and were welcomed by Hon. J. Taylor Ellyson, Mayor of Richmond, who briefly referred to the social and political history of the city, its progress and accumulation of wealth during the last 25 years, and to its present mechanical and manufacturing prospects. He predicted, as the result of the convention, a stimulus in the direction needed. President Oberlin Smith replied, thanking him and the people of Richmond for their welcome, and then presented his official address, the subject of which was, "The Engineer as a Scholar and a Gentleman."

"Assuming," said Mr. Smith, "that the great majority of the men who are styled and who style themselves 'engineers' are really worthy of the title—that in some one or more of the numerous departments of their calling they know how to get the better of Dame Nature, so to speak, by designing and constructing a good road, or bridge, or railway, or canal; by locating and digging a good mine, and knowing what comes out of it; by planning and building a good machine, without the scrap-heap's credit entry showing more avoirdupois than the bill of lading; by taming the lightning as a gentle beast of burden in its modern harness of copper and silk and iron; by creating beautiful buildings not of the order of the ephemera, the following questions arise:

"Does this aggregate mass of engineers attain to as high a professional standard as, all things considered, our modern civilization would lead us to expect? Does this body of men, who, without question, are of vastly more importance to the world than those of any other one profession or trade, stand as high in the estimation of their fellow-men as their important position would seem to demand? and is their craft (one which, if properly practiced, requires as much learning as do the crafts of law or medicine) thoroughly recognized as one of the learned professions? The answer is an unqualified affirmative."

Mr. Smith, speaking further, pointed to what he considered the proper course of education to be pursued in preparation for engineering studies.

In the evening the members and guests were received at the Gubernatorial Mansion by his excellency, Governor Phillip McKinney and his wife, assisted by Col. W. Miles Carey of his staff, and many Richmond ladies and gentlemen, and by the local committee.

WEDNESDAY MORNING.

The first business was the reading of the general report of the Council. This was followed by the report of the Finance Committee, which showed that the receipts were $17,720.40; disbursements, $17,673.37; balance, $37.13; amount to the credit of the library fund, $2,163.48.

The committees on "Uniformity of Flange Diameters" and "Methods of Tests of Materials" reported progress. The committee on the "Methods of Test of Locomotive Efficiencies" made no report. The committee on "Methods of Duty Trials of Pumping Engines" reported through its chairman, who summarized the main features of the report presented last May, recommending the duty determination by measurement of heat units, the separation of boiler from engine duty, and the consideration of plunger displacement.

Discussion followed by George H. Barrus, Albert W. Jacobi, F. M. Wheeler, W. M. Barr, John T. Hawkins and James E. Denton, who approved of the use of thermal units, separation of pump and boiler and engine duties, and the use of the pump itself for its own meter. They also believed that some slight differences, not now accounted for, might be met in the action of a pump under special conditions of feed-water, that temperature was of great importance, and that a stroke indicator might be necessary, An instance of slip was mentioned where a pump delivered 7 per cent. more than its displacement. It was also thought better not to shorten the length of tests on account of the conditions of the fire.

The secretary read the report of the committee from the American Society of Mechanical Engineers who attended a joint meeting in Chicago, October 14, of delegates from the various engineering societies, which was held for the purpose of considering the feasibility of establishing headquarters at Chicago during the Columbian Exposition for their own members and for the entertainment of foreign visitors. The report recommended the establishment of headquarters at Chicago, and also recommended the holding of an International Congress of Engineers during the Exposition, to be in session six days, the proceedings to be conducted in English.

It was recommended to employ a secretary and two assistant, linguists, at the headquarters, chiefly to give information to engineers and introduce foreign visitors. The total expense was estimated at $10,000, to be met by a tax of $2 on each of the members of the societies, and by subscriptions. It was recommended that the Western Society have three delegates; the Civil, Mechanical, Mining, Electrical and Canadian Societies each two delegates, and the local societies each one delegate, and that all the societies take definite action within two months. The report was referred to the council. A communication from H. L. Binnsse was read, suggesting the compilation of an engineers' handbook by a committee of experts, and giving topical divisions similar to a recent German publication. The matter was laid on the table. Members were requested to interest Congressmen in behalf of an Ericsson memorial.

The following officers were elected for the ensuing year: President, Robert W. Hunt, of Chicago, Ill. Vice-Presidents, Stephen W. Baldwin, New York City; John F. Pankhurst, Cleveland, O.; Alexander Gordon, Hamilton, O. Managers, Andrew Fletcher, New York City; W. R. Warner, Cleveland, O.; Colman Sellers, Jr., Philadelphia, Pa. Managers holding over, J. E. Denton, C. W. Nason and H. H. Westinghouse. Treasurer, William H. Wiley, New York City.

Notice was given of a proposed amendment to Article 31 of the Rules, to provide for the nomination of at least two candidates for election for each office. Papers were presented as follows: By Frank Van Vleck on "Light Cable Road Construction;" by R. H. Thurston on "Authorities on the Steam Jacket: Facts and Current Opinions;" and by W. H. Adams on "An Engineering Problem at Richmond, Va.," the latter being a consideration of the available water power there, estimated at over 40,000 horse power.

The engineers were invited to inspect the Burton Electric Heater for warming street cars, and adjournment was followed by an excursion down the James River. Luncheon was served on the boat, and the party was received by Commander J. D. Graham, U. S. N., who extended to them the courtesies of the U. S. monitors Manhattan, Mahopac, Lehigh, Canonicus, Catskill, Ajax, and Wyandotte. These were inspected under the guidance of the staff officers.

On Wednesday evening papers were read on "Chimney Draft: Facts and Theories," by R. H. Thurston; "A Novel Form of Flexible Tubing," by T. R. Almond; "Heat Transmission Through Cast-iron Plates Pickled in Nitric Acid," by R. C. Carpenter; "Some Properties of Ammonia; Mechanical and Physical Properties of Sulphur Dioxide, and Theoretical Investigations of Efficiency of Vapor Engines," by D. V. Wood; "Experimental Determination of the Latent Heat of Ammonia," by D. S. Jacobus; and "The Automatic Regulation of Injection Water to Vapor Condensers," by J. McBride. These papers and the topical question, "Is there any reason why corrosion should be more active in one place rather than another inside a steam drum properly piped to connect several boilers in a battery?" were discussed by Messrs. Denton, Smith, Barratt, Nason, Grimm, Sterling, Barr, Hawkins, Davis, Wheeler, McElroy and Britton.

Thursday morning papers were read on "Hydraulic Hoisting Plant for the Pier of Brooklyn Sugar Refining Company," by L. G. Engel; "Hydraulic Traveling Cranes," by E. Graves; "The Single-Acting Compound Engine," by W. A. Bole; "Rope Driving," by C. W. Hunt; "Accident-Preventing Devices for Machines," by J. H. Cooper; "New Process for Generating and Cutting the Teeth of Spur Wheels," by A. Swasey; "An Interesting Experiment with a Lubricant," by G. W. Bissel; "Performance of a 75-Ton Refrigerating Machine of Ammonia Compression Type," and "Some Special Experiments with a Lubricant," by J. E. Denton. Written and oral discussions were presented by Messrs. Sweet, Ball, Webber, Miller, Smith, McBride, Hawkins, Denton, Hunt, Campbell, Tompkins, Thurston, Nason and Woolson.

Resolutions of thanks were passed for the hospitality and attentions received from the Governor, Mayor, citizens, railroads, and numerous firms and individuals and corporations who entertained the society.

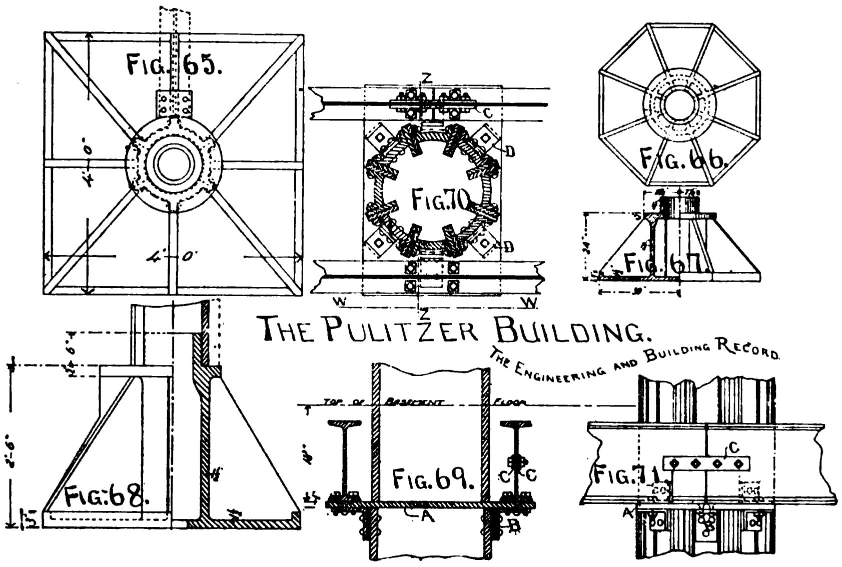
Thursday afternoon the members and guests were taken in carriages to the Tredegar Iron Works, where luncheon was served. Thence they visited the Richmond Locomotive Works, the Lee Monument, Hollywood Cemetery, and various points of local interest.

Thursday evening a reception, ball and supper were given by the ladies and gentlemen of Richmond, and on Friday the party went by special train to the yards of the Newport News Ship Building Company; to the Portsmouth Navy Yard, visiting the new United States battle ship "Texas" and the cruisers, and to Norfolk and to Old Point Comfort, where some of the party remained to attend the ball given them, and the remainder returned home, via Richmond and other points.

The following members and guests were registered as in attendance at the meeting:

Alberger, Louis R., with H. R. Worthington, New York City; Allison, Robert, and wife, Franklin Iron Works, Port Carbon, Pa.; Albree, Chester B., Pittsburg, Pa.; Archer, E. R., Richmond, Va.; Adams, W. H., New York; Ashworth, Daniel, Pittsburg, Pa.; Babbitt, George Rodney, and wife, Providence, R. I.; Ball, Frank H., and wife, Erie, Pa.; Bang, Henry A., New York; Barr, William M., Germantown Junction, Philadelphia, Pa.; Barrus, George H., Boston, Mass.; Bennett, F. M., Washington, D. C.; Beach, C. S., Bennington, Vt.; Bond, Geo. M., Hartford, Conn.; Britton, J. W., Cleveland, O.; Brooks, Wm. B., Richmond, Va.; Bulkley, H. W., New York; Campbell, Geo. W., Newark, N. J.; Burr, S. D. V., New York; Carr, C. A., U. S. N., Washington, D. C.; Coleman, J. B., Elmira, N. Y.; Cooper, J. H. and wife, Philadelphia; Cullingworth, Geo. R., New York; Dallett, W. P., Philadelphia; Davis, E. F. C., Richmond, Va.; Denton, J. E., Jersey City, N. J.; Doran, W. S. New York; Engel, L. G., Brooklyn, N. Y.; Eberhart, F. L. H. and sister, Newark, N. J.; Fairbank, Sidney, Winchendon, Mass.; Frost, G. H., New York; Fitts, J. H.; Fladd, F. C. and wife, New York; Foster, W. A., Corning, N. Y.; Foster, C. E., Washington, D. C.; Gantt, H. L., Philadelphia; Gobeille, J. L., Cleveland, O.; Gentry, T. W., Richmond, Va.; Gray, G. A., Cincinnati; Grimm, P. H., Glen Cove, N. Y.; Hand, S. A., Philadelphia; Greenwood, P. F., Richmond; Hawkins, J. T., Taunton, Mass.; Hemenway, F. F., New York City; Henderson, Alexander, Chief Engineer U. S. N., Navy Yard, Boston, Mass.; Henderson, G. R., Roanoke, Va.; Hillard, Charles J., Pittsburg, Pa.; Holland, John, Dover, N. H.; Holloway, J. F., New York City; Hunt, Charles Wallace, New York City; Hutton, Frederic R., New York City; Hyde, Charles E., Bath, Me.; Jacobi, Albert W., New York City; Jacobus, D. S., Hoboken, N. J.; Husted, Chas. L., Coatsville, Pa.; Jewett, L. C., Erie, Pa.; Laforge, Frederick Henry, Waterbury, Conn.; Laird, John A., St. Louis, Mo.; Lane, Harry M., Cincinnati, O.; Leonard, I. H., U. S. N., Washington, D. C.; Lowe, F. R., New York; McBride, James, Brooklyn, N. Y.; McElroy, Samuel, Brooklyn, N. Y.; MacFarland, Walter M., U. S. N., Washington, D. C.; Mattes, William F., West Superior, Wis.; Mellin, Carl J., Richmond, Va.; Mirkil, Thomas H., Jr., Philadelphia, Pa.; Moore, D. G., Elizabeth, N. J.; Mumford, E. H., Detroit, Mich.; Nason, Carlton W., New York City; Parks, Edward H., Providence, R. I.; Passel, George W., Cincinnati, O.; Painter, Wm., Baltimore, Md.; Pope, Ralph W., Elizabeth, N. J.; Phillips, C. Von, Bethlehem, Pa.; Pickrill, J. M., Richmond, Va.; Rogers, Winfield S., Troy, N. Y.; Rood, Vernon H., Jeanesville, Pa.; Redwood, Lloyd J., Brooklyn, N. Y.; Ross, D. L., Indian Orchard, Mass.; Shirrell, David, Richmond, Va.; Smith, George H., Providence, R. I.; Skinner, F. W., ENGINEERING AND BUILDING RECORD, New York; Smith, Jesse M., Detroit, Mich.; Smith, Oberlin, Bridgeton, N. J.; Smith, Scott A., Providence, R. I.; Snell, Henry I., Philadelphia, Pa.; Spaulding, H. C., Boston, Mass.; Sperry, Charles, Port Washington, N. Y.; Stillman, Francis Hill, Brooklyn, N. Y.; Stirling, Allan, New York City; Swasey, Ambrose, Cleveland, O.; Thompson, John, New York; Tompkins, S., Charlottesville, Va.; Torrey, Herbert Gray, Sterling, N. J.; Tucker, W. B., Elizabeth, N. J.; Webster, John H., Boston, Mass.; Wellman, Samuel T., Cleveland, O.; Wheeler, F. Meriam, New York; Whitehead, George E., Providence, R. I.; Whitney, Baxter D., Winchendon, Mass.; Wilcox, John F., Pittsburg, Pa.; Wiley, Wm. H., New York City; Whitney, Wm. M., Winchendon, Mass.; Woolson, Orosco C., Newark, N. J.; Wolcott, Frank P., Carteret, N. J.; Lipps, H. Jr., Raleigh; Vanderbilt, A., New York; Wood, W. H., Philadelphia, Pa.; Phillips, G. H., Newark, N. J.; Almond, T. R. and wife, New York; Parker, C. D., Worcester; Hemenway, F. F. New York; Wightman, D. A., Pittsburg; Bray, C. W., Youngstown; Hand, F. L., Philadelphia; Dick, J., Meadville, Pa.; Reiss, J. T., Hamilton, O.; Graves, E., Camden, N. J.; Kinney, R. C., Hamilton, O.; Raynal, A. H. and wife, Richmond; Field, C. J., New York; White, W. Jr., Pittsburg; Jones, W. C., Cincinnati; Simpkins, Wm. and wife, Richmond; Roberts, Wm., Waltham, Mass; Delaney, A., Richmond; Ogden, J. L., Philadelphia; Barnes, A. T., Boston; Comly, G. M., Edgemoor, Del.; Shepherd, W. J., Chester, Pa.

BARREN ISLAND odors are at present the subject of an investigation by the New York State Board of Health, a movement having been started to have the horse and fish rendering establishments removed from that place.



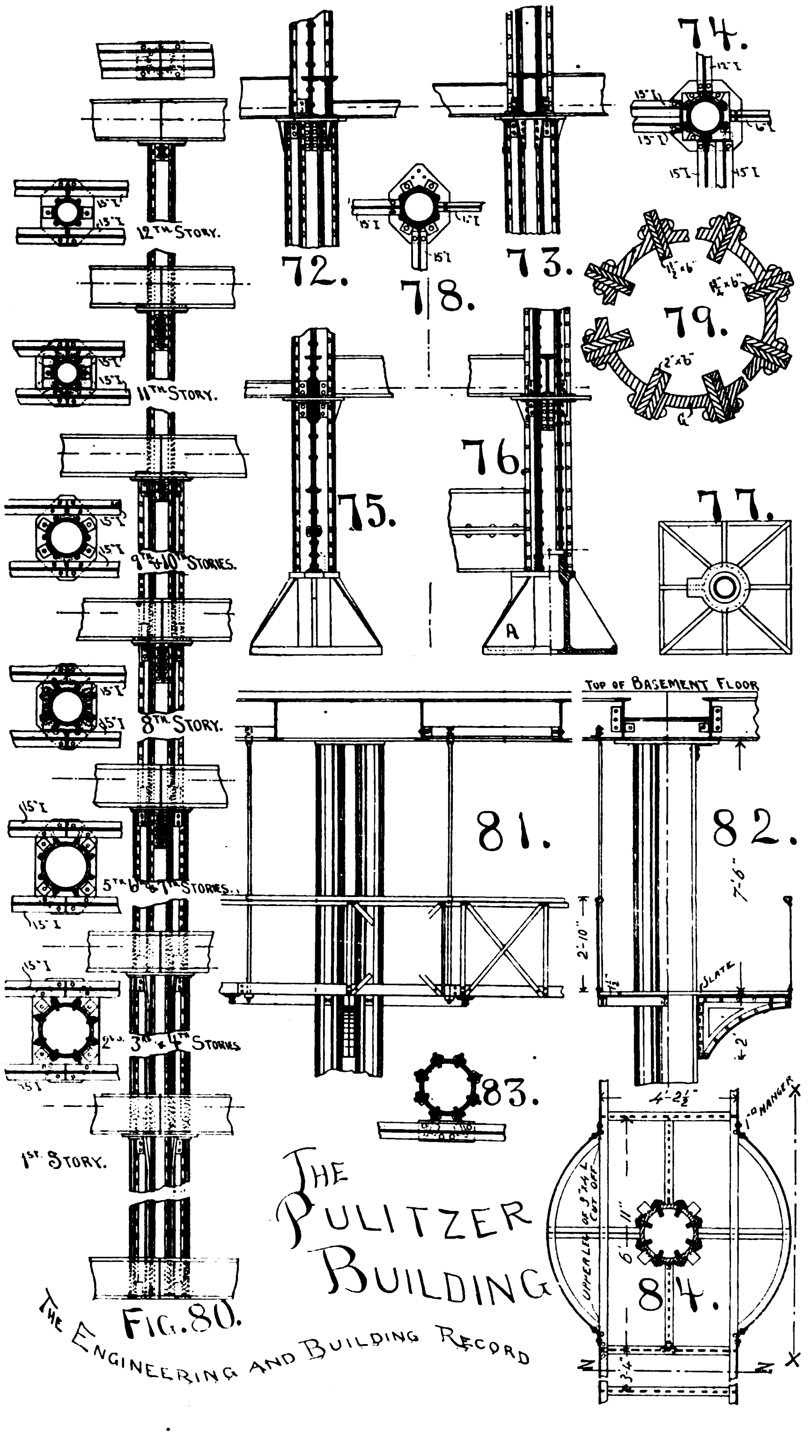
THE NEW YORK WORLD BUILDING.

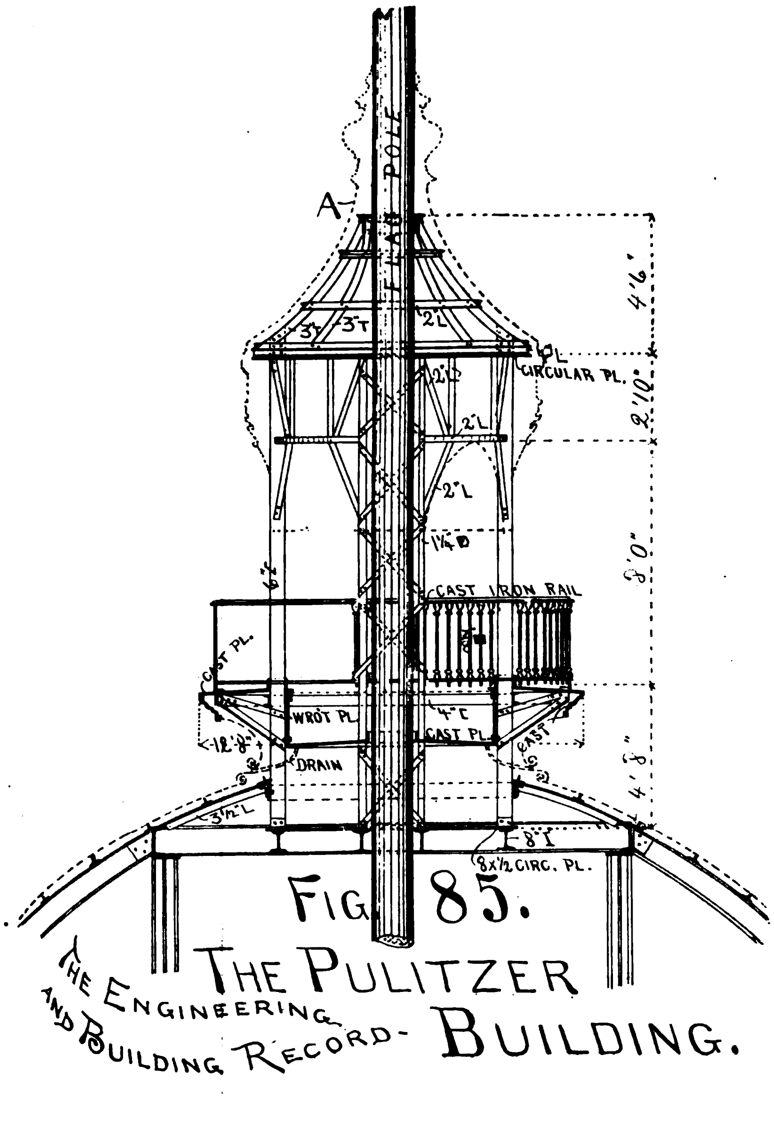
PART. III.—BEAM PLANS AND DETAILS OF COLUMNS; LANTERN, AND GENERAL IRON CONSTRUCTION.*

FIGURE 54 is a diagram of the third tier or first floor beam arrangement. The different sizes are indicated by letters as follows: A, 7-inch 15lb. I-beam; B, 15-inch 41lb. I-beam; C, 15-inch 80lb. I-beam: D. 12-inch 40lb. I-beam; E, 15-inch 50 lb. I-beam; F, 9-inch 27lb. I-beam; G, 12-inch 32lb. I-beam; H, 6-inch 13lb. and 15lb. I-beam; I, 8-inch 18lb. I-beam; J, 10-inch 25lb. I-beam; K, 7-inch 20lb. I-beam; L, 9-inch 21lb. I-beam; M, 8-inch 22lb. I-beam; N, 10-inch 38 and 33lb. I-beam; O, 6-inch 10lb. I-beam; P, plate girders; Z Z, etc., are cast-iron lintels, and T T. etc., are tie rods securing the beam webs laterally.

Figures 55 to 60, inclusive, show special arrangements at the Park Row and Frankfort Street corner, and, excepting these variations, the beam plans are essentially alike up to the roof. Figure 55 is at the street level; Fig. 56 is on the second tier; Fig. 57, on the fourth tier; Fig. 58, on the fifth tier; Fig. 59, on the eleventh tier, and Fig. 60, on the twelfth tier. Figure 61 shows the roof beam plan. P P, etc., are plate girders under the dome. Figure 62 is a half section through the center of the dome, and is taken through rooms A and C, Figs. 39 and 40. If taken through rooms D D, Fig. 40, another floor would be shown in the 20 foot story. A is a section of one of the dome columns, showing the flange plates D and B, to which the lateral and wall braces are connected.

Figures 63 and 64 are beam plans of the second and fourth dome floors, respectively, and the reference letters designate the same dimensions for the beams as in Figs. 54 to 61. Figure 65 is a plan, and Fig. 68 is an elevation and section of the cast pedestal for one of the wall columns, as at A, Figs. 2, 10, 16, 54, etc.; Fig. 66 is a plan, and Fig. 67 is an elevation, half in section, of one of the interior column pedestals, as at I_c, Figs. 2, 10, 54, etc.; Fig. 70 is a horizontal section through a pair of basement floor beams, as at column K, Figs. 2, 10 and 54, showing the arrangement of bed-plate A, bracket





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* Part I.—General Description, Location, Perspective View, and Floor Plans was published November 1, 1890.

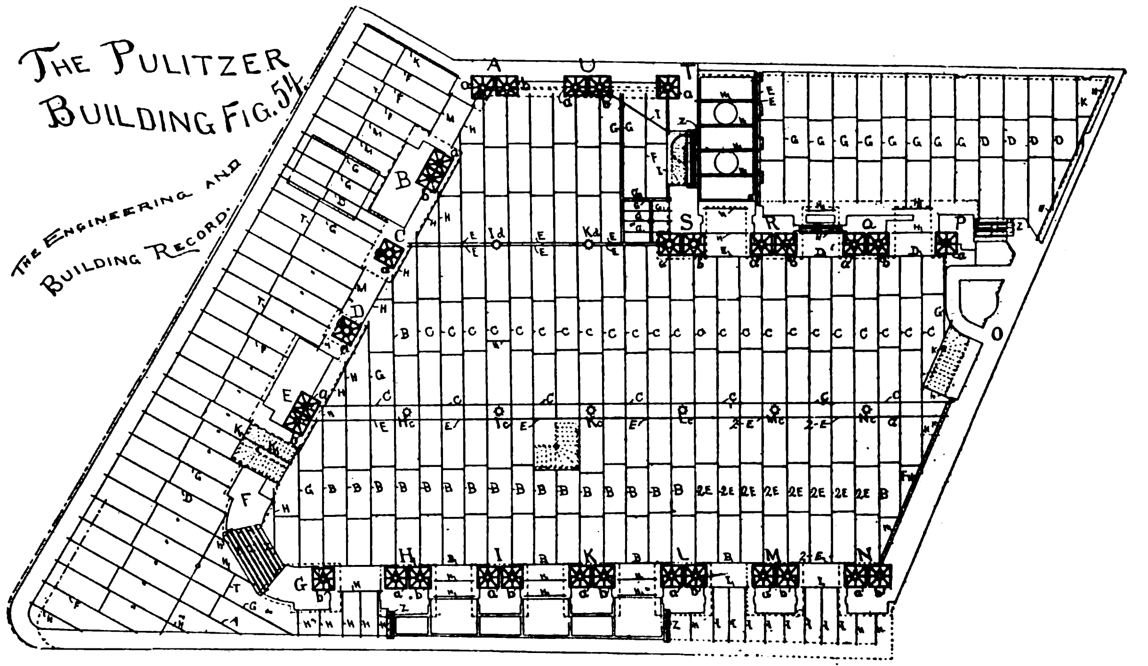
Part II.—Foundation Plan and Elevations, Details of Piers and Walls, Elevations, Sections and Plans of Dome, was published November 8, 1890.

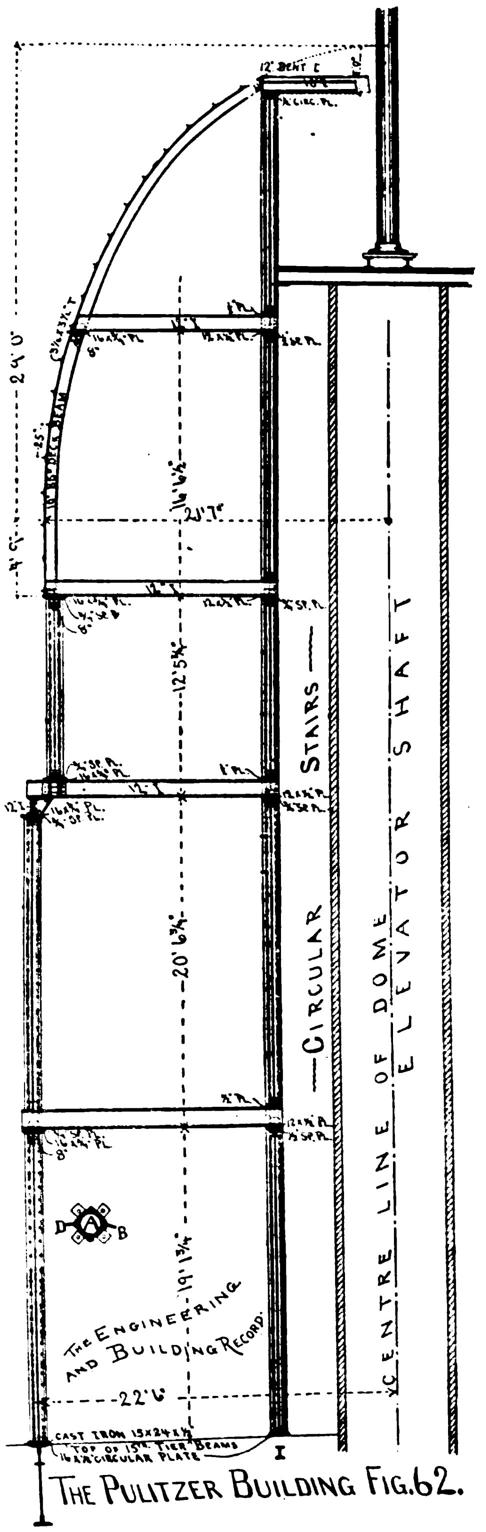
angles B B, braces D D, and splice bars C C; Fig. 69 is a section at Z Z, and Fig. 71 is an elevation at W W, Fig. 70.

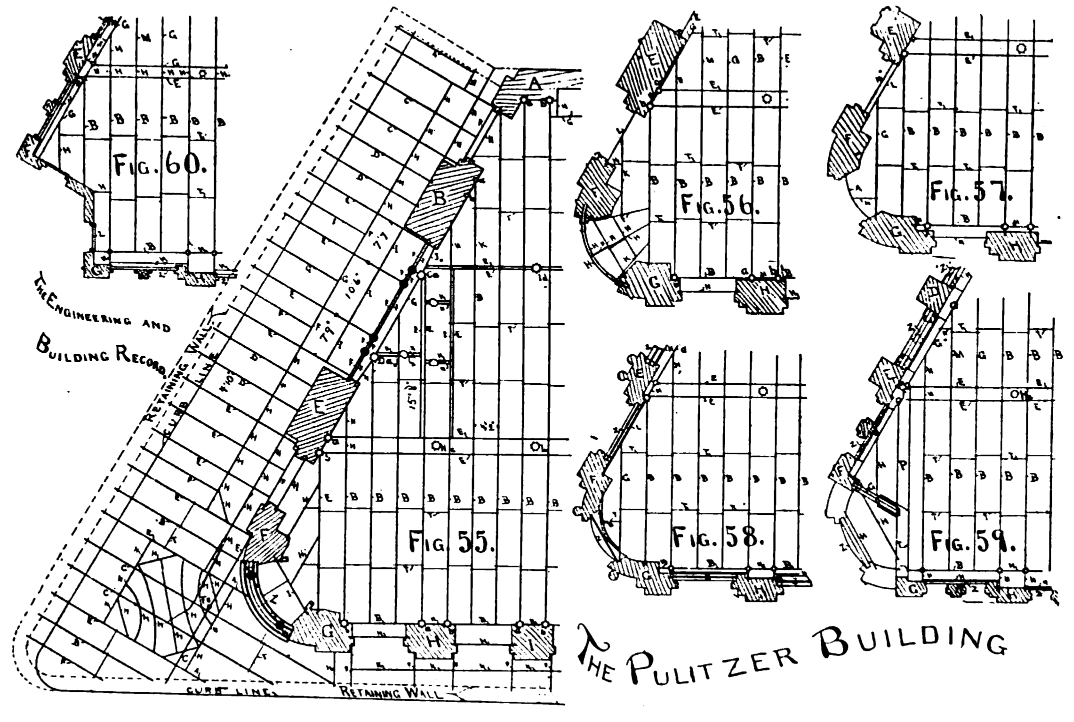
Figures 72 and 73 are elevations, at right angles to each other, of the details of the connection between the interior columns Mc and Nc, and the second story floor beams, Fig. 74 is a horizontal section through the webs of the floor beams* in Figs. 72 and 73; Figs. 75 and 76 are elevations, at right angles to each other, of the pedestal and first tier connections of floor beams to columns, L M and N, Fig. 54; Fig. 77 is a plan of pedestal A, Figs. 75 and 76; Fig. 78 is a horizontal section through the webs of the floor beams, Figs. 75 and 76; Fig. 79 is a detail, showing the segments and re-enforcement plates used to secure the different heavy sections for the lower lengths of the Phœnix columns.

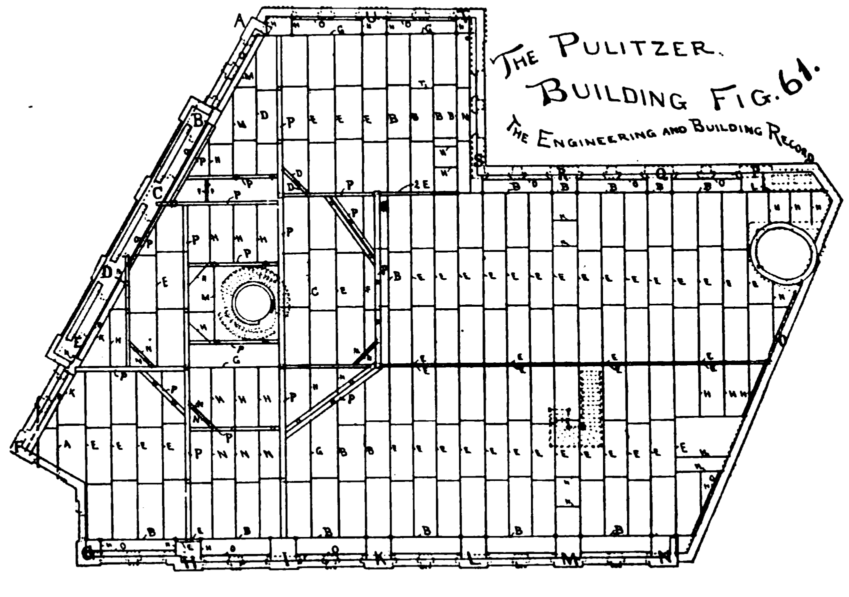
Figure 80 is a complete elevation of column Kc, Figs. 2, 10, 54 and 61, showing all connections from pier to roof. All the column ends are milled to a true bed and exact length, and all the floor beams are carried on heavy steel shelf plates, or diaphragms, inserted between adjacent column sections, and braced, when necessary, by bracket pieces, or gussets. No cast iron whatever is used in the floor-beam connections.

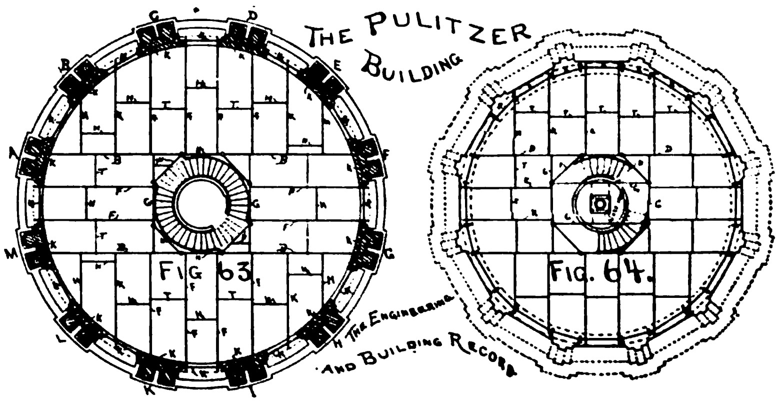
Figure 84 is a horizontal section through column Nc, Fig. 2, and shows a portion of the platform X of the visitors' gallery in the basement; Figs. 81 and 82 are elevations from X X and Z Z, Fig. 84, respectively; Fig. 83 is a section through column Nc, Figs. 81 and 82, showing the detail of connection of the gallery floor beams to the column; Fig. 85 shows details of framing in the lantern; A is 20-ounce copper sheathing.


THE PULITZER BUILDING FIG. 54.


THE PULITZER BUILDING FIG. 62.


THE PULITZER BUILDING
Fig. 60. Fig. 55. Fig. 56. Fig. 57. Fig. 58. Fig. 59.


THE PULITZER BUILDING FIG. 61.


THE PULITZER BUILDING
Fig. 63. Fig. 64.

RECENT WATER-WORKS CONSTRUCTION.

No. XXIII.

(Continued from page 24.)

THE CORNELL UNIVERSITY WATER-WORKS.

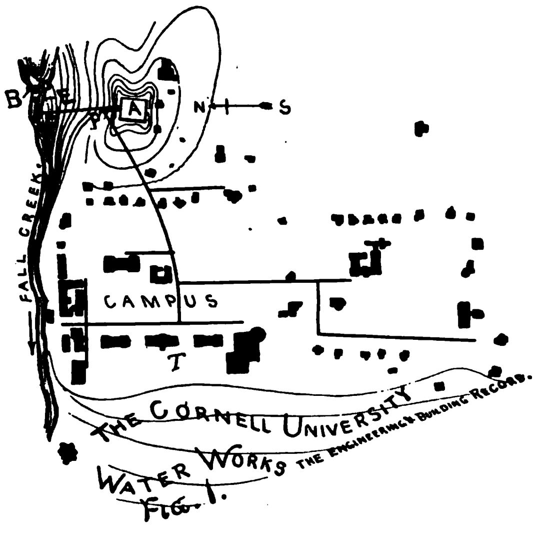
Cornell University is located at Ithaca, N. Y., on a hill about 400 feet above the Cayuga Lake, and so far above the business portion of the town that soon after it was established a separate and independent water-supply system had to be provided. It was designed and its construction superintended in 1874-5, by E. A. Fuertes, M. Am. Soc. C. E., Director of the College of Civil Engineering at Cornell, from whose notes and sketches this description and illustrations have been prepared.

Figure 1 is a diagram showing the location of the pumps, reservoir, main pipes and some of the University buildings and dwellings supplied by the system. A few contour lines are sketched in to indicate the topography of the campus and show the hill on whose summit the reservoir A is constructed at a height to furnish ample head for the gravity system. The water, from a mountain stream, is impounded at R by a curved stone dam B, about 100 feet long and 40 feet high firmly seated between the high walls of solid rock which form the banks of the stream.

Water is taken from above the dam through a closed conduit E to the pump-house F, whence it is forced into the reservoir A, and thence distributed under a head that at T is about 90 feet. The lift of the pumps is 145 feet.

An arrangement of valves at P enables the pumps to work directly through the service mains without discharging into the reservoir in case of fire or other emergency.

The original 72,000-gallon pump has been reinforced by two more, with a combined capacity of 3,600,000 gallons per diem.


B
E
P
A
N
S
FALL CREEK
CAMPUS
T
THE CORNELL UNIVERSITY WATER WORKS
THE ENGINEERING & BUILDING RECORD.
FIG. 1.

The present consumption is about 3,000,000 gallons; used in all laboratories, for fountains and green-houses, to run small turbines and other motors, for making steam for heating and motive purposes, for all domestic uses and for fire protection through about 30 hydrants.

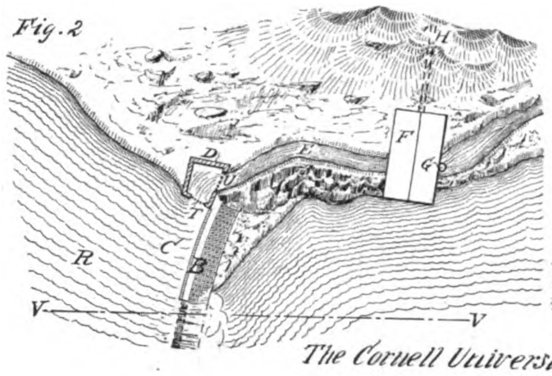
Figure 2 is a plan of the pumping station, etc.

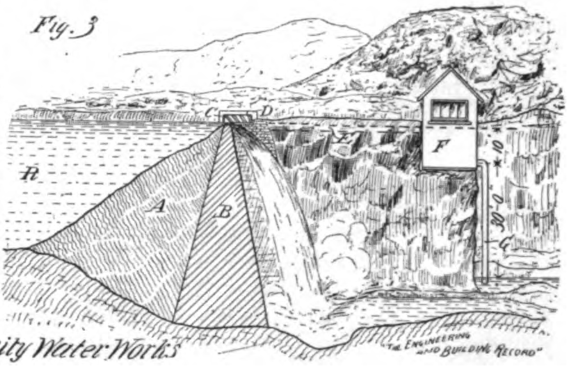
Figure 3 is a section and elevation at V V, Fig. 2. R is a pool that at low water has an area of about four acres and a maximum depth of 25 feet and stores some of the water impounded by the stone dam B. C is a timber bulkhead. The entrance of the inlet E was found to be subject to obstruction from floating ice, etc., and the intake chamber D was built of stone masonry and provided with screen gates at T and U. The gates at the dam proper are moved by a sliding frame worked by a screw. The pump-house F contains three pumps that deliver to the reservoir through the mains H. They are essentially Worthington pumps driven by water at 10 feet head which they receive instead of steam in their cylinders, and discharge through the exhaust pipe G, which greatly increases the efficiency. The pumps deliver into the reservoir against a pressure head of 145 feet. Dam B, though probably possessing some strength as an arch, is stable by gravity and has a packed earth filling, B.

Figure 4 is a plan of the reservoir and Fig. 5 is an enlarged partial section at Z Z, Fig. 3.

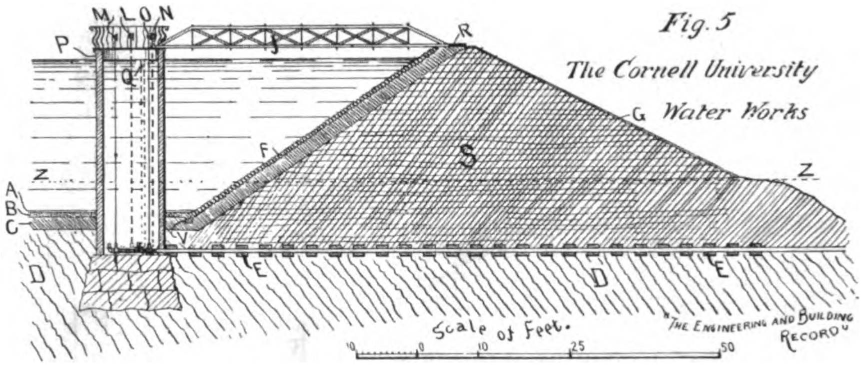
The reservoir was built on the French plan of partial excavation and partial elevation. It is 27 feet deep, 100 by 144 feet at the top, and has exterior and interior slopes of 1½ to 1 and 2 to 1, respectively. When filled to the top of the overflow it contains 1,000,000 gallons of water. The excavated loam and gravel was spread directly on the leveled surface of the coarse gravel bed, D D (Fig. 5), and built up in horizontal layers eight or ten inches thick that were rolled and sprinkled with a 1,800-pound cylinder, to form the reservoir walls, S. A two-foot layer of clay puddle C was then spread on the interior sides of the reservoir and the sides were paved with limestone sets F, carefully laid on edge and breaking joints. They were selected of regular size, about 10 by 2 inch to 3 by 6 to 12 inch, and were sound and square. A layer of hydraulic concrete 10 inches thick was carefully laid on the bottom, with the fillet V, one foot in section, about the inner toe of the pitching. Unexpected hindrances had delayed the work so that freezing weather set in before it could be finished, and when operations were discontinued for the winter a layer of straw was spread, much against the designer's wishes, over the bottom and inner sides. When this was removed in the spring it was found to have partly decayed, and left a thick adhesive slime all over the stones, which could not be removed without entirely destroying the paving.

The original design provided a cement lining, which it was attempted to dispense with. Three times the reservoir was filled only to soon empty itself through cracks produced in the puddle at the center of pressure, viz., one-third the distance from the bottom to the top. These cracks were repaired. The pavement F was then grouted with one part of Rosendale cement and two parts of sand, mixed to the consistency of cream, and applied from the bottom upward in a continuous zone about three feet wide, round and round the sides spirally. All the joints of the stones were flooded and each successive passage of the grouting trough forced the grouting into any cracks or open spaces that might have been left lower down. Considerable anxiety was felt lest the slime produced by the straw covering should prevent adhesion between the stones and the grout, but no such difficulty was experienced.





The Cornell University Water Works


M L O N
P
J
R
Q
Fig. 5
The Cornell University Water Works
G
F
S
Z
Z
A
B
C
V
D
E
D
E
Scale of Feet.
10 0 10 25 50
"The Engineering and Building Record"

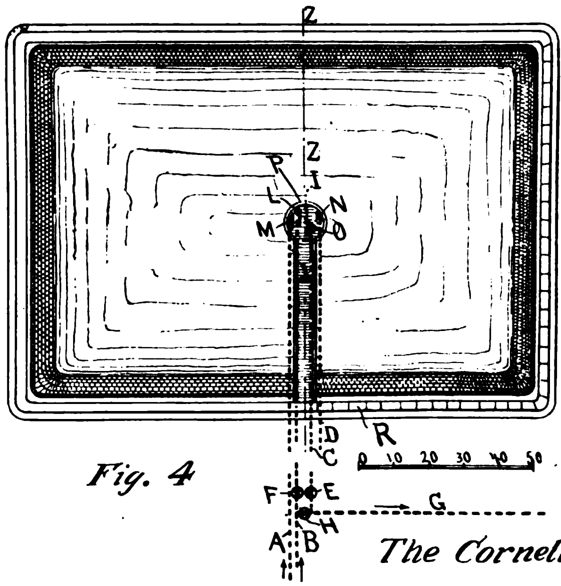
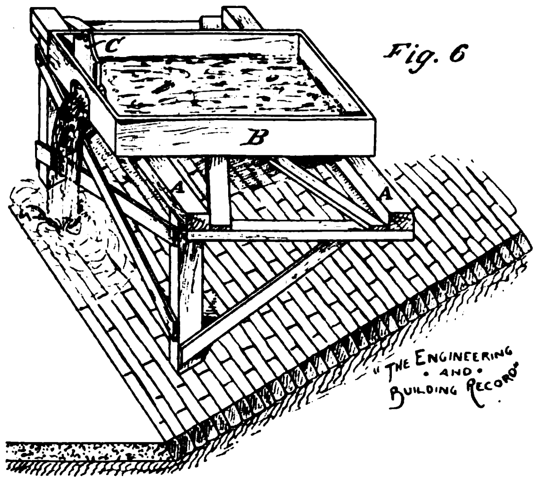


Fig. 4



The Cornell University Water Works

The reservoir being built before the arrival of the iron pipes, a gap was left for them in the embankment, and they were laid and the trench (37 feet deep) was filled up in the same way that the walls were built. To prevent leakage along the line of the pipes small pockets about 18 inches apart and 18 inches square were scooped out of the levelled bottom of the trench, and in each a cube of concrete (E E, etc.) was rammed around the pipe, and the filling carefully packed around it. Pipes A and B (fig. 4), are 6 and 8-inch supplies from the pump-house, C is a 10-inch delivery to the consumers, and D is a 12-inch overflow and emptying pipe.

These pipes enter the cylindrical brick well P that is divided by the porous vertical partition wall I, and is floored over to form a platform from which the rack and pinion gears M, L, O and N, controlling the gate valves below are operated.

Overflow pipe D terminates with a stop-gate valve opened by the gear L, when it is necessary to empty the reservoir. A stand-pipe, Q, is connected to the pipe D, adjacent to the emptying gate, and serves for an overflow.

Gear N controls the delivery main, and M and O control the supply pipes. The tower is inclosed by a locked iron fence, and is reached by an ornamental wooden bridge J.

The reservoir is pleasantly located, and a popular resort. A flagstone pavement R is laid around the sides.

Ordinarily the valves F and E are open, and the valve H is closed; and the pumps deliver to the reservoir, but by closing F and E, and opening H, the pressure from the pump pipe B is turned directly into the service main G.

Figure 6 shows the method of grouting the paved slopes.

The grout was mixed in the box B, 3'x7', and delivered as required through the gate C. The box being easily slipped along on the caps A A of a movable frame.

After the reservoir was finished its outside slopes were top-dressed and carefully turfed on the slopes from the bottom upwards, each length being secured by wooden pins and thoroughly set by pounding with heavy wooden mauls.

The total cost of the reservoir was about $8,000, and it has not leaked or required any repairs whatever since its completion in 1875. The entire cost of the works was about $18,000.

ROPE DRIVING.

In a paper on rope driving, read this week at the Richmond, Va., meeting of the American Society of Mechanical Engineers, Mr. Charles W. Hunt stated that the most prominent questions which the engineer wishes to have answered who proposes to make an application of rope driving are those relating to the horse-power, wear of rope, first cost of rope, catenary. The subject is so new that but few accurate data are available, arising from the long period required in each experiment, a rope lasting from three to six years. In many of the early applications so great a strain was put upon the rope that the wear was rapid, and success only came when the work required of the rope was greatly reduced. The strain upon the rope has been decreased until it is approximately known what it should be to secure reasonable durability. Installations which have been successful, as well as those in which the wear of the rope was destructive, indicate that 200 pounds on a rope one inch in diameter is a safe and economical working strain. When the strain is materially increased the wear is rapid. For the purpose of his paper Mr. Hunt assumed this strain of 200 pounds for the normal fibre stress of a manila rope one inch in diameter to be the one which it is advisable to use.

To ascertain the average breaking strength of commercial rope, Mr. Hunt lately purchased four pieces made by different cordage works, and had them tested on the Fairbanks' testing machine in New York. They varied slightly in diameter, but when reduced to the equivalent of a rope one inch in diameter had an average breaking strength of 7,140 pounds. Expressed algebraically, the breaking strength, weight per foot, and the working strains are:

$$W = 720\ C^2$$
$$P = .32\ C^2$$
$$w = 20\ C^2$$

In these equations $C =$ circumference of rope in inches.

This makes the normal working strain equal to one thirty-sixth of the breaking strength, and about one twenty-fifth of the strength at the splice. The actual strains are ordinarily much greater, owing to the vibrations in running, as well as from imperfectly adjusted tension mechanism.

The centrifugal force of the rope in running over the pulley will reduce the amount of force available for the transmission of power. The centrifugal force of the rope is computed by the formula:

$$F = \frac{P\ v^2}{g},$$

P being the weight, in pounds, per foot of rope; v, the velocity of rope in feet per second; and g, gravity. At a speed of about 80 feet per second the centrifugal force increases faster than the power, from increased velocity of the rope, and about 140 feet per second equals the assumed allowable tension of the rope. Computing this force at various speeds, and then subtracting it from the assumed maximum tension, we have the force available for the transmission of power. The whole of this force cannot be used, because a certain amount of tension on the slack side of the rope is needed to give adhesion to the pulley. What tension should be given to the rope for this purpose is uncertain, as there are no experiments which give accurate data, and at the present time a decision must be made partly from analogy and partly from experience.

If the rope be considered as a belt on a plain pulley, the friction would be substantially the same as a leather belt at the same tension, but as ropes are frequently lubricated to reduce the wear, the co-efficient of friction must be materially reduced. There have been no experiments to decide with accuracy what this reduction is, but it is known, from considerable experience, that when the rope runs in a grove whose sides are inclined toward each other at an angle of 45 degrees there is sufficient adhesion when the ratio of the tension is

$$\frac{T}{t} = 2,$$

T, being the tension, in pounds, of driving side of rope and t the tension on slack side of rope.

T can be divided into three parts:

Tension doing useful work.
Tension from centrifugal force.
Tension to balance the strain for adhesion.

The tension t can be divided into two parts:

Tension for adhesion.
Tension from centrifugal force.

It is evident, however, that the tension required to do a given work should not be materially exceeded during the life of the rope.

There are two methods of putting ropes on the pulleys; one in which the ropes are single and spliced on, being made very taut at first, and less so as the rope lengthens, stretching until it slips, when it is respliced. The other method is to wind a single rope over the pulley as many turns as needed to obtain the necessary horse-power and put a tension pulley to give the necessary adhesion and also take up the wear.

Transmission ropes are usually from 1 to 1¾ inches in diameter.

The first cost of the rope will be smallest when the power transmitted by it is greatest.

The wear of the rope is both internal and external; the internal is caused by the movement of the fibres on each other, under pressure in bending over the sheaves, and the external is caused by the slipping and the wedging in the grooves of the pulley. Both of these causes of wear are, within the limits of ordinary practice, assumed to be directly proportional to the speed. Hence, if we assume the co-efficient of the wear to be k, the wear will be kv, in which the wear increases directly as the velocity, but the horse-power that can be transmitted will not vary at the same rate.

ACTION OF ALUM ON MICROBES IN POTABLE WATER.

In the *Chemical News* for October, page 177, there is an interesting reference to the use of alum for the removal of organic matter in suspension and in solution in drinking water. It is well known that when alum is added to ordinary water it is decomposed, its sulphuric acid combining with the lime, and its alumina being thrown down in combination with the organic substances which are present. Along with this precipitate and entangled with it the microbes are also mostly precipitated.

The *Chemical News* states that since this method has been adopted by the French troops in Tonquin they have enjoyed a nearly complete exemption from dysentery. This method was employed in preference to boiling the suspected water, the facilities for doing which were not always at hand.

THE OMAHA, NEB., WATER-WORKS.

The improvements now being made in connection with the Omaha, Neb., Water-Works involve the construction of a new reservoir at the river and a generally improved system of filtering the water after it has been pumped from the river. The plans contemplate the erection of a stand-pipe at the river, near where the present second pumping station is located. The water will be pumped directly into this from the river, and will then be conveyed in large mains to the reservoirs around the central pumping station. The new reservoir will be located east of the present two, and they will all be connected by weirs instead of pipes as now, over which the water will flow in a broad thin sheet, less than half an inch deep. It is estimated that this system will cause the deposit of about 70 per cent. of the silt in the primary reservoir, and by the time it reaches the final basin from which it will be pumped into the Fairmount Park reservoir, it will be relieved of nearly all matter held in suspension.

A Florence, Ala., dispatch states that after years of work the canal around Muscle Shoals, in the Tennessee River, is at last completed. and will soon be formally opened. It will enable the passage of boats from Florence to Knoxville.

FIRE-PROOF DOORS.

In our issue of September 21, 1889, we illustrated a form of fire-proof door which is made the subject of further comment in a circular recently issued by the Boston Manufacturers Mutual Fire Insurance Company. Some of the particulars there given will bear repetition.

There are a number of applications of fusible solder for the purpose of closing the door when the temperature rises to 162 degrees; but whatever method is used, the doors should always be kept closed, except during working hours, and even in working hours when it is feasible.

The tin-covered doors may be hung on hinges or at doorways when such form would be more convenient; but in such instances it is important to maintain a constant supervision in order that the doors shall not be held open by objects placed on the floor in front of them.

When this form of construction is used for window shutters, it is important that they should always be closed at night. The great fire at Lynn, in November, 1889, was stopped in a westerly direction by the resistance of a large building protected by this type of shutter, although a burning frame building, three stories high, had fallen against this building, the heat of the fire being sufficient to melt the tin from the plates and to reduce much of the wood in the shutters to charcoal. As air cannot reach the wood in these shutters, the wood may be slowly carbonized, but rapid combustion is impossible. At the opposite extremity of the burned district, a large bank building provided with a different type of shutter was burned. Efforts were made to close the shutters, but as they had been kept open for 25 years they were rusted in position so firmly that it was impossible to move them.

It is recommended that shutters and fire doors should be painted with a light paint, which tends to reflect the heat. A dark paint tends to absorb it.

COST OF DREDGING.

In an article on dredging operations in the East, the London *Engineer* states that the cost of dredging in Portsmouth harbor, which more than ten years ago was eight pence per cubic yard, has now been reduced to three and one-half pence. Similar reductions have been made in the United States, Canada and the West Indies, due entirely to improvements in dredging machinery during the past ten years. In India and the Eastern colonies, however, there are no signs of such reductions, the cost per cubic yard being as high as from 1*s*. 6*d*. to 4*s*. 6*d*. per cubic yard. The reason as given by the *Engineer* is that dredges 20, 30 and even 40 years old are employed upon such work in the East. In one case a dredge was stopped for repairs 120 out of 180 days of employment. These unfortunate machines, it says, "are kept wheezing and grinding along years after they should have been broken up for old metal."

WATER-SUPPLY OF LONDON AND GLASGOW.

The Corporation Committee, which has been sitting, under the Presidency of Sir William Guyer Hunter, since May last, to report on the question of the London water supply, has presented its report. The question is really a revival of that considered by the Parliamentary Select Committee on London Water Supply, held in 1880. This Parliamentary Committee reported that it was desirable in the interests of the public that the Metropolitan Water Supply should be vested in the hands of a public body, and that it should not, as now, be under the control of private companies. The city of Glasgow affords, to a certain extent, a parallel to existing conditions of London. Previous to 1855 Glasgow was supplied by two companies, and at that date authority was obtained to take over the undertakings. The authorities have reason for satisfaction at the results. Mr. Gale, the Engineer, states that the daily supply per head in Glasgow is 49.84 gallons, the water charge on a house of £50 rental is £1 9*s*. 2*d*. per annum if within the Municipal boundary, and £2 1*s*. 8*d*. without. In London the average daily supply per head is stated at 29.91 gallons, while the charge for a house with £50 rental ranges from £2 4*s*. 0*d*. to £3 17*s*. 0*d*. per annum, according to the company making the supply.

The favor with which American machinery is regarded abroad is, in a measure, illustrated by the fact that the Ingersoll-Sergeant Rock Drill Company, of New York, have received a second order for a plant of submarine drilling machinery for removing the Iron Gates of the Danube River, Austro-Hungary.

MAGNESIA IN PORTLAND CEMENT.

IN view of the recent decided scare, particularly abroad, as to the deleterious effects of magnesia in Portland cement, special interest is attached to some rather reassuring tests results arrived at by Dyckerhoff, and recorded in the *Thonindustrie Zeitung*.

It appears that experiments were made with a series of cements containing magnesia in proportions ranging from 1.9 to 21.24 per cent.

A condition of the utmost weight, and too often overlooked in researches of the kind, was in this case scrupulously complied with; ample time was allowed for the development of latent defects, the experiments extending over two years. All the cements dealt with increased in strength up to the end of six months, although those containing most magnesia were weaker than the others. The three containing the largest proportion of magnesia, viz., 10.82, 17.80, and 21.24 per cent. respectively, began at this point to retrograde rapidly. The other specimens, containing 6.23 and 11.36 per cent., increased in tensile strength up to twelve months, and then gave evidence of retrogression. It was also proved that the temperature at which the cement had been burned was of considerable influence, lightly-burned cements growing weaker sooner than those made from well-burned clinker. This is in no way surprising, for it is a well-known chemical fact that the exposure of magnesia to a very high temperature renders it almost inert, or, to speak more exactly, slower in its reaction with water, the product slacking very gradually, and remaining caustic for a considerable period.

To sum up, then, it is plain that magnesia in tangible amount, *e. g.*, over 5 per cent., is distinctly dangerous, and cement containing such a proportion should be rejected without appeal, but the moderate quantities found in ordinary cements of good quality are thoroughly innocuous, and rejection based on their presence is considered capricious and unreasonable.

A RAILROAD APPROACH TO NEW YORK CITY.

L. L. BUCK, writing in *The Railroad Gazette*, says that in 1876, while looking over a map of New York City and its vicinity, it occurred to him that Long Island and Staten Island were favorably situated to afford a very superior route for railroads to approach New York from the south and west. A further study of the subject satisfied him that it might at the same time be made a connecting link between railroads coming in from the former points and those coming in from the east and north.

The plan was to cross the Arthur Kill at some convenient point, by a bridge from New Jersey to Staten Island, thence on Staten Island to the Narrows, thence by a tunnel under the Narrows and Bay Ridge to Long Island, thence through or around Brooklyn to the vicinity of Lawrence's Point, and thence by a tunnel under the East River to Westchester, where it could form a junction with the various railroads coming in from the east and north.

From all that could be learned of the character of bottom of the Narrows, it did not appear to be such as to present very serious obstacles to driving a tunnel through it, and Mr. Buck believed that a tunnel might be so constructed as to be permanent. He gave this part of the problem considerable study.

The advantages of the route are pointed out as follows:

1. The great facility it would afford in reaching New York. The city of Brooklyn is now well supplied with a system of elevated railroads, terminating at various important points on the East River. Two or three substantial bridges could be built across this river for what one would cost across the North River from Jersey City or Hoboken, and these bridges would have the decided advantage of distributing the traffic over a proportionately greater number of convenient points in New York City, while the railroads from the north and east would continue to enter the city by their present routes, By these means a very material assistance would be given to the solution of the rapid transit problem in New York.

2. It would place Long Island and Staten Island on a through line of railroad ; a very important consideration, when it is remembered that the large and rapidly growing city of Brooklyn is completely isolated from the mainland. These islands would also have their value as suburbs greatly enhanced.

Branch tracks extending along the shores of the Bay and the Brooklyn shore of the East River would be of decided benefit as terminal facilities,

3. The advantages that such a railroad would afford in receiving and shipping goods might soon cause the erection of large storage warehouses around the outskirts of Brooklyn, where heavy goods could be received and repacked for shipment directly by rail instead of bringing them to New York and carting them about the streets by horse-power, thus saving a large percentage in the cost o handling and preventing the present crowded condition o the streets from becoming much worse.

Finally, no more direct route connecting New England with the South, West, and the coal regions be found than by the line above described.

A bridge has already been built across the Arthur Kill, and a railroad on Staten Island. A movement is now on foot to tunnel the Narrows and extend the railroad on to Long Island. That the improvement will end there Mr. Buck does not consider as at all probable,

CAUSTIC LIME FOR PURIFICATION OF SEWAGE WATER.

DR. H. WEIGMANN, of Kiel, Germany, contributes to the *Gesundheits-Ingenieur* an interesting article on the above subject. In the pamphlet of foreign abstracts of the British Institution of Civil Engineers, the following resumé of it is given :

While admitting that the purification of sewage water by means of irrigation is the more perfect system of treatment, Dr. Weigmann points out that in certain cases some chemical process has, for various reasons, to be employed. Notwithstanding the numerous substances which have been proposed, lime still holds the foremost place. The caustic lime combining with the carbonic acid gas, a product of decomposition always present in sewage water, yields a bulky precipitate of calcic carbonate, which mechanically entangles the suspended impurities, and effects a rapid clarification.

Recent experiments respecting the action of lime have shown this substance to possess such excellent disinfecting properties that it seems that the lime treatment is among the best of the precipitation processes. As one result of the use of lime, it is pointed out that the substances in solution are thereby invariably increased rather than diminished in quantity, though the recent researches of Schreib tend to controvert this theory. In order to arrive at accurate conclusions, careful estimations of the amount of chlorine in the sample, both before and after treatment, are advisable. Dr. Weigmann's experiments have led to the conclusion that from the clarified effluent after the lime treatment there is a considerable evolution of ammonia and other nitrogeneous gases, and he states that though water which has been rendered so strongly alkaline as to destroy all the bacteria therein cannot decompose so rapidly as water teeming with bacteria (which are the active exciters of putrefactive changes), there can be no doubt that. owing to the dissolved lime, an important change takes place in the condition of the organic substances in solution. Dr. Weigmann insists upon the necessity for a rapid separation of the sludge from the water in order to put an end to the changes which take place in the organic matters entangled with the calcic carbonate, and points to the advantages, on chemical grounds, of passing the sludge through a filter-press, as soon as possible after deposition, as is done, for instance, in the works at Halle.

In addition to its powerful action in destroying the bacteria and germs of every kind, there can be no doubt that lime is a strong disinfectant. The tendency of alkaline sewage-water, after it has, by means of carbonic acid gas in the atmosphere or in the river water, parted with its dissolved lime, is to become again rapidly charged with bacteria; but these are by the self-purification powers of running water speedily rendered innocuous or converted into the food-stuff of water-plants, and it is pointed out that the previous lime precipitation has removed all the germs of a pathogenic character, and the new growth of bacteria are probably of a non-dangerous character.

THE School Board of St. Paul, Minn., has requested the Board of Health to make a thorough investigation and examination of the sanitary condition of all public school buildings in the city. This action has been prompted by recent severe criticisms of the city's schools.

THROUGH the generosity of James Lick, San Francisco has been provided with a public bathing institution, which has just been made ready for use.

THE ONEGA WHITE SEA CANAL.

THE preliminary surveys for the projected Onega White Sea Canal have been completed. The British Vice-Consul at Archangel, Russia, in his last report, says that the following facts have been established. The level of the White Sea is about 15 feet higher than that of the Lake Onega, and the length of the proposed canal would be 219 versts, of which 129 versts are a natural waterway. The proposed measurements of the canal are: Breadth, 63 feet; at the locks, 112 feet; and along its other portions the proposed depth is 10 feet. The cost is estimated at about 7,500,000r.—£800,000 — not including the expenses incurred in the construction of a port at a point on the coast of the White Sea. With the construction of the canal it is expected that the cost of transport of goods from St. Petersburg to Archangel will be diminished from 1r. per pood to 40c. The canal will afford every facility for the transport of fish from the plentiful fishing grounds of the White Sea to St. Petersburg, and also for the transport of the mining products of Olonets. It will also be of great stragetical importance in connecting St. Petersburg and Cronstadt with the White Sea. There can be no doubt, the Vice-Consul thinks, that, considering the unlimited supply of timber in the province of Olonets, and the enterprising character of the population, shipbuilding will be carried on on a large scale when the canal is constructed.

DISPLACING A WATER MAIN WITHOUT STOPPING THE SUPPLY.

IN connection with our recent articles on lowering water mains without interrupting the supply, a communication on the same subject, contributed to the *Journal of the Royal Institute of Engineers*, of Holland, by T. Stang, Superintendent of the Municipal Water-Works, at the Hague, is of interest. An abstract is given in the Excerpt Minutes of the Proceedings of the British Institution of Civil Engineers.

It appears that the extension of the town of the Hague made it necessary to alter the position of the main conduit of the water supply. An interruption in the service would have entailed great inconvenience, and as the intended change was comparatively slight, Mr. Stang resolved to try slewing the main sideways without stopping the supply even for a moment. The main, when flowing full, weighs 260 kilograms per lineal meter (524 pounds per yard), the length to be moved being 250 meters (273 yards), made the total mass a weight of 65 tons. When the main had been laid bare and found in excellent condition, a trench was dug alongside reaching a little deeper than the underside of the pipe, which was then suspended by chain slings and screw-bolts and nuts to beams laid across the trench. While the nuts were being turned, over the whole length of the operation, and at the same time slid sidewards, the earth on which the main had been resting was slowly dug away, allowing the main to swing sideways. This operation was repeated two or three times till the pipe was in its desired position. During this time the pressure was reduced from 3 to 1½ atmospheres. No leaks of importance occurred in the lead joints, and where slight ones were observed they were easily calked.

ACCORDING to an account from San Juan del Norte, Nicaragua, Senor Don J. F. Medina, Minister of Public Works, has advised the general agent of the Maritime Canal Company at Managua, Henry C. Hall, that the company has more than fulfilled its obligations as to expenditures upon the work under the requirement of its concessions. The government of Nicaragua has sent congratulations to the company on account of the satisfactory results and favorable prospects. The company has expended upon the work in the last year more than $3,000,000, and has now, by the terms of the concession, 10 years during which to construct the canal.

A LONDON correspondent writes: "An extraordinary defence was entered by the Shoreditch Vestry in an action brought against them recently by a firm of manufacturing chemists. Owing to subsidence in the roadway at Dalston, a horse belonging to the plaintiffs had been injured, and the action was brought to recover damages. The Vestry, in defence, stated that the roadway had been undermined and honeycombed by rats, and the subsidence was a consequence and not due to negligence on their part. The jury accepted the defence and returned verdict for the Vestry. Inspection which permits undermining by rats to such an extent as to endanger a roadway would appear to be peculiarly and particularly superficial."

BUILDERS' AND CONTRACTORS' ENGINEERING AND PLANT.

No. CV.

(Continued from page 362.)

UNDERPINNING YARMOUTH CITY HALL.*

THE City Hall of Yarmouth, England, is about 130 by 106 feet, and 50 feet high to the cornice, and has a total estimated weight of 5,000 tons. The clock tower, Z, Fig. 1, is 108 feet high, weighs 700 tons, and has a base 20 feet square. The building stands on soft, wet soil about 70 feet from the river Yare. It began to settle soon after its completion, and within four years was considered so unsafe that it was determined to rebuild portions of it. The first plan, to put a mass of concrete under the foundations, was abandoned on account of the difficulty of draining the working trenches without endangering the walls. It was proposed to widen the foundations by putting wrought iron girders under the brick masonry, and supporting them on concrete piers level with the ground surface. Finally, the west, or river, front having settled one foot at its extremities and 6 inches in the middle, the north and south walls began to crack and the building to tip over towards the river, and it was determined to demolish the west wall and rebuild it on firmer foundations. Duckham & Teasdel then proposed to restore the walls to the level of least settlement and assure their future stability, with less delay and expense than the reconstruction would require, and were awarded the contract for the work, which they accomplished as shown in Figs. 1 to 9 inclusive.

Figure 1 is a half plan of the building, whose walls Y Y, etc., are shown in section, and their footings, X X, etc., in elevation.

Figure 7 is a section of the main wall at any point, as U U, Fig. 1, and shows the foundations as repaired.

Figure 8 is an elevation from S S, Fig. 7, with the new concrete, W, omitted.

Figure 2 is an enlarged elevation from P P, Figs. 7 and 8.

Figures 3 and 4 are elevations from T T and R R, Fig. 2, respectively.

Figure 5 is a section at X X, Fig. 2.

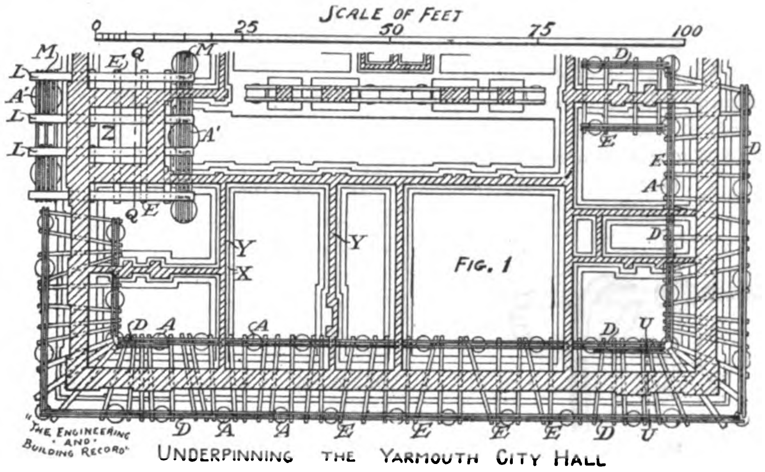
Figure 6 is a section and elevation at Q Q, Fig. 1.

The walls were first braced as shown in Fig. 9, then the cast-iron piles A A, etc., were sunk about 40 inches in the underlying gravel, and filled with concrete. The piles were 22 feet, 6 inches long, 1⅝ inches thick, and 30 inches in diameter where they supported a 35-ton wall, and 36 inches where it was a 50-ton wall. The concrete core was designed to form a column able to carry all the load if the iron shell should be totally destroyed. Longitudinal girders D were then set on the piles, and from them were suspended by 2 inch bolts J J, etc., and bearing plates I I, etc., 16-inch transverse beams E E, etc., from 14 to 16 feet long. Their flanges were 6 inches wide, reinforced by 12-inch plates K, on top where they supported the old concrete footing V. H H are friction washers. The tower piles A¹ A¹, etc., were 4½ and 5 feet in diameter and connected by the small beams M, on which the riveted girders L L were set, and carried transverse girders E, connected as shown in Figs. 2, 3 and 4, to support the walls. By adjusting the suspension bolts J J, etc., all the transverse beams were brought to bearing under the wall, and, lifting it to the required level, transferred its weight entirely to the piles A A, etc.

A trench was then dug under the foundations, and a new concrete footing W, Fig. 7, put in that enveloped the tops of the piles, and all the other iron work.

The work was satisfactorily accomplished in about 12 months at a cost within the contract price of $41,400.

(TO BE CONTINUED.)



UNDERPINNING THE YARMOUTH CITY HALL

FIG. 2

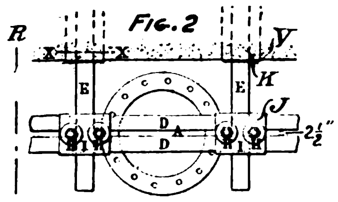


FIG. 3

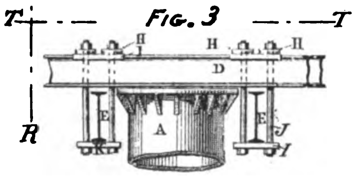


FIG. 4

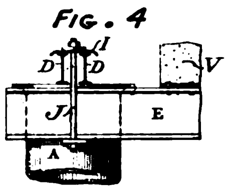


FIG. 5

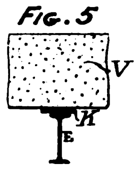
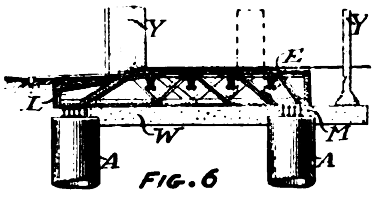


FIG. 6



UNDERPINNING

• THE •

YARMOUTH CITY HALL

"THE ENGINEERING AND BUILDING RECORD"

FIG. 7

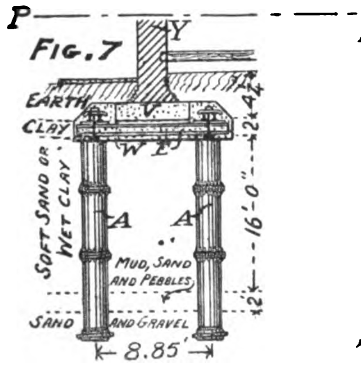


FIG. 8

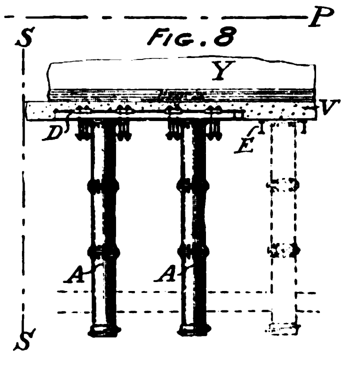
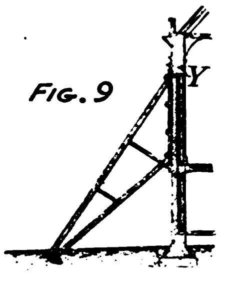


FIG. 9



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* Described in a paper presented to the Institution of Civil Engineers.

MILL COLUMNS.

TIMBER posts, according to a circular recently issued by the Boston Manufacturers Mutual Fire Insurance Company, offer more resistance to fire than iron pillars, and have generally displaced them in mill work, being preferable in many respects.

Experiments made for the company on the testing machine at the United States Arsenal at Watertown, Mass., show that sound timber posts of the proportions customarily used in mill work yield by direct crushing and not by crippling, the strength being directly as the area of cross-section at the smallest part. The columns yielded at about 4,500 pounds per square inch, confirming the general practice of allowing 600 pounds per square inch as a safe load. Square columns are, therefore, one-fourth stronger than round ones of the same diameter, and do not interfere to any greater extent with the floor space.

It has been the general practice to bore a hole 1¼ inches in diameter along the axis of the column for the purpose of reducing checking, but later methods are to leave the columns solid. It may be safer to bore the holes for ventilation, lest, by inadvertence, posts made of unseasoned wood should be painted, varnished, or filled, so as to promote fermentation, or what is commonly called "dry rot."

There is no part of a mill where good work is more essential than at the columns. It is recommended that the cap, pintle, and base be made of one piece of cast iron, instead of three, as is the present general practice.

ANNUAL REPORTS.

ANNUAL REPORTS OF THE CITY OF GLOUCESTER, MASS., for the year 1889.

The report of the City Engineer, Winslow L. Webber, refers mainly to the laying out of new streets and widening of old ones, and furnishing plans for a variety of purposes. Attention is directed to the plans for a complete system of sewerage for the city, recently made by Ernest W. Bowditch, Civil Engineer, which are now before the State Board of Health for their approval. The plans call for a separate system at an estimated cost of $325,000.

ANNUAL REPORT OF THE SUPERINTENDENT OF THE JOLIET, ILL. WATER-WORKS, April 30, 1890.

During the administration of the present Superintendent, J. F. Gleason, the amount of water supply has been greatly increased by a system of drive wells, 20 in number, which, with the aid of the four old artesian wells, now yield a supply to the city of over 3,000,000 gallons per day. A new duplex condensing pumping engine of 3,000,000 gallons capacity in 24 hours, built by the Edward P. Allis & Co. Reliance Works, of Milwaukee, Wis., is in process of erection. The average cost of pumping for the year was $8.30 per million gallons, and the cost per million gallons, including all expenses of maintenance and interest on bonded debt, was $28.75. The total amount of water pumped during the year was 637,704,000 gallons.

ANNUAL REPORT OF THE SEWER COMMISSIONER OF THE CITY OF ST. LOUIS, for year ending April 7, 1890. Robert E. McMath, Sewer Commissioner.

This report gives an account of an accurate survey o the city now in progress, in addition to the usual work of the Sewer Department. The large Mill Creek Sewer, it seems, is approaching completion, as it is hoped that the last section will be completed during the current year. Editorial reference is made in another column to the method pursued in making the surveys.

SEWERAGE AND WATER SUPPLY OF ST. JOHN, N. B. Superintendent's and Engineer's Report, 1889.

The report gives an account of the work done in connection with the sewerage and water supply systems during the year 1889, and shows the present condition of the works on both sides of the harbor. There was added to the water distributing system during 1889 1,615 feet of main pipe and 2,039 feet of leaden service pipe.

With the additions made in 1889 the whole length of distributing pipe in use at the end of the year was 385,184 feet. Measured by the miles of pipe laid there was one leak for each three miles of main and one on each service pipe for each seven-tenths of a mile laid—including such as arose from blasting and sewerage works.

In the section on sewerage the several systems of Carleton, Portland, and St. John (East), which are now under the supervision of one engineer, Gilbert Murdoch, C. E., are briefly reviewed.

Novelties.

Devices are described under this head purely and strictly as news; because believed to be new and calculated to interest readers.

In no case is pay accepted, directly or indirectly, for publishing a novelty notice.

As the subjects are selected for their supposed novelty and interest merely, it will, of course be understood that the selection does not imply indorsement.

FLEXIBLE TUBING.

At the Richmond, Va., meeting, this week, of the American Society of Mechanical Engineers, Mr. T. R. Almond exhibited and described a novel form of flexible tubing, designed to convey gases, steam, or liquids under considerable pressure. The tubing was claimed to have sufficient flexibility for all practical purposes, with the additional advantages of great strength and durability.

When a tube is formed by coiling a wire around a mandrel, the convolutions may be made to press upon each other with considerable force, and the joint formed at the point of contact of the individual convolutions will be tight in proportion to the amount of pressure exerted. If such a tube be bent, the joints will be broken all around the coils except at one point, and therefore, when bent, it is useless for conveying liquids or gases.

Wishing to utilize the peculiar flexibility of spiral spring tubing for the conveyance of gases in cases where a flexible tube is required, Mr. Almond conceived the idea of interposing a triangular-shaped wire between the coils of a round wire. When a tube so constructed is bent, the convolutions of the tringular coil adjust themselves to the spaces between the round coils, as shown in Fig. 1. The triangular wire is pressed between the coils of the round wire, during the process of constructing the tube, with sufficient force to spread them apart, so that the contact surfaces are at all times under pressure. The triangular wire serves two purposes: one is to spread the coils apart, so that the pressure will be exerted on the contact surfaces; the other, to fill the irregularly shaped spaces between the coils of round wire, adjusting itself to the changing form of the spaces due to any given flexion. This pressure brings into play the element of friction to such an extent as partly to destroy the flexibility of the tube, which, when bent, will retain the form given to it. This was an unlooked for and unexpected quality. As the primary object was to obtain a flexible tube, trials were made with wire having a more obtuse angle. This gave better results, as a more perfect joint was produced with less tension of the inner coil, and the friction became correspondingly less, the result being a tight tube with sufficient flexibility.

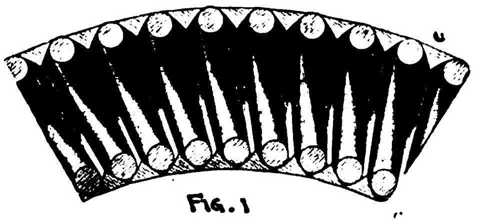


Fig. 1

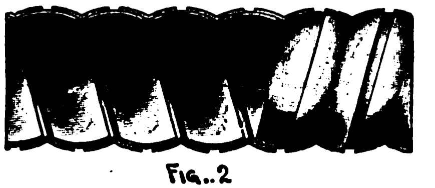


Fig. 2

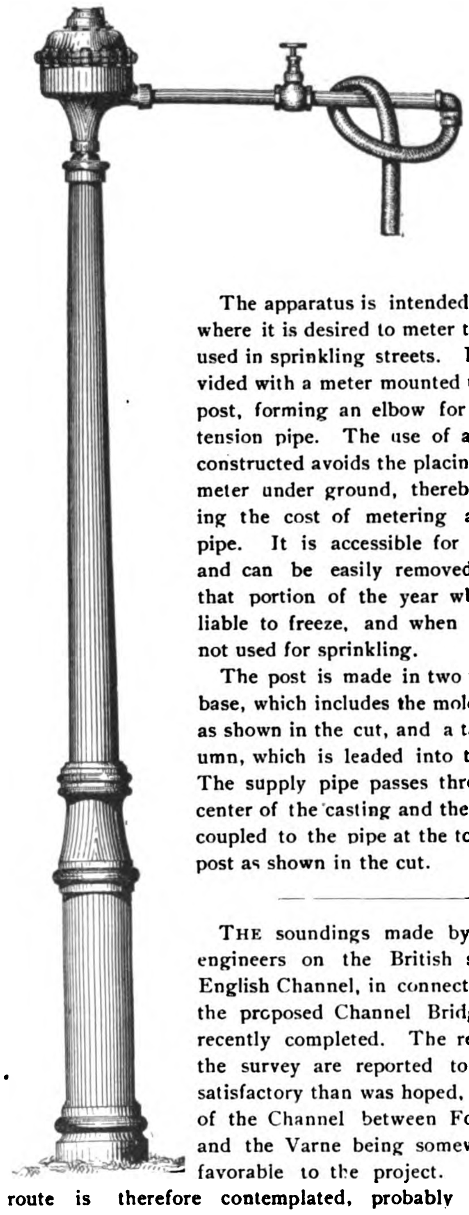
Flexible Tubing

The degree of flexibility depends upon the amount of tension put upon the inner coil, or the extent to which the convolutions are forced apart. Mr. Almond claims to have produced a perfectly tight tube with two coils of round wire, in which the outer coil is wound sufficiently tight between the convolutions of the inner coil to spread them apart for the purpose of getting pressure on the joints, substantially the same as with the triangular wire. This, he says, makes a very strong tube, but is too bulky for many purposes. Two half-round wires, or even less than half-round, may be used; or the inner wire may be round, and the outer half-round, or much less than half-round. The tubes will then be less bulky.

Mr. Almond has made several tubes in which the contact surfaces of the coils are made to coincide with a circle whose center is the axis of the tube. The joints so formed are practically a series of ball and socket joints; such a tube has smoother outer and inner surfaces than those previously described. It is pointed out that a serious objection to such a tube is that the wire changes its shape during the process of coiling, so that the joint surfaces will not make sufficiently complete contact, whereas the forms of wire previously mentioned are of simple construction, and the slight change of form which occurs during the process of coiling will not affect the result. The extent to which this tubing may be bent without leakage is said to be considerable. A piece of ¼-inch bore is claimed to have been subjected to a steam pressure of 75 pounds without leakage; the smallest curves of the bent portion corresponded in this case to a circle two inches in diameter. Tubes larger than 5/16-inch bore have not yet been made, but it is thought possible to make them as large as 1-inch bore, and strong enough to stand any ordinary steam pressure. For purposes where pressure is not required, the tube may be made of sheet metal, shaped as shown in Fig. 2, which may possibly be made as large as two inches in diameter.

WATER CART STAND-PIPE.

The Hersey Manufacturing Company, of South Boston, Mass., have designed and are about to put on the market the water cart stand-pipe shown in the annexed cut.



The apparatus is intended for use where it is desired to meter the water used in sprinkling streets. It is provided with a meter mounted upon the post, forming an elbow for the extension pipe. The use of a post so constructed avoids the placing of the meter under ground, thereby reducing the cost of metering a stand-pipe. It is accessible for reading, and can be easily removed during that portion of the year when it is liable to freeze, and when water is not used for sprinkling.

The post is made in two pieces, a base, which includes the molded part as shown in the cut, and a taper column, which is leaded into the base. The supply pipe passes through the center of the casting and the meter is coupled to the pipe at the top of the post as shown in the cut.

The soundings made by French engineers on the British side the English Channel, in connection with the proposed Channel Bridge, were recently completed. The results of the survey are reported to be less satisfactory than was hoped, the floor of the Channel between Folkestone and the Varne being somewhat unfavorable to the project. Another route is therefore contemplated, probably between the nearest land points, namely, Cape Grisnez and Dover.

COMPRESSED AIR FOR SANITARY PURPOSES.

In an article bearing on the development of compressed air distribution systems in some of the larger German cities and towns, the *Gesundheits-Ingenieur* explains how water may be raised by compressed air and made available for fire extinguishing purposes. It is shown, further, how this agent can be utilized for emptying cesspools and discharging the contents into tank wagons for removal. The value of compressed air for ventilating is also pointed out.

Questions and Answers.

All questions relating to building construction, paving, sewerage, water supply, or kindred subjects, will be welcomed in this column provided they relate to matters of general interest and are not such as should properly be referred to a consulting engineer. Answers will be carefully prepared and a proof of both question and answer mailed to the inquirer as early as proper consideration will permit. They will be published for the benefit of other readers as soon as convenient. The full name and address should be given, not necessarily for publication, but as a guarantee of good faith, and to facilitate further correspondence in case the question is not sufficiently explicit.

Inquiries of the Editor, in order to secure prompt attention, should *not be written on the same piece of paper as a communication* to the *Publishing Department*. Letters renewing subscriptions are sent to a clerk in the publishing office, and matter for the Editor, if in the same enclosure, is likely to be overlooked unless it is on a separate piece of paper, so that it may be promptly sent to the Editor.

BRIDGE DESIGN AND FACTORS OF SAFETY.

V. S. Hopkins, Williamsville, New York, writes: "Please give me the average load taken in designing common road bridges, sometimes carrying threshing engines. Also give me the loads taken for railroad bridges, and the factors of safety."

[There is no average load assumed for designing common road bridges. Some have been built that fell down under their own weight as soon as completed, and others that would support any load that could be placed upon them.

Most bridge engineers separate ordinary highway bridges into at least three classes, city, suburban and country bridges, which are, in general, respectively designed for heavy, moderate and light loads. One part of the bridge may be suitably adapted for heavier loads than another part, or than the whole structure is. Short spans should be designed for greater loads per lineal foot than long ones. Those in exposed situations must provide for heavy windstrains, which can be greatly reduced in other cases, and in all cases both safety and economy require a consideration of locality, and conditions and adaptation to the usual and possible traffic, which, with the details of construction, should be approved by a competent bridge engineer.

Several comprehensive specifications for highway bridges have been published by Theodore Cooper, J. A. L. Waddell, and other engineers, and they require from 50 to 100 pounds or more per square foot of floor surface, and wind strains up to 300 pounds per lineal foot. Provision is also generally made for concentrated loads of from 4 to 16 tons on one or two pairs of wheels. It is still less possible to state any general requirements for railroad bridges which are subject to infinite variations of traffic, and are built under all conditions of design and construction. The growing tendency now is to proportion certain parts of the structure so as to gain great stiffness and solidity by an increase of mass beyond the requirements for the simple strains.

A single-track railroad bridge should be proportioned to carry two of the heaviest locomotives used on the road, followed by a train of the heaviest loaded cars. Provisions for high speeds, impact, brake action, multiple tracks, etc., require the most careful and expert consideration.

There is no such thing as a factor of safety, and no general rule whatever for the intensity of stress in bridge members. The working stress in a part may be from one-half to one-tenth or one-twentieth of the amount per square inch that is supposed to be necessary to destroy it at the first application. In that case 2, 10 or 20 is said to be the factor of safety; but it is not so in any proper sense, as the strains should be proportioned entirely according to the conditions of working design of the members, materials used, treatment in manufacture, etc., etc.]

The new water-works pumping engines at the Toronto, Ont., high-level pumping station were handed over to the city on October 27. The plant consists of two compound high-duty pumping engines. The George F. Blake Company of Boston supplied the water cylinders, while the steam cylinders, boilers and all other parts of the complete machinery were built by the Polson Iron Works Company of Toronto.

Anent the recently much-talked-of natural gas scarcity in and around Pittsburg, it now appears that many of the statements have been far from the truth. It is stated, on good authority, that the iron and steel plants in the Pittsburg district affected by the recent rise in the price of gas are very few when compared with the total number now using that fuel.

DOMESTIC PLUMBING HEATING LIGHTING & VENTILATION ENGINEERING

STEAM HEATING IN THE BOSTON AND ALBANY RAILROAD STATIONS AT SPRINGFIELD, MASS.

WE show, in the accompanying cuts, foundation plans of the new adjoining stations at Lyman and Liberty Streets, Springfield, Mass., of the Boston and Albany Railroad Company, illustrating the main features of the steam heating system with which they were equipped by Messrs. Norcross Brothers, of Springfield, under the superintendence of Mr. E. M. Harding, now with the United States Heating and Plumbing Company, of Boston, Mass.

The boilers, which are of the Hennessy triple-draft pattern, designed for using oil fuel on the plan of the Aerated Fuel Company of Springfield, are located in a detached boiler house, about 1,000 feet west of the two stations, and carry a pressure of 80 pounds, supplying, as they do, steam for electric light engines also. The boilers, four in number, are all connected with one 10-inch steam drum, from which the supply pipes for heating and power are taken.

The steam for heating is used at reduced pressure—not over five pounds—both direct and indirect radiation being employed, with gravity return. The stacks of indirect radiators are designated by the letters H, the numerals at the right indicating the number of sections. These are of cast iron, with extended surface suspended from the ceiling by heavy wrought iron hangers. Each stack is incased in two thicknesses of wood, consisting, first, of a box of sound flooring lined with tin, the bottom being removable; and, second, of an outer covering of matched and beaded stuff, with a layer of heavy building paper between, put together with screws. The air supply to the stacks for the smoking rooms, restaurants, and women's waiting-rooms, on each side of the middle portions of the buildings, is taken direct from the outside; for the main waiting-rooms in the middle, however, a system of interior circulation has been adopted, the air being taken from the rooms through registers F in the floor at convenient points, passed through the radiator stacks, and discharged again into the rooms. It is thought that a sufficient supply of fresh air to these rooms is maintained by the continual opening and closing of the doors leading to the outside.

The fresh air supply is led through ducts D, along the basement ceiling. Each duct, where connecting with the outside, has a galvanized wire screen, and near the inlet to the stacks H, has a balanced damper arranged to work automatically by the pressure of the steam. The ducts consist of matched and beaded stuff. The dampers have the obvious advantage of stopping the supply of fresh, cold air to the stacks as soon as the steam is cut off, and there is thus no danger of freezing of the radiators. Under each floor register, between it and the coil, is suspended a pan of galvanized iron, as a receptacle for any dirt that may drop through the grating. These pans can be removed for cleaning.

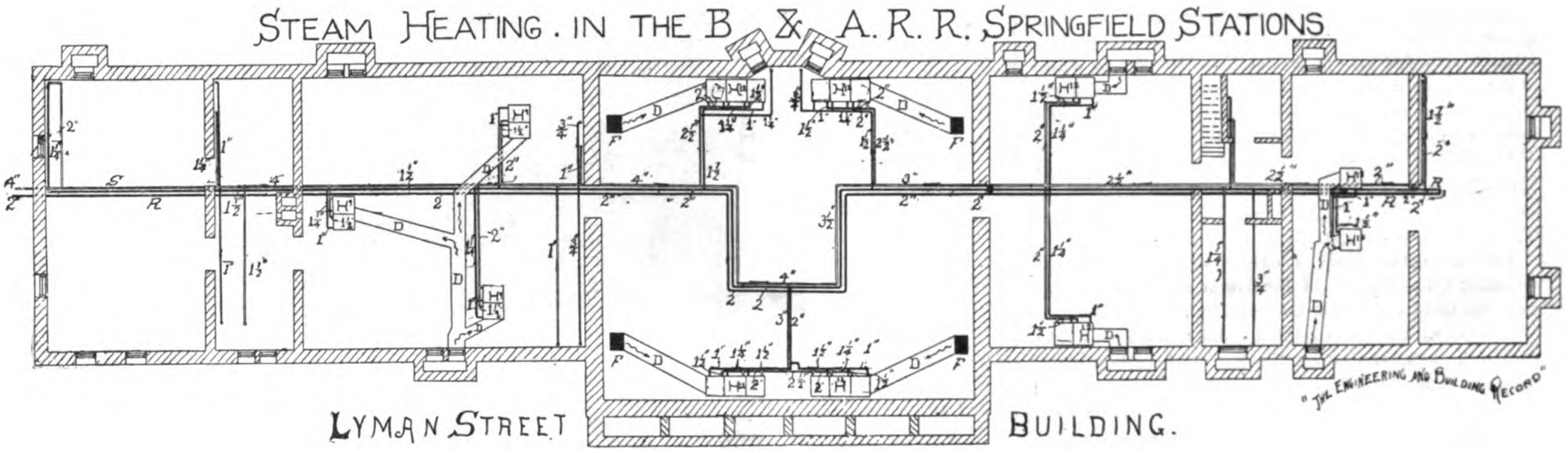
The steam main from the boilers to the buildings is 6 inches in diameter, underground, and has a branch with a reducing valve and by-pass. From it two 4-inch mains are taken to the two buildings.

The piping in both buildings is practically the same. The steam-supply pipes are shown by double lines in the illustrations, and are marked S, while the return pipes R are in full black. The steam mains, starting with a 4-inch diameter, continue along the basement ceilings, reducing gradually in size, as indicated, as branches are taken off for the various coils and radiators, to 2 inches at the far ends of the buildings. The return mains, in both cases, start at the left-hand ends, 1¼ inches in diameter, and also run along the basement ceiling, increasing gradually, as connections are made to them, to 2 inches at the other ends. From these ends the two main returns are brought back, retaining that size, and are joined in one 2½-inch pipe, which is carried to the boiler-room independently on the same line followed by the steam-supply pipe, and is trapped into a tank.

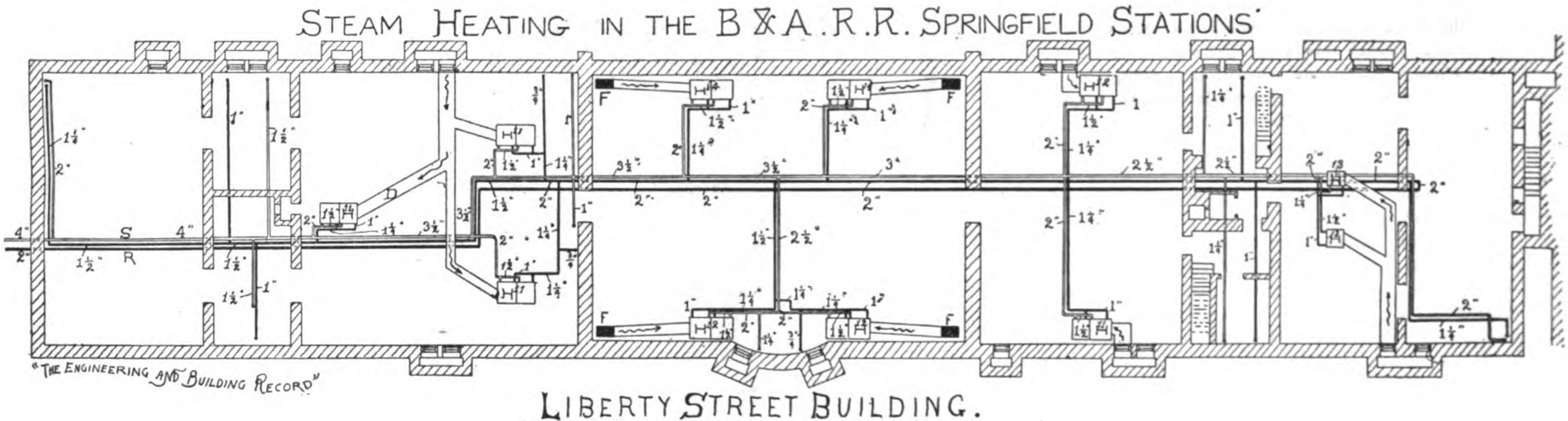
The steam and return mains from the boiler-house are carried in masonry trenches. At intervals of 200 feet along the line of these trenches are manholes of masonry with stone coping and cast-iron covers. Drainage of water from the trenches is secured by means of earthenware tile pipe in the bottom, with proper outlet connections.

Expansion joints are provided in the pipes at every 200 feet. Expansion of the mains in the buildings is allowed for by offsets, as shown. All the underground pipes are covered with asbestos cement, and all steam and return pipes in the buildings, above ¾-inch in diameter, are also provided with non-conducting covering.

The direct radiation consists of 1-inch wrought-iron pipe wall coils, and of Bundy loops.


STEAM HEATING. IN THE B & A. R. R. SPRINGFIELD STATIONS

LYMAN STREET BUILDING.


STEAM HEATING IN THE B & A. R. R. SPRINGFIELD STATIONS

LIBERTY STREET BUILDING.

ELECTRIC MOTORS.

(Continued from page 365.)

THE JENNEY MOTOR.

THE Jenney constant-potential motor, made by the Jenney Electric Motor Company, 218–224 South Illinois Street, Indianapolis, Ind., is shown in Fig. 25, page 382.

The motor differs considerably from those in general use. The pole pieces, it is claimed, are made to correspond with the natural curvature of the lines of force, thereby reducing to a minimum the length of the magnetic circuit and its resistance.

There is but a single field magnet, and in all sizes the core is made of soft wrought iron. No yokes are needed. The pole pieces are made of soft cast iron. The cores extend entirely through the pole pieces, which are bored to fit them accurately. The pole pieces are then slotted, and by means of bolts are firmly clamped to the core. By this means, it is claimed, the largest possible surface contact is secured, and a good magnetic union with a small amount of magnetic resistance.

The armature is of the drum type, and is built up of thin disks, all of which are securely fastened to the shaft. The winding is a modification of the Siemens method, and the armature is so proportioned that it has but little idle wire over the ends. The commutator is insulated with mica.

Self-oiling boxes are used on the machines. All motors above one horse-power are supplied with a double set of brushes, so that the brushes may be turned or changed without stopping the motor. All parts are made after fixed standards, and are interchangeable.

For convenience in starting and stopping the motor a rheostat is furnished to be included in the armature circuit. The switch should be placed so that when the motor is started all of the resistance is thrown in. This prevents an excessive flow of current into the armature, and allows the motor to start gradually. The motors are made from one-half horse-power up to 36 horse-power.

The company is now also preparing an arc motor for smaller capacities.

THE THOMSON-HOUSTON MOTOR.

THE motor made by the Thomson-Houston Motor Company, 620 Atlantic Avenue, Boston, Mass., is shown in Fig. 26.

All the motors are of one type, extremely simple in construction, and all parts are interchangeable. They are ordinarily shunt wound and are built for constant potential circuits of 110, 220 and 500 volts. The first two are intended for use in connection with the ordinary two and three wire systems of incandescent lighting, and the last one is for use on railway circuits, or for special purposes where power is transmitted over long distances or in units so large that a lower voltage would prove uneconomical. Special motors differing in type from the one here shown, or for other voltages, are built for special cases. By a simple shunt winding, properly proportioned, automatic regulation of speed of less than 2 per cent. variation is claimed to be obtained on all of the Thomson-Houston motors, no matter what the fluctuations of load may be. This feature permits simple construction of the motor, and at the same time secures an automatic regulation of speed well within the range of that which is guaranteed for the best regulated high speed steam engines.

The base frame is made of cast iron, and in all the machines is very heavy in proportion to the total weight. Up to, and including, Class 40, the yoke which joins the field magnets is an integral part of the bed-piece, the whole being made in one casting, and the seat for the field magnets afterwards planed down so as to secure a perfect fit between these and the bed-piece. Above Class 40 the yoke of the magnet does not form a part of the base frame, and in these machines the casting for the base is made with a cavity of sufficient size to receive the separate yoke-piece. The surfaces upon which the pillow blocks rest are planed down to a true face. The base frame is provided with projecting lugs, so that by means of lag screws the motor may be fastened to its foundation. Each motor is provided, whenever desired, with a supplementary base for tightening and loosening the belt.

The pillow blocks are made of cast iron and rest upon planed surfaces on the ends of the base frame, and are each fastened to it by four bolts, two of them being tapered and two straight.

The bearings are made of brass in all motors up to and including Class 30, and in the larger sizes are made of cast iron faced with babbitt, the cast iron being in the form of a sleeve with a spherical hub which has a seat, also spherical, made for it upon the top of the pillow block. Near the ends of the sleeve and on its upper side are cut two grooves entirely through the shell at right angles to the line of the shaft, and in these grooves upon the shaft rest two metal rings, which, at their lower side, pass beneath the sleeve and dip into small reservoirs of oil situated one upon each side of the spherical seat of the bearing. These reservoirs are made in the casting upon the top of the pillow block. As the shaft turns, the rings are set in motion and continually carry fresh oil from the tank to the upper surface of the shaft. The spherical hub of the sleeve resting in a hollow spherical seat provides for the maintenance of an accurate alignment of the bearings with the shaft.

The magnetic circuit is of the single horse-shoe form, with the arms of the magnet projecting upward. It consists of a yoke, two magnet cores, two pole pieces, and the armature core. The yoke is, in all machines up to and including Class 40, a part of the base, and is, therefore, made of cast iron. In larger sizes it is detachable from the base and is made of wrought iron. The cores and pole pieces are cast iron in all machines up to and including Class 30, and in these machines one core and its pole piece are cast in a single piece. Above Class 30 the cores are separate and are of wrought iron, the poles in all cases being made of cast iron.

The field coils are in all cases wound on spools or cylindrical shells of galvanized iron with brass heads. Double cotton covered copper wire is used, the bottom layers being thoroughly insulated from the core.

The armature of the Thomson-Houston motor may conveniently be described as made up of four parts—the shaft, the core, the commutator, and the winding. The shaft is made of steel, and in the smaller sizes of motors is of uniform diameter throughout, but in the larger motors has its largest diameter along its central part. Two rings are shrunk upon the shaft near the brass journals to prevent the end play of the armature damaging the commutator. The armature core, which is of the drum type, is made of thin circular plates of charcoal iron, insulated from each other by thin sheets of paper. These plates have a hole in the center through which the shaft of the armature passes, and three other holes through which bolts for clamping the plates together are passed.

The commutator is built with the utmost care as to its solidity, its thorough insulation and its durability. To secure solidity the bars are beveled at both ends and tightly clamped between suitable iron heads from which they are insulated by mica rings. The commutator bars are insulated from each other and from the iron core of the commutator by the same material. A modified Siemens winding is employed for the armature. Cotton-covered wire is used, and is insulated from the core with mica.

The motors are made in capacities ranging from 1 to 75 horse-power.

(TO BE CONTINUED.)

CITY ENGINEER JACKSON, of Boston, Mass., has prepared a plan for the abolition of all the grade crossings on the Providence Railroad in the city. It is the third plan that has been prepared for this purpose.

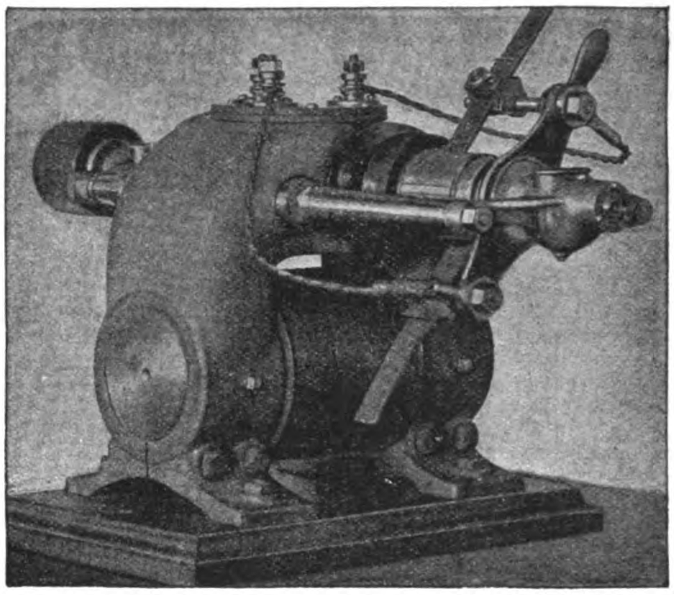


FIG. 25.—THE JENNEY MOTOR.

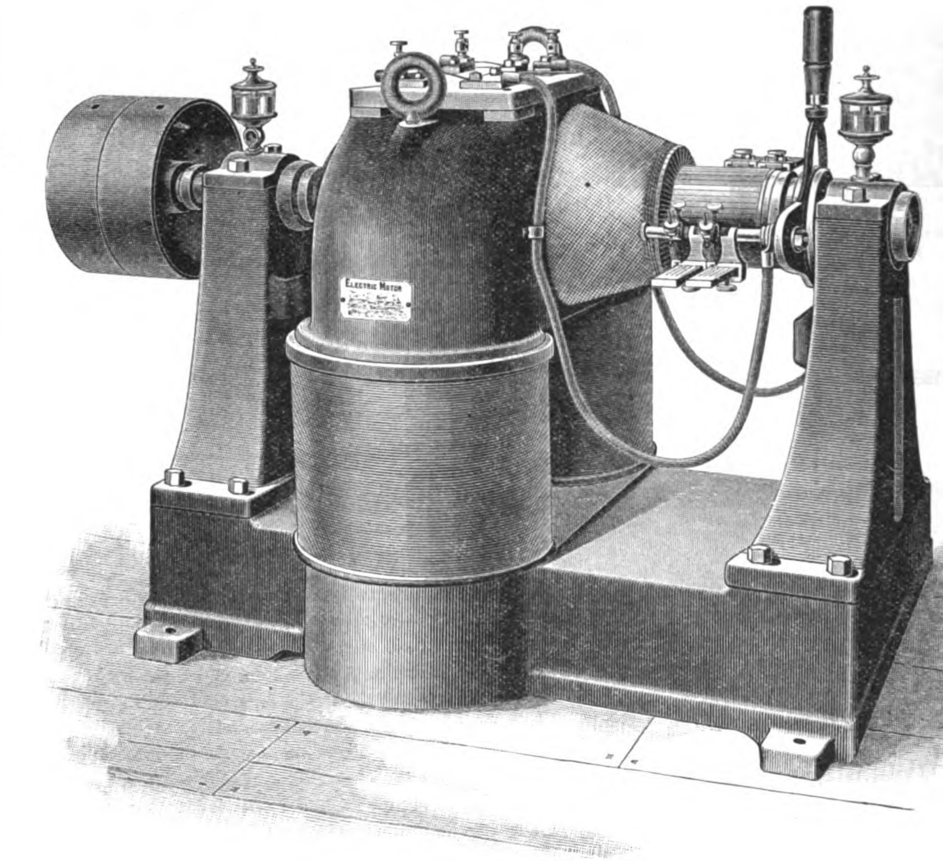


FIG. 26.—THE THOMSON-HOUSTON MOTOR.

FEEDING BOILERS WHEN SHORT OF WATER.

THE Manchester (England) Steam Users' Association has issued a report on a series of experiments made with a view of ascertaining the result of injecting feed-water into a boiler when the boiler is short of water, and the furnace is red-hot. It has for long been a common belief among engineers, that many boiler explosions are due to this cause; and to the same cause have been attributed accidents to domestic circulating boilers which have been allowed to run dry, and have then had cold feed-water admitted. The correctness of this belief has, however, for some time been doubted, and the elaborate series of experiments recorded in this report go to prove that it is altogether erroneous. As described in the *Journal of the Society of Arts*, London, a Lancashire boiler 27 feet long was fitted up for the purpose of the experiments, so that the condition which it was desired to investigate could be reproduced, while observations could be taken of what was going on within the boiler. These experiments were by no means free from danger, and an observatory had to be constructed near the boiler. As a result, it was found that the sudden injection of the cold feed did not cause a rapid generation of steam and a sudden violent pressure which the boiler in its weakened condition could not stand. In some cases, indeed, the pressure was slightly raised; but it always fell immediately afterwards, and in other cases the cold feed at once lowered the pressure. The writers of the report even think that it might be advantageous in cases where the water has been allowed to get very low, and the furnace-crowns to become heated, to turn on the feed, though they hesitate, in the present state of knowledge on the subject, to recommend such a proceeding.

THE work of replacing the car stove by a steam-heating system has been almost completed in the State of New York, where the car stove has been put under a legislative ban. In New England all the railways are rapidly abandoning the old system, and in Canada considerable progress in the same direction has been made. In the West and in the Middle States, however, but little has been done in this field during the past year.

THE MAINTENANCE AND OPERATION OF WATER-WORKS BY PRIVATE COMPANIES.

(Concluded from page 367.)

16. **Order Book.** Record No. 918.

Every order given for any kind of material or supplies must be made out on the Order Book, and a duplicate made on the stub before the order is torn off and sent.

When the material is received, it should be carefully examined and checked up by the bill, and, if found to be satisfactory enough to be kept and used, check the same on the stub of the Order Book, and enter the date it was received.

17. **Bills, Fixture Rates.** 12 inches long, 4¾ inches wide. Color, white. Record No. 915.

In filling out these bills, give the name of the owner and the location of the premises. If, by agreement, a tenant or agent is to pay the bill, then, after giving name of owner, say "in care of," and then give name of party who is to pay the bill, but unless there is special arrangement to the contrary all bills must be made out against the owner.

On the first line, in the right-hand column, enter the gross amount at the quarterly fixture rate, and then, on the lines below, give the details of the same, naming each fixture or use charged for, and the amount of the charge.

If the amount of the bill, or any special reason, entitles the party to a discount, give the amount of the same and then the "amount due."

When the bill is paid, fill in the date, both on the bill and on the stub, and sign the bill, all in the places provided.

18. **Bills, Meter Rates.** 12 inches long, 4¾ inches wide. Color, primrose. Record No. 916.

In filling out these bills, observe the same rules as in filling out bills for fixture rates, as far as names and location are concerned.

On the first line in the right-hand column give the minimum quarterly meter rate, charged in advance.

Then fill out the blanks, and carry out the amount to be charged for, which is the excess used above the amount charged for in the minimum rate.

If the meter read in "cubic feet," give the readings, but only transpose the "total amount used" into gallons.

Fill out the other lines as indicated, and, when the bill is paid, date and sign it.

There is no "discount" on "meter rents," but only on the charge for water. Consequently, the "discount" line is above that for "meter rent."

19. **Bills, Miscellaneous.** 12 inches long, 4¾ inches wide. Color, opaline. Record No. 917.

These bills are to be used for all service pipe work, including repairs on such work. The usual items that will be most often charged for are printed out in the bill, and blank spaces left for other charges.

In making out, receipting, and filling these bills follow the same general instructions as are given for fixture and meter bills.

20. **Gate Book.** 4 inches by 7 inches. 180 pages, numbered. Horizontal ruling 3 to the inch, with double red heading. Record No. 921.

Gates are any kind or size of gate or valve that is used on the pipes of the company, except corporation cocks, service and sidewalk stops, and air and pet cocks.

This book must be arranged by streets, alphabetically, leaving space enough between streets for future additions, extensions, or new streets.

In the front of the book, arrange an alphabetical index, giving the page on which each street commences.

Head the pages with the name of the street, and then, commencing at one end, enter in their proper order the location of every gate necessary to control that street, including main gates, gates to side streets, and blow-offs. This will cause most gates to be recorded twice, but will be found invaluable in attempting to "shut off" or "let on" a street.

In making entries, give first the size of the gate, then the maker's name, then the direction to turn to open, then the general location, and then the exact location by description and measurements. Add any remarks or details considered of value.

[EXAMPLE.]
Main Street.
16 inch. Chapman. Opens to the left.
South side of State Street.
Twenty-eight feet east of building line on Main Street.
On building line south side of State Street.

21. **Hydrant Book.** 4x7 inches. 180 pages. Horizontal ruling, three lines to the inch, with double red head lines. Pages numbered. Record No. 922.

Give each hydrant a number, arranging them in the most natural and consecutive order possible.

Enter the numbers in proper successive order, and give the necessary description and location of the same. As a large majority of all hydrants, if not all, on any one works, will be of the same size, make, and pattern, it will not be necessary to describe each separately, but give a description of such in the front of the book, and then enter all such as "standard," or other designating word. But, if any vary from this "standard," describe them in detail opposite their proper number.

If any hydrant is paid for by private parties, mark it "private." All others will be considered as being public—*i. e.*, erected by order of the municipality.

22. **Street Plan Book.** 22x30 inches. (Whatman's Imperial.) Record No. 923.

This should be a "book plan," made on a scale of 50 feet to an inch, which is sufficiently large to show all main pipes, gates, hydrants, specials, etc., and give the necessary dimensions and location measurements of the same.

The first sheet should contain an outline map of the city, town, or village in which the works are situated. This map should be divided into as many rectangular sections—each section numbered—as there are detail sheets in the book. This map will be on such scale as the size of the place will admit.

Each following sheet should contain that portion of the place which is indicated by its corresponding rectangle on the map, together with such extensions, etc., as may be useful in connecting one sheet with another. Each sheet should show streets, alleys, parks, etc., and such principal or public buildings as may be deemed best. If desired, all buildings of a reasonably permanent nature may be shown, always excepting sheds, small barns, etc.

On the streets, alleys, etc., should be shown, in their proper location, all mains, specials, gates, hydrants, blow-offs, air-valves, etc., with sizes and location measurements given.

All pipes, specials, gates, hydrants, etc., to be shown in full red lines, and all sizes indicated in red ink, while location measurements should be given in black.

Fill in the pipe system, and give all the details of the same before lettering the streets, etc., so that there may be no confusion between the two. The plans are made to show the pipe system, and this should take precedence over all else on the map.

If there is room, without crowding, and the information is at hand, it will be found convenient to put on the maps all street-car lines, sewers, gas-pipes, etc. When done, the sheets should be carefully bound and lettered. The "Boston office" will attend to this at any time.

23. **Maps.**

There should be a large bound map, made on cloth backed egg-shell paper, and mounted on a roll, showing all the streets, alleys, parks, public and principal buildings in the place, on which should be shown the pipe system and location of the works of the company. Whenever possible, make this on a scale of 200 feet to an inch.

Show the pipe system in red, using figures to indicate pipe sizes. Draw the line, representing the pipe, full across all street intersections or other places where there are specials, gates, hydrants, etc., so as to show the same clearly, but once on each block leave a short gap, or space, in the line in which to place the figures representing the size of the pipe.

There will be very few places where the pipe changes size, except at street corners and intersections; but, if it should, then the point will be indicated by the introduction of the reducing special, and the sizes of the pipe be given on each side of it.

It will not be necessary to give distances or other measurements on the map, as the book plan should furnish all details of that kind.

A smaller map, on a scale of 500 feet to an inch, should also be made for use on the work. The original should be kept in the office, corrected from time to time, and tracings made from it for pocket use. It should show streets, etc., and the entire pipe system, the same as the larger maps.

There should also be full and complete plans of all buildings, dams, reservoirs, foundations, machinery, etc., carefully drawn and preserved.

These should be of different scales, but on uniformed sized sheets, 30 inches long by 22 inches wide. Whatman's Imperial will be found best for this, and the sheets can be bound into the "book plan," if the latter is not too large. If it is they can then be bound separately.

24. **Vouchers or Bill Covers.** Color, lilac. Record No. 905.

All bills should be placed in one of these covers; and the same numbered consecutively, as they are entered in the Invoice Book.

The name and address of party rendering the bill, with its date and amount, all properly entered on the back.

When it is approved, the party or parties approving should indorse it, and indicate the different accounts to which it is to be charged, with the amount of each division.

25. **Trial Balance Sheets.** 13¼ inches long, 8 inches wide. Printed on distinctive tinted papers for different companies. Record Nos. 940 to 945, etc.

Fill out in the respective columns the "ledger page," "debit," or "credit balance," opposite the names of the different accounts which each company keeps.

The accounts are so arranged that those which will usually have a "debit balance" come together, and those which usually have a "credit balance" come together.

BOOK NOTICES.

Domestic Sanitary Drainage and Plumbing. By William R. Maguire. London: Kegan Paul, Trench, Trubner & Co., 1890.

This handsomely printed volume of 437 pages, contains a series of lectures given to plumbers and others at the Technical Institution in South Kensington, London, under the auspices of the City and Guilds of London Institute for the Advancement of Technical Education, and of the Worshipful Company of Plumbers, London. The author is a registered master plumber of 30 years' experience, and an associate of the Institution of Civil Engineers of Ireland.

The subjects treated of are the education of plumbers, elementary science for plumbers, sewage disposal, sewerage and drainage, sanitary plumbing, sanitary appliances, water supply, hot-water supply, plumbers' materials and plumbers' tools, and the work is illustrated with 283 wood cuts.

Taken as a whole, it affords an excellent view of the best methods of work in sanitary plumbing as now ordinarily practiced in England, and describes and illustrates the various fixtures, traps and tools in ordinary use. The author does not believe in the possibility of teaching young plumbers their handicraft from books, holding that "the only way to acquire the skill necessary for a journeyman is the way of the bench in the workshop, under the guidance of an experienced craftsman," but he also rightly holds that plumbers' apprentices must learn much more than can be acquired at the bench and on the job, before they can hope to become first-class journeymen.

Masters and foremen have not time to teach, and journeymen cannot be expected to teach possible competitors.

The chapter headed "Elementary Science for Plumbers" is an excellent one. The chapters on sanitary plumbing and sanitary appliances are full and well illustrated. No particular patents are advocated, and it does not appear that the author's own devices are patented. The direction that soil pipes should always be fixed outside the outer wall of a house, would not answer in this climate.

We commend the work to all practical plumbers, and especially to those who are learning the trade.

The Marquis of Tweeddale, speaking at the North British meeting, said the Forth Bridge is already earning almost enough to pay the full dividend on its cost, and that no fear need be entertained that the North British or any of the guaranteeing companies will be called upon to make up any deficiency under the guarantee. As an instance of the development of traffic since the opening of the bridge, he mentioned that the traffic between Edinburgh and Dumfermline and Kirkcaldy had increased 88 per cent.

CONTRACTING NEWS DEPARTMENT.

A WEEKLY RECORD

OF SPECIAL INTEREST TO CONTRACTORS, BUILDERS AND MANUFACTURERS OF ENGINEERING AND BUILDING SUPPLIES.

THE ENGINEERING AND BUILDING RECORD,
277 Pearl Street, New York.
November 15, 1890.

CONTRACTING INTELLIGENCE.

Persons who make any use of the information they find in these columns we trust will not omit to mention THE ENGINEERING & BUILDING RECORD as the source

For works for which proposals are requested see also the "Proposal Columns," pages i-ii-385.

WATER.

For Additional Water Items see Proposal Columns.

ZANESVILLE, O.—John W. Hill, Consulting Engineer, Cincinnati, O., informs us that project for water-works improvement at this place was defeated last week at general election. It is expected that the question will be revived, with better results, during the winter.

STOCKTON, CAL.—The Blue Lakes Water Company will run its pipe line to this place to furnish water and power. Seventy five miles of pipe and a large reservoir will be required to perfect the project.

WHITESTONE, L. I.—The question of establishing a system of water-works at this place is to be decided by the taxpayers at a special election to be held November 20. The estimated cost of the plant desired is $35.000. For further particulars address C. B. Williams, Secretary of the Board of Water Commissioners, as above.

FOREST GROVE, ORE.—The Gales Peak Water Company, recently incorporated at this place, will expend the sum of $100,000 on a system of water-works. The towns of Cornelius and Hillsboro will also be supplied. For particulars address C. M. Keep, as above.

SAGINAW, MICH.—Several thousand feet of water main extensions are to be made in this city. For particulars address Mayor Weadock; as above.

ARKADELPHIA, ARK.—G. W. Carder, of this place, is advertising for bids for the construction of a system of water-works. For particulars see our Proposal Columns.

CRANFORD, N. J.—A system of water-works is to be established at this place by a newly organized company,

GRIFFIN, GA.—It is proposed to expend the sum of $75.000 on the projected system of water-works and electric lights at this place. For particulars address W. A. Robinson, as above.

WESTCHESTER, N. Y.—The New York and Westchester Water Company has been incorporated with a capital stock of $500.000. The company's sources of supply are intended to be from springs, streams, wells, and artesian wells, or other available sources of supply. The incorporators are John F. Hume, of Poughkeepsie, and others.

QUINCY, ILL.—The movement to establish a system of water-works at this place is rapidly maturing, and it is expected that important steps towards that end will soon be taken. An engineer is now making estimates regarding the probable cost of the undertaking, and a special meeting of the City Council will be held shortly to take decisive action.

KEITHSBURG, ILL.—J. L. Noble writes from here as follows· "The contract for water-works was not let; there will be nothing done before next March."

MADELIA, MINN.—C. C. Cooley, Recorder, writes: "In the spring we will put in water-works; $9.000 voted. High tank and water mains. Plans and specifications will be on file about 30 days."

CANTON, S. D.—A. A. Richardson, Consulting Engineer, of Lincoln, Neb., has finished plans for a system of water-works for this place, and bids are now wanted, to be opened December 1. For further particulars see our Proposal Columns.

COAL CREEK, COL.—City Clerk John Graham writes: "We are inviting bids for laying one mile of water mains, 3-inch iron pipe, with 10 hydrants, at stated points along the line; also, one circle reservoir, 50 feet in diameter, to be cemented, and all work guaranteed."

ST. PAUL, MINN.—The Red Rock Camp-meeting Association has awarded contract for artesian well to J. E. Cary, of West St. Paul.

LISBON FALLS, ME.—The taxpayers of this place propose to establish a system of water-works at once. For further particulars, address Hon. W. H. Newell, as above.

ROCHESTER, N. Y.—Several additional water mains are to be laid here. For particulars, address City Clerk Sheridan.

MISHAWAKA, IND.—City Clerk R. D. O. Smith writes: "Water-works to be established here by a local company in connection with town authorities. The system to become the property of the town upon repayment of investment. Pumps will be two compound condensing; capacity, 3,000,000 gallons. Town also owns water power, which may be utilized later. Water will be taken from 30-foot well. If weather permits pipes will be put in the ground this fall and water will be ready to run by March next."

ROCKFORD, IOWA.—Mayor C. Yorker writes, "Our water-works project has advanced so far as to insure you in publishing that we are ready to receive bids for the construction of the plant."

SORRENTO, ME.—Plans, etc., embracing five different schemes of piping, for a system of water works for this place have been submitted by the engineer, M. M. Tidd, of Boston, Mass., to the Frenchman's Bay Land and Water Company. Water will be taken from Long Pond, five miles distant.

FORT SMITH, ARK.—M. M. Tidd, C. E., of Boston, Mass., is preparing plans for additions, etc., to the water-works system of this place. Improvements are contemplated in the reservoir capacity, pumping machinery, etc.

WESTBORO, MASS.—Plans for a system of water-works for the Lyman school for boys are being prepared by the engineer, M. M. Tidd, of Boston, Mass. Water will be taken from Chauncey Pond and pumped into a stand-pipe to be located on the summit of the hill in the rear of the present school buildings.

YORKSHIRE CENTER, N. Y.—Town Clerk D. S. Churchill writes: "There has been some parties here from Stamford, N. Y., looking up the matter of water-works. I think there is a fair prospect of our getting some works in here either by parties who reside here or from outside parties."

JASPER, TENN.—County Clerk J. S. Drokehs writes: "There has been no definite steps taken for any water-works in our town. At Sequachee, Tenn., they contemplate erecting water-works soon. E. E. Smart, Sequachee, Tenn., is the general manager of the company."

PHILADELPHIA, PA.—The following bids for the construction of a reservoir were received by Louis Wagner, November 7: Filbert & Porter, Philadelphia, Pa., $665,945; John B. Riley, Langhorne, Pa., $500,000.

CINCINNATI, O.—The new B. C. A. will probably advertise for pumping machinery for the water-works very soon; 60,000,000 gallons capacity per day will be added to the present capacity.

KNOXVILLE, TENN.—The Board of Aldermen of West Knoxville, at a meeting held November 11, decided to suspend action in the water-works improvement matter, for a period of 30 days, during which time each of the parties now proposing to furnish water to the corporation will be allowed to lay before the Aldermen such testimony, etc., as they deem proper in favor of their individual plans. Alderman Smith can furnish particulars.

READERS of **THE ENGINEERING AND BUILDING RECORD** interested in the Contracting News Department of that paper are respectfully requested to examine those columns every week, and advise the Editor of any item which they may find that, in their judgment, is of no value to any one other than the person mentioned.

ATLANTA, GA.—The award of the contract to the Howard-Harrison Iron Company, of Bessemer, Ala., voted on November 4, has been postponed, pending an opinion regarding the legality of the bonds recently voted for the projected water-works improvement.

WATERBURY, CONN.—The question of increasing the water supply of this place is still under discussion by the local officials, though no definite plan of action appears to have been agreed upon. The City Clerk can furnish particulars.

ROCKAWAY, L. I.—The Queens County Water Company, whose stand-pipe is now 100 feet high, proposes adding 50 feet to its height in order to secure a greater volume of water, and give additional force in distributing it through the mains.

WATER WORKS.—See our proposal columns for information regarding water-works and water-works furnishings at the following places: Harrison, O.; Ballinger, Tex.; Canton, S. D.; Arkadelphia, Ark.; Toronto, Ont.

SEWERAGE.

For Additional Sewerage Items see Proposal Columns

CORDELE, GA.—Mayor G. M. McMillan writes: "An election for or against issuing bonds for sewerage system will be held November 27."

ROCHESTER, N. Y.—Numerous important sewer extensions are to be made in this city. Address City Clerk Sheridan for details.

SALEM, MASS.—It is proposed to expend the sum of $4.400 for establishing sewers in the Fourth Ward of this city. The City Clerk can furnish particulars.

BRISTOL, CONN.—The officials at this place are agitating the question of an improved system of sewers. The scheme proposed, approved by the State Board of Health, is to carry the sewerage through an 18 inch pipe to a tract of 10 acres, a mile and a half from the town, where it can be disposed of by filtration, the land having a depth of about 10 feet of fine gravel.

MANCHESTER, VA.—The question of establishing a system of sewers is being discussed by the officials of this place. Address the Town Clerk for details.

PITTSBURG, PA.—It is proposed to improve the sewerage system of the south side of the city. For particulars address Dr. G. B. Sweeney, as above.

ATLANTA, GA.—The project to extend the sewerage system of this city, at an estimated cost of $95,000, has been postponed indefinately.

SEWERS.—See our Proposal Columns for information regarding sewer construction at the following places: Poughkeepsie, N. Y.; Victoria, B. C.; Suspension Bridge, N. Y., Rockford, Ill ; Denver, Col.

BRIDGES AND IRON STRUCTURES.

For Additional Bridge Items see Proposals Columns.

ALEXANDRIA, LA.—It is probable that immediate steps will be taken towards the construction of the projected bridge over the Red River, at this place.

SIOUX CITY, IA.—City Engineer Wingeland has submitted his report regarding the viaduct to be erected over the railroad tracks, at lower Fourth Street. The cost is estimated at $80.000, and the matter is to be further considered at a later meeting.

GREENVILLE, MASS.—Reports say that a bridge is to be erected over Little Trail Lake, at this place.

VICTORIA, B. C.—The City Council has authorized that necessary repairs be made to the Rock Bay drawbridge. For particulars, address Mayor Grant, as above.

SCRANTON, PA.—The City Engineer has been directed to prepare plans, specifications, and an estimate of cost for an iron bridge across Beach Creek.

UTICA, N. Y.—Superintendent Hannan has inspected the Genessee Street Bridge, and states that it will have to be removed and a new structure take its place. He has therefore authorized the making of plans, etc., for the proposed new bridge, which are to be submitted to him, after which the work of construction will be undertaken.

SPOKANE FALLS, WASH.—The following proposals for the construction of the Monroe Street bridge were opened November 5 by the City Council: Wrought Iron Bridge Company, of Canton, O., $113,300; San Francisco Bridge Company, $118,500; Smith Bridge Company, of Toledo, O., $124.450; Hoffman & Bates, Portland, Ore., $125.000; King Iron Bridge and Manufacturing Company, Cleveland, $125,800; Pacific Bridge Company, Portland, Ore., $121,000; Chicago Bridge and Iron Company, $114,000; Milwaukee Bridge and Iron Works, $114.867; The latter company presented a design of their own, which they offered to build for $111,000. All the bids were referred to the City Engineer, with instructions to examine and report as soon as possible to the Council. The contract for furnishing the stone to be used in the bridge was awarded to Andrew Conburg, at $124 per cubic foot for cut stone.

PHILADELPHIA, PA.—A sub-committee of the Councils' Survey Committee, on November 10, conferred with Chief Engineer Nichols, of the Philadelphia and Reading Railroad Company; Chief Engineer Brown, of the Pennsylvania Railroad, and other railroad officials, with reference to several ordinances introduced in Councils and approved by the Board of Surveyors for bridges at various places. One of the ordinances provides for the construction of a bridge over the Chestnut Hill branch of the Reading Road at Graver's Lane. In reference to an ordinance for a bridge on the line of the Connecting Railroad at Seventeenth Street, which is said to be necessary to carry out the plan of grades lately revised by the Bureau of Surveys, Engineer Brown said that such a structure would cost about $61,000, and he did not think the company would erect a bridge, as the railroad was constructed before the street was placed on the city plan. The company, he said, was ready to bridge Margaretta. Bridge and several other streets on the New York Division, to avoid grade crossings, and was only waiting for the city to act in the matter. In regard to an ordinance for a bridge over the Reading Road on the line of Seventeenth Street, Engineer Nichols said the cost would be about $55,000, and that he would lay the subject before the officers of the company. Several ordinances for bridges over Collom and other streets, in the Twenty-second Ward, were also discussed, but no action was taken.

MACON, GA.—At a meeting of the Bibb County Commissioners it was ordered that a bridge be erected over the Vineville branch, at the foot of Jefferson Street, this city. Judge Miller can furnish particulars.

AUBURN, ME.—It has been suggested by several taxpayers of this place that a bridge is necessary over the Androscoggin, at Boxer's Island. The City Clerk can probably furnish particulars.

AUGUSTA, GA.—The Charlotte, Columbia and Augusta Railroad Co.'s wooden bridge over the Savannah River, at this place, is to be replaced by an iron structure. For particulars address E. W. Scott, Bridge Foreman, Richmond and Danville Railroad, as above

TORONTO, CAN.—The City Engineer has completed the plans for the proposed high level bridge over the Don at King Street, and it is probable that proposals will soon be wanted.

TOPEKA, KAN.—Our correspondent writes: "The proposition submitted at the November election to build a bridge across the Kansas River, in this city, on Quincy Street, to cost $100,000, was carried by about 3,000 majority."

MONTREAL, CAN.—An appropriation is to be made for having surveys, etc., prepared for a new bridge in this city, the particulars of which can be procured by addressing Alderman Prefontaine, as above.

COLUMBUS, O.—The plans for a viaduct at the High Street crossing, presented to the Board of Public Works November 9, by the various railroads, have all been rejected.

BRIDGES.—See our Proposal Columns for information regarding bridge construction at the following places: Sheboygan, Wis.; Hamilton County, O.

NEW DEPOTS.

Orwigsburg, Pa.—The Valley Railroad is about to erect additional buildings at this place.

Ashville, Ala.—The Ashville Railroad Company is about to erect a new depot at this place.

GAS AND ELECTRICITY.

Indianapolis, Ind.—The question of public lighting for this city still remains unsettled. The Mayor can furnish particulars.

Utica, N. Y.—The Common Council has contracted with the Utica Electric Light Company to light the public streets, etc., for a term of three years, at the rate of 35 cents per light per night for 400 lights.

Ashbourne, Pa.—An electric lighting plant is to be established at this place.

East Liverpool, O.—A system of electric lights is to be established at this place in the near future. For particulars, address Mr. McKeehan, as above.

Elgin, Ill.—Another electric light company has been organized at this place and a franchise is to be asked for. Address Alderman Joslyn for details.

Louisville, Ky.—Mayor Jacob has awarded the contract for lighting the streets, etc., of this city, to the Louisville Gas Company, at $66 per light per annum, for 150 electric lights.

Charleston, S. C.—The Charleston Electric Light and Power Company has decided to make extensive improvements to its plant, including the addition of considerable machinery.

Stamford, Conn.—Extensive alterations are to be made to the electric lighting plant at this place. The Borough Clerk can furnish particulars.

Electric Railways.—New electric railways are projected, and improvements are to be made to those already established, at the following places: Bridgeport, Conn.; New Bedford, Mass.; Schenectady, N. Y.; Ottawa, Ont.; Saratoga, N. Y.; Methuen, Mass.; Jamestown, N. Y.; Spokane Falls, Wash.

STREET-WORK AND PAVING.

Meriden, Conn.—The Street Committee of the City Council has authorized the improvement of several streets of this place.

Philadelphia, Pa.—The improvement of numerous business streets in this city is contemplated. Address the City Engineer for particulars.

Trenton, N. J.—There is a project being discussed here regarding the paving of several streets, the details of which can be had by addressing the City Clerk.

Grand Rapids, Mich.—The City Council has authorized the improvement of several streets of this place.

Toronto, Ont.—Considerable street paving is about to be commenced in this city. For particulars address Robert Jaffray, as above.

INDUSTRIAL.

Plainfield, N. J.—The Plainfield Common Council has adopted a resolution which calls for bids for the establishment of an electric railroad system. These propositions must be entered before November 24, when decisive action for rapid transit will undoubtedly be taken.

Delano, Cal.—The Kern and Tulare irrigation district, embracing 20,000 acres in the northern part of Kern and the southern part of Tulare County, voted, November 1, for the issuance of bonds in the amount of $700,000 for the construction of a canal from Kern River and laterals.

The Detroit Heating and Lighting Company has the contract for heating by hot water St. Anthony's Hospital of the Sisters of the Poor, at Columbus, O. The new extra large Bolton heaters will be used, and there will be about 15,000 feet of radiation.

BIDS OPENED.

Brooklyn, N. Y.—The following proposals for heating and ventilating in public schools Numbers 27, 31 and 36 were opened by the Board of Education November 11: In public school No. 27—The H. B. Smith Co., $2,785; William Blake & Co., $2,065; E. Rutzler & Co., $2,255; Philip Doup & Co., $2,173. In public school No. 31—E. Rutzler & Co., $7,596, Blake & Williams, $6,593; Philip Doup & Co., $7,331. In public school No. 36—E. Rutzler & Co., $6,392; Blake & Williams, $5,690; Philip Doup & Co., $6,354. The bids were referred to the Committee on Heating and Ventilating.

San Francisco, Cal.—The following proposals for the erection of the girls' new high school in this city, have been opened. For the building itself: John Butler, $86,770; J. H. McKay, $89,000; Thomas H. Day, $82,760; Shain & Hoffman, $92,300; J. P. McCormick, $74,521; J. W. Smith, $77,245; Riley & Doane, $88,490; McGowan & Butler, $86,770; J. J. Konrad, $89,400; J. R. Whalen, $87,423; S. T. Green, $84,473; Richard McCann, $90,000. The bids for plumbing, gas fitting, etc., were: H. Williamson, $3,924; Peter A. Kerrigan, $4,175; William F Wilson, $3,980; J. Dougherty, $4,495; Fritz & Kean, $3,900. The bids for heating, painting, tinning, etc., were as follows: Harney Heating Company, heating, $12,550; M. J. & J. J. Donovan, painting, $695; J. N. Sinlinger, painting, $1,950; William Winter, painting, $550; William Cronin, slating, tinning, iron work, etc., $10,090; Conlin & Roberts, slate, tin and galvanized iron work, $10,240; W. B. Glen, tinning, slating and iron work, $7,800.

GOVERNMENT WORK.

Washington, D. C.—The following proposals for the work specified were opened on the given dates by the Supervising Architect of the Treasury Department:

Louisville, Ky.—Approaches to the United States Court House and Post-Office. Opened November 11. Bidders: Owen Patterson, Baltimore, Md., Joliet limestone and Ohio sandstone, $39,950.50; Martin Hendricks, Washington, D. C., Wakefield granite, $37,352; Baltz & Kreles, Louisville, Ky., Granby, S. C., granite, $41,565; Virginia granite, $37,295.

Lancaster, Pa.—Erection and completion, except heating, of the United States Court House and Post-Office. Opened November 6. Bidders: W. Gray & Sons, Philadelphia, Pa., $84,587, Bedford oolitic; $89,635, Hummelstown; $92,789, Lee marble. John A. Bergen & Sons, Lancaster, Pa., $82,573, Indiana limestone. B. Donavan & Johnson, Allegheny, Pa., $111,600, Bedford. E. F. Gobel, Chicago, Ill., $86,396, Ohio bluestone; $87,096, buff Bedford; $91,396, Prentice brown stone. E. J. Bell, Portland, $96,000, Connecticut brown stone. J. E. & A. L. Pennock, Portland, $85,694, Indiana limestone. Lean Planing Mills Co., $93,896, Indiana limestone; $91,896, Ohio buff. Henry Shenk, Erie, Pa., $90,345, buff Amherst; $88,745, blue Amherst; $92,945, Indiana limestone. McLaughlin & Gessel, Lancaster, Pa., $77,915, Indiana or Ohio limestone. Geo. W. Corbett, Washington, D. C., $83,792, Indiana limestone. Robert S. Johnson, Trenton, N. J., $69,825, Indiana limestone; $75,000, Pennsylvania blue marble. Peter Pitken & Son, Rochester, N. Y., $78,000, buff Amherst; $76,240, Prentice brownstone; $75,505, buff Bedford. L. L. Leach & Son, Chicago, Ill., $80,755, Prentice brownstone. Justin McCarthy, Washington, D. C., $83,477.23, Ohio or Indiana buff Amherst.

PROPOSALS.

(Continued from page ii.)

REMOVAL OF SHOALS BETWEEN SISTER Islands and Cross-over Light, Saint Lawrence River, New York.—U. S. Engineer Office, Burlington, Vt., November 8, 1890.—Sealed proposals, in duplicate, addressed to the undersigned, will be received at this office until 11:30 A. M., December 9, 1890, and then publicly opened, for blasting and removing 247 cubic yards of rock, more or less, from two **SHOALS** between Sister Island and Cross-over Light, Saint Lawrence River, N. Y. Attention is invited to the Acts of Congress approved February 26, 1885, and February 23, 1887, Vol. 23, page 332, and Vol. 24, page 414, Statutes-at-Large. Detailed information can be had on application. M. B. ADAMS, Major of Engineers. 23-24-1

BREAKWATER AT NEW HAVEN, CONN.—Engineer Office, U. S. Army, Room 74, Army Building, 39 Whitehall Street, New York, November 1, 1890.—Sealed proposals, in triplicate, for construction of a breakwater at NEW HAVEN, CONN., will be received at this office until twelve (12) o'clock noon, on TUESDAY, December 2, 1890. The attention of bidders is invited to Acts of Congress approved February 26, 1885, and February 23, 1887, Vol. 23, page 332, and Vol. 24, page 414, Statutes at Large. Further information can be obtained at this office. D. C. HOUSTON, Colonel of Engineers. 25

U. S. ENGINEER OFFICE, CHARLESTON-Kanawha, W. Va., November 3, 1890.—Proposals for building the **FOUNDATIONS**, and the pier, abutment, etc., for a movable dam at lock No. 8 of the great KANAWHA RIVER improvement, will be received at this office until 3 P. M. of December 19, 1890 and then opened. The attention of bidders is called to the Acts of Congress approved February 26, 1885, and February 23, 1887, Vol. 23, page 332, and Vol. 24, page 414, Statutes at Large. Information can be obtained by application to ADDISON M. SCOTT, Resident Engineer. WM. P. CRAIGHILL, Colonel of Engineers, U. S. A. 1

PROPOSALS.

PROPOSALS FOR DREDGING AND PIER WORK.—U. S. Engineer Office, Duluth, Minn.—Sealed proposals, in triplicate, will be received at this office until 2 o'clock P. M., December 6, 1890, and then opened, for **DREDGING**, and for repairs to breakwater at GRAND MARAIS, MINN. Preference will be given to articles of domestic production or manufacture, conditions of quality and price being equal. The attention of bidders is invited to the Acts of Congress, approved February 26, 1885, and February 23, 1887, Vol. 23, page 332, and Vol. 24, page 414, Statutes at Large. The United States reserves the right to reject any and all bids. All information may be obtained at this office. JAMES B. QUINN, Major, Corps of Engineers. 26

OFFICE CONSTRUCTING QUARTERMASTER, Fort Thomas, Ky., October 27, 1890.—Sealed proposals, in triplicate, subject to usual conditions, will be received at office of Constructing Quartermaster, U. S. A., FORT THOMAS, KY., until 11 A. M., November 27, 1890, and then opened, for construction there, of a **HOSPITAL** and hospital steward's quarters, and for the steam heating apparatus for the hospital, and for the plumbing of each building. The United States reserves the right to reject any or all bids, or parts thereof. Plans and specifications to be seen at this office, with full instructions as to bidding. Envelopes containing proposals should be marked, "Proposals for Hospitals, etc.," and addressed to 1st Lieutenant R. B. TURNER, 6th Inf'try, A. A. Q. M., U.S.A.

U. S. ENGINEER OFFICE, ROOM 62, ARMY Building, New York, October 15, 1890.—Sealed proposals, in triplicate, will be received at this office until 12 o'clock, noon, WEDNESDAY, November 19, 1890, for the following work: I. For the construction of new DIKES; II., for rebuilding and repairing existing dikes; III., for dredging in the Hudson River between New Baltimore and Troy, N. Y. Amount available, $105,000. The attention of bidders is invited to Acts of Congress, approved February 26, 1885, and February 23, 1887, Vol. 23, page 332, and Vol. 24, page 414, Statutes-at-Large, and the River and Harbor Act of September 19, 1890, Sections 6 to 12. For specifications, blank forms, and all information, apply to the undersigned. G. L. GILLESPIE, Lieut.-Col. of Engineers. 24

PROPOSALS FOR CONSTRUCTION OF Breakwater at Rockland, Maine.—United States Engineer Office, Portland, Maine, November 11, 1890.—Sealed proposals, in triplicate, for construction of **BREAKWATER** at ROCKLAND, MAINE, will be received at this office, No. 537 Congress Street, until 3 P. M. of TUESDAY, December 2, 1890, and then opened. Attention is invited to Acts of Congress approved February 26, 1885, and February 23, 1887, Vol. 23, page 332, and Vol. 24, page 414, Statutes-at-Large. All necessary information furnished by JARED A. SMITH, Lieut.-Col., Corps of Engineers, U. S. Army. 26

PROPOSALS FOR HARBOR IMPROVEMENTS.—United States Engineer Office, No. 366 Milwaukee St., Milwaukee, October 27, 1890.—Sealed proposals, in triplicate, will be received at this office until 12 o'clock, noon, November 25, 1890, and opened immediately thereafter in the presence of bidders for the following harbor improvements: Menominee River, Mich. and Wis., dredging about 200,000 cubic yards; Green Bay Harbor, Wis., dredging about 36,000 cubic yards; Kewaunee Harbor, Wis., pier extension 300 feet, more or less; Manitowoc Harbor, Wis., pier superstructure 600 feet, more or less; Sheboygan Harbor, Wis., pier extension 150 feet, more or less; Harbor of Refuge, Milwaukee Bay, Wis., breakwater extension and superstructure 400 feet, more or less; Racine Harbor, Wis., pier extension 200 feet, more or less; Kenosha Harbor, Wis., pier extension 150 feet, more or less. The attention of bidders is invited to the Acts of Congress, approved February 26, 1885, and February 23, 1887, Vol. 23, page 332, and Vol. 24, page 414, Statutes at Large. Proposals will be accompanied by a guarantee that if the bid is accepted contract will be entered into within ten days after notice of acceptance. Preference will be given to materials and plant of domestic production and manufacture, conditions of quality and price (import duties included) being equal. For blank proposals and information apply at this office. The United States reserves the right to reject any or all bids. Proposals will be indorsed on the envelope, "Proposals for Menominee River, Mich. and Wis.," or "Proposals for .... Harbor," and addressed to Major CHAS. E. L. B. DAVIS, Corps of Engineers, U. S. Army. 25

PROPOSALS FOR DREDGING.—U. S. Engineer Office, Duluth, Minn.—Sealed proposals, in triplicate, will be received at this office until 2 o'clock P. M., December 6, 1890, and then opened, for **DREDGING** in the harbor of DULUTH, MINN., on west side of Rice's Point. Preference will be given to articles of domestic production or manufacture, conditions of quality and price being equal. The attention of bidders is invited to the Acts of Congress approved February 26, 1885, and February 23, 1887, Vol. 23, page 332, and Vol. 24, page 414, Statutes at Large. The United States reserves the right to reject any and all bids. All information may be obtained at this office. JAMES B. QUINN, Major, Corps of Engineers. 26

U. S. ENGINEER OFFICE, BURLINGTON, Vt., November 13, 1890.—Sealed proposals, in duplicate, addressed to the undersigned, will be received at this office until 11:30 o'clock, A. M., December 15, 1890, and then publicly opened, for furnishing 1,610 cubic yards of rubble stone, 1,783 cubic yards of large stone (one to three tons weight), and completing the continuation of 135 linear feet of extension to the **BREAKWATER** at GORDON'S LANDING, LAKE CHAMPLAIN, VERMONT. Attention is invited to the Acts of Congress approved February 26, 1885, and February 23, 1887, Vol. 23, page 332, and Vol. 24, page 414, Statutes-at-Large. Detailed information can be had on application. M. B. ADAMS, Major of Engineers. 24-25-2

PROPOSALS.

PROPOSALS FOR BREAKWATER.—U. S. Engineer Office, Duluth, Minn.—Sealed proposals, in triplicate, will be received at this office until 2 o'clock P. M., December 17, 1890, and then opened, for constructing 240 linear feet of **BREAKWATER** at MARQUETTE, MICHIGAN. Preference will be given to articles of domestic production or manufacture, conditions of quality and price being equal. The attention of bidders is invited to the Acts of Congress approved February 26, 1885, and February 23, 1887, Vol. 23, page 332, and Vol. 24, page 414, Statutes-at-Large. The United States reserves the right to reject any and all bids. All information may be obtained at this office. JAMES B. QUINN, Major, Corps of Engineers. 1

U. S. ENGINEER OFFICE, BURLINGTON, Vt., November 8, 1890.—Sealed proposals, in duplicate, addressed to the undersigned, will be received at this office until 11:30 A. M., December 9, 1890, and then publicly opened, for furnishing 182,886 feet, b. m., of hemlock timber; 9,600 feet, b. m., of white pine timber; 3,000 cubic yards of rubble stone; 7,750 cubic yards of large stone, 1 to 5 tons weight; 1,208 pounds of screw and washer bolts; 546 pounds of ring bolts; 23,441 pounds of drift bolts, and constructing 300 linear feet of extension and repairing 1,225 linear feet of old superstructure to the **BREAKWATER** at Plattsburgh Harbor, New York. Preference will be given to materials of domestic manufacture or production, conditions of quality and price (import duty included) being equal. Attention is invited to the acts of Congress approved February 26, 1885, and February 23, 1887, Vol. 23, page 332, and Vol. 24, page 414, Statutes-at-Large. Detailed information can be had on application. M. B. ADAMS, Major of Engineers. 23-24-1

November 6, 1890.

SEALED PROPOSALS WILL BE RECEIVED at the office of the Supervising Architect, Treasury Department, Washington, D. C., until 2 o'clock P. M., on the 4th day of December, 1890, for all the **LABOR AND MATERIAL** required for the excavation, concrete foundations, stone and brickwork of the basement and area walls, first floor iron beams and girders and columns in basement, for the U. S. Court-House, Post-Office and Custom-House building at BAY CITY, MICHIGAN, in accordance with the drawings and specification, copies of which may be had at this office or the office of the Superintendent at Bay City, Mich. Each bid must be accompanied by a certified check for $200. The Department will reject all bids received after the time herein stated for opening the same; also, bids which do not comply strictly with all the requirements of this invitation. Proposals must be inclosed in envelopes, sealed and marked "Proposal for the Excavation, Concrete Foundations, Stone and Brickwork and Ironwork for the Basement and Area Walls for the U. S. Court-House, Post-Office and Custom-House at Bay City, Mich.," and addressed to JAS. H. WINDRIM, Supervising Architect. 24

November 5, 1890.

SEALED PROPOSALS WILL BE RECEIVED at the office of the Supervising Architect, Treasury Department, Washington, D. C., until 2 o'clock P. M. on the 3d day of December, 1890, for furnishing all **LABOR AND MATERIALS** required for the erection and completion (except heating apparatus and approaches), of the U. S. Court-House and Post-Office building at HELENA, ARKANSAS, in accordance with the drawings and specification, copies of which may be had on application to this office or at the office of the Superintendent at Helena, Arkansas. Each bid must be accompanied by a certified check for $500. The Department will reject all bids received after the time herein stated for opening the same; also, bids which do not comply strictly with all the requirements of this invitation. Proposals must be inclosed in an envelope, sealed and marked, "Proposal for the Erection and Completion of the U. S. Court-House and Post-Office building at Helena, Arkansas," and addressed to JAS. H WINDRIM, Supervising Architect. 24

November 10, 1890.

SEALED PROPOSALS WILL BE RECEIVED at the office of the Supervising Architect, Treasury Department, Washington, D. C., until 2 o'clock P. M., on the 29th day of November, 1890, for all the **LABOR AND MATERIALS** and fixing in place, complete, the low-pressure, steam heating and ventilating apparatus for the U. S. Post-Office, etc., building at HOUSTON, TEX., in accordance with the drawings and specification, copies of which may be had on application at this office or the office of the Superintendent at Houston, Texas. Each bid must be accompanied by a certified check for $100. The Department will reject all bids received after the time herein stated for opening the same; also, all bids which do not comply strictly with all the requirements of this invitation. Proposals must be inclosed in an envelope, sealed and marked, "Proposal for the Low-Pressure, Steam Heating and Ventilating Apparatus for the U. S. Post-Office, etc., building at Houston, Texas," and addressed to JAS. H. WINDRIM, Supervising Architect. 25

November 10, 1800.

SEALED PROPOSALS WILL BE RECEIVED at the office of the Supervising Architect of the Treasury Department, Washington, D. C., until 2 o'clock P. M., on the 2d day of December, 1890, for all the **LABOR AND MATERIALS** required to put in place, complete, the iron vault and closet doors for the U. S. Court-House and Post-Office building at PITTSBURG, PA., in accordance with the drawings and specification, copies of which may be had at this office, or the office of the Superintendent at Pittsburg, Pa. Each bid must be accompanied by a certified check for $100. The Department will reject all bids received after the time herein stated for opening the same; also, bids which do not comply strictly with all the requirements of this invitation. Proposals must be inclosed in an envelope, sealed and marked, "Proposal for Vault Doors at Pittsburg, Pa.," and addressed to JAS. H. WINDRIM, Supervising Architect. 25

PROPOSALS.

U. S. ENGINEER OFFICE, WILMINGTON, N. C., November 6, 1890.—Sealed proposals for **DREDGING** in the harbor at BEAUFORT, N. C.; Waterway between Beaufort Harbor and New River, N. C., and New River, N. C., will be received at this office until 12 M, December 16, 1890. The attention of bidders is specially invited to Acts of Congress approved 26th of February, 1885, and 23d February, 1887, Vol. 23, page 332, and Vol. 24, page 414, Statutes-at-Large. All information furnished by W. H. BIXBY, Capt of Engineers. 1

NOVEMBER 11, 1890.

SEALED PROPOSALS WILL BE RECEIVED at the office of the Supervising Architect, Treasury Department, Washington, D. C., until 2 o'clock P. M., on the 29th day of November, 1890, for all the **LABOR AND MATERIAL**, and fixing in place, complete, the low-pressure, return circulation, steam heating and ventilating apparatus for the U. S. Court-House, Post-Office, etc., building at HUNTSVILLE ALABAMA, in accordance with the drawings and specification, copies of which may be had on application at this office or the office of the Custodian at Huntsville, Alabama. Each bid must be accompanied by a certified check for $100. The Department will reject all bids received after the time herein stated for opening the same; also, bids which do not comply strictly with all the requirements of this invitation. Proposals must be inclosed in envelopes, sealed and marked, "Proposal for the Low Pressure, Return Circulation, Steam Heating and Ventilating Apparatus for the U. S. Court-House, Post-Office, etc., building at Huntsville, Ala.," and addressed to JAS. H. WINDRIM, Supervising Architect. 25

U. S. ENGINEER OFFICE, BURLINGTON, Vt.. October 24, 1890.—Sealed proposals, in duplicate, addressed to the undersigned, will be received at this office until 11.30 o'clock A. M., November 24, 1890, and then publicly opened, for furnishing 9,000 cubic yards of **RUBBLE STONE**; 2,112 cubic yards of large stone, 1 to 3 tons weight, and constructing 200 linear feet of extension to the breakwater at ROUSE'S POINT, LAKE CHAMPLAIN, N.Y. Attention is invited to the Acts of Congress approved February 26, 1885, and February 23, 1887, Vol, 23, page 332, and Vol 24, page 414, Statutes at Large. Detailed information can be had on application M. B. ADAMS, Major of Engineers. 21-22-24

WATER-WORKS, Canton, S. D.—Proposals are wanted until December 1, for the construction of a system of water-works at this place. Address A. A. Richardson, C. E., Lincoln, Neb.

WATER-WORKS, Arkadelphia, Ark.—Proposals are wanted, no date specified, for the construction of a system of water-works at this place. Address G W. Carder, as above.

SEWERS, Rockford, Ill.—Proposals are wanted until November 29, for the construction of certain sewers in this city Address E. K. Conkling, City Clerk, as above.

PUMPING MACHINERY, Toronto, Ont.—Proposals are wanted until December 3, for furnishing a vertical pumping engine. Address J. D. Cook, Consulting Engineer, Toledo, O.

ELECTRIC LIGHTING, Harrison, O.—Proposals are wanted until December 2, for the construction of an electric lighting plant at this place. Address Mayor J. A. Graft, as above.

PIER, Ottawa, Ont.—Proposals are wanted until November 27, for the construction of a landing pier at Beaverton. Address A. Gobeil, Secretary Department of Public Works, as above.

DREDGING, Chicago, Ill.—Proposals are wanted until November 19, for doing certain dredging. Address Captain W. L. Marshall, U. S. A., as above.

LEVEES, New Orleans, La.—Proposals are wanted until November 20, for the construction of certain levees. Address Lieut. John Mills, U. S. A., as above.

SEWER, Denver, Col.—Proposals are wanted until November 25, for constructing certain sewers. Address F. B. Crocker, as above.

STREET WORK, Brooklyn, N. Y.—Proposals are wanted until November 17, for paving certain streets. Address John P. Adams, as above.

ELECTRIC LIGHTING, Little Falls, N. Y.—Proposals are wanted until November 21, for lighting the streets of this place by electricity. Address the Electric Light Committee, as above.

WATER-WORKS, Rockford, Iowa.—Proposals are wanted, no date specified, for the construction of a complete system of water-works at this place. Address Mayor C. Yorker, as above.

PAVING, Trenton, N. J.—Proposals are wanted until November 25, for paving certain streets of this city. Address Jno. C. Owens, City Clerk, as above.

BRIDGE, Murphy, N. C.—Proposals are wanted, no date specified, for the construction of a bridge over Brasstown Creek at this place. Address the County Commissioners, as above.

DREDGING, New York City.—Proposals are wanted until November 21, for dredging for proposed bulkhead wall at East One Hundred and Second Street Section, on the Harlem River. Address the Department of Docks, Pier A, North River, as above.

PIER, New York City.—Proposals are wanted until November 19, for doing certain work on the city piers. Address the Department of Docks, Pier A, North River, as above.

STREET WORK. Brooklyn, N. Y.—Proposals are wanted until November 24, for the improvement of certain streets of this city. Address John P. Adams, Commissioner of City Works, as above.

DREDGING, ETC., New York City.—Proposals are wanted until November 21, for preparing for and building a new crib bulkhead at Charity Hospital, Blackwell's Island, East River, and for removing the existing platform and crib bulkhead thereat. Address the Department of Docks, Pier A, North River, as above.

POSITIONS WANTED.

TOO LATE FOR CLASSIFICATION.

WANTED.—A POSITION AS ENGINEER BY a man with 14 years' experience in the shop and in the care of pumping and marine engines; best reference. Address JNO. B. NORRIS, P. O. Box 633, Huntington, W. Va.

MECHANICAL ENGINEER, 12 YEARS' EXperience, familiar with all branches of locomotive and machine construction, accustomed to managing men and supervising structural work, desires engagement; first-class references. Address G. A. H., care THE ENGINEERING AND BUILDING RECORD, 1050 Drexel Building, Philadelphia.

Building Intelligence.

NEW YORK.

217 West 17th st, br ten; cost, $12,000; o, J Boekell; a, J Boekell & Son.

S s 119th st, 150 e 3d av, br flats; cost, $23,000; o, F S Moore; a, O B Ogden & Son.

S s 72d st, 263 e 1st av, 2 br flats; cost, $40,000 all; o, J F Gallagher; a, A Spence.

N e cor Rivington and Cannon st, br flat; cost, $63,000; o and a, Herter Bros.

N s 83d st, 20 w 8th av, 7 br dwells; cost, $112,000 all; o, J Livingston; a, F T Camp.

107th and 108th sts, 290 s Amsterdam av, br stable; cost, $80,000; o, Buchlimer & Schund; a, Ledeile & Co.

S s 147th st, 100 w 3d av, 4 br flats; cost, $88,000 all; o, Cotter Bros; a, J C Burne.

408-10 E 14th st, br and st warehouse; cost, $25,000; o, S W Granger; a, Stoll & Son.

5th av, n w cor 33d st, br, st and terra cotta hotel; cost, $1,000,000; o, W W Astor; a, H J Hardenburgh; b, J Downey.

S s 90th st, 100 W 1st av, 4 stone flats; cost, $14,000 each; o, Sauer & Gross; a, F Wennemer.

115 E 77th st, 3 story br stable; cost, $12,000; o, F P Perkins; a, F Tyrrell; b, J Dougherty.

N s 83d st, 200 w 1st av; 4 stone flats; cost, $20,000 each; o, Moore & McLaughlin; a, Thom & Wilson.

S s 120th st, 125 w 8th av, 3 br and st flats; cost, $11,000 each; o, J Thompson; a, J E Kirby.

N s 115th st, 200 w 5th av, 2 br and st flats; cost, $36,000 all; o, Lena Gebhart; a, F S Barus.

ALTERATIONS.—NEW YORK.

221 Henry st, br ten; cost, $7,000; o, J Block; a, F Ebling.

302 Fifth av, br store; cost, $25,000; o, Dennison Estate; a, G Edbrook.

101-7 E 58th st, roof raised, interior alterations and walls altered; cost, $8,000; o, F & M Schaefer Brewing Co; a, J Kastner.

Irving pl, n w cor 15th st, new elevator and shaft; cost, about $8,000; lessees, Benetrich & Spinnetti; a, J P Leo.

BROOKLYN.

Howard av, s w cor Macon st, br and st store and ten; cost, $12,000; o and a, Clarence Lincoln; b, not selected.

Evergreen av, n w cor Halsey st, fr (br filled) store and ten; cost, $10,000; o, a and b, Cozine & Gascoine.

N s Chauncey st, 100 e Stuyvesant av, 6 br dwells; cost, $27,000 all; o, W Sweet; a, S W & C J Dodge.

N s Macon st, 110 e Lewis av, 4 br dwells; cost, $24,000 all; o, G H Stevens; a, J S Stevens.

25 Siegel st, fr dwell; cost, $9,000; o, Paskus & Feldman; a, H Smith.

15 Siegel st, fr dwell; cost, $9,000; o and a, as above.

S s Palmetto st, 100 w Knickerbocker av, 8 fr dwells; cost, $20,000 all; o, Jas Leonard; a, F W Ames.

N s Scholes st, 75 e Bushwick av, br storage; cost, $28,000; o, Ernest Ochs; a, C Stoll & Son.

N e cor Kent av and N 9th st, br office bldg; cost, $20,000; o, L M Palmer; a, G B Post.

W s Bedford av, 90 n Prospect pl, br stable; cost, $14,000; o, R W Gleason; a, G P Chappell.

N s 6th st, 197 w 5th av, 5 br dwells; cost, $20,000 all; o and a, Allan Bros.

S s Flushing av, 84 e Cleremont av, br stable; cost, $10,000; o, City of Brooklyn; a, J Ingram.

BUILDING INTELLIGENCE.

CAMDEN, N. J.—Carpenter st, bet 9th and 10th sts, 13 br dwells; o, W C J Aitken.

Cherry st, w 5th st, 5 br dwells; o, Jno Corbett.

CINCINNATI, O.—Eastern av and Main st, Pendleton 1-story electric generating station; cost, $6,000; o, Cincinnati St Ry Co a, Bert L Baldwin.

3d av and Wood st, round house; cost, $12,000; o, C C C & St L R R Co; a, J Stewart.

8th st and Broadway, 3-story br factory; cost, $6,000; o, Chatfield & Woods; a, J Kukertz.

Freeman and Louisa sts, 2½-story packing and smoke house; cost, $20,000; o, The Robinson Co; a, A J Bast.

Pearl and Central avs, 3-story br and iron warehouse; cost, $75,000; o, C C C & St L R R Co; a, S W E Field.

The Perin Estate will build a pressed brick store and flat building on the northwest corner of 5th and Race sts, to cost $200,000. Samuel Hannaford's Sons are the architects.

PHILADELPHIA, PA.—W s 48th st, W Paschel st, 5 dwells; b, Isaac Wood.

E s Reese st, n Butler st, 4 dwells; b, John Miller.

W s 19th st, s Moore st, 3 dwells; o, Jas Quinn.

W s 19th st, n Morris st, 2 dwells; b, Chas Booth.

N and s s Silver st, s Kensington av, 14 dwells; o, J G Torpey.

W s Winton st, bet 2d and 4th sts, 18 dwells; o, W J Ross.

507-09 S 9th st, stable, o, R T Hazard.

S s Florence st, e 51st st, 2 dwells; b, A J Mosley & Son.

E s 38th st, n Aspen st, 3 dwells; o, Albert L Du Puget.

E s Spring st, s Green st, 6 dwells; b, W H Sperry.

Isabella st, e Kensington av, Helen st, s Silver st, Jasper st, s Silva st, 18 dwells; o, J G Tapey.

BUILDING INTELLIGENCE.

PHILADELPHIA, PA.—S s Hamilton st, e 62d st, 2 dwells; o, H L Waugh.

S w cor Tioga and Tulip sts, mill; o, Wm Abbott.

S e cor Indiana av and Marshall st, 8 dwells; o, John S Kelly.

E s Gurter st, opp Manheim st, store; o, M D Wartman.

N s Catharine st, w Broad st, foundry; o, Paul S Reeves.

S s Almond st, n e York st, 12 dwells; o, W. C. Williamson.

N s Lehigh av, w 15th st, 7 dwells; b H Barmaclough.

N s Washington av, e Otsego st, shop; o, Armstrong & Printzerhoff.

12th st, n Tasker st, Palas st, n Tasker st, 8 dwells; o, Michael Whelan.

N s Mercy st, w Front st, 28 dwells; o, J J Cassidy.

43d st, w Westminister av, 43½ st, n Ogden st, 18 dwells; o, J A Jordan.

ROCHESTER, N. Y.—Cor Brown and Frank sts, br business block; o, W B Cooper; a, Otis & Crandall.

E Main st, stone and fr first-story extension, colonial design; cost, $8,000; a, Orlando K Foote.

E Main st, 2-story fr and stone bldg; cost, $9,000; o, G W Crouch, Jr; a, Otis Crandall.

SPRINGFIELD, MASS.—Main st, near Washington, 3-story br block of tenements; o, John McFethries; b, S E Walton.

WALTHAM, MASS.—Newton st nr Main, 3-story fr bldg, Home for Aged Women; o, City of Waltham, a, Hartwell & Richardson; b, S C Abbott.

BUILDINGS.—There is nothing over $7,000 in value to report at the following places: Montclair, N. J.; Wilkes Barre, Pa.; Allegheny, Pa.; Geneva, N. Y.; Ogdensburg, N. Y.; Binghamton, N. Y.; Worcester, Mass.; Charleston, S. C; Pottsville, Pa.; Poughkeepsie, N. Y.; Harrisburg, Pa.; Dayton, O.; Clinton, Iowa; Pottstown, Pa.; Scranton, Pa.; St. Louis, Mo.; Saginaw, Mich.; Madison, Wis.; Topeka, Kan.; Knoxville, Tenn.

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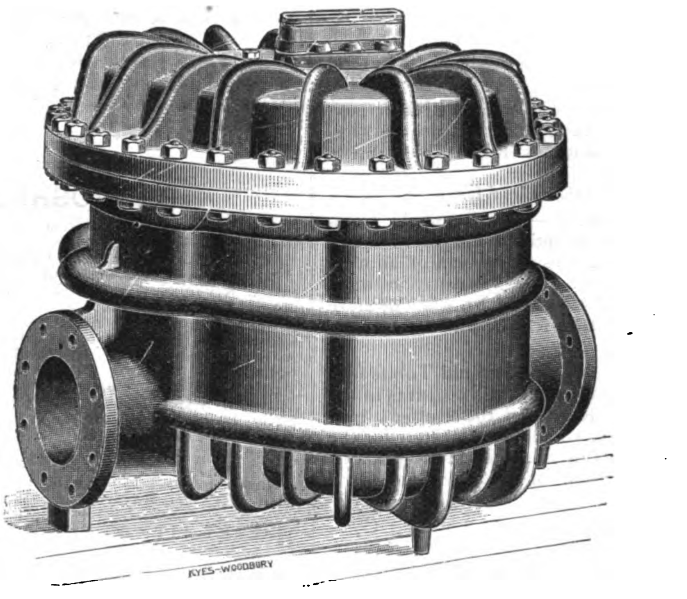

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THE ENGINEERING AND BUILDING RECORD,
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IMPROVEMENT OF INLAND NAVIGATION.

THE advent of railroads, some sixty years ago, acted not only to prevent any further extension of the system of canals and river navigation, which had made much progress in the early years of the century in this country, considering its moderate amount of wealth and population, but also to cause the abandonment of many canals that had already been constructed. In recent years the United States Government has expended considerable amounts in the improvement of natural water-courses, which have operated to increase, quickly and largely, the commerce of the districts adjacent to them The opposition frequently manifested, however, by influential newspapers of the country, has unfortunately caused, or been the main factor in causing, at different times the entire failure of the annual River and Harbor Bill, or such a diminution of the amount of the appropriations as to cause long delays in greatly needed improvements, sacrificing, by intermittent or insufficient appropriations for specific objects, considerable of the work already done, and increasing materially their final cost.

Public attention abroad has recently been more fully awakened to the desirability of increasing the facilities for internal water transportation, from its greater economy, especially for heavy or bulky articles of little value, and from its usefulness in acting as a check on the overcharges of railroads. It resulted in the holding of an International Canal Congress for the discussion of, and dissemination of information upon, this important subject, at Manchester, England, in July last. It was composed of delegates from all the principal countries of Europe, many of them holding official positions. Col. William E. Merrill, of the U. S. Corps of Engineers, who also attended the Congress by order of the War Department, on his return submitted a valuable report, showing what has been accomplished in France, and comparing it with the little progress yet made in this country. Extracts from this report are given elsewhere in this issue.

France, it appears, with an area of about 204,000 square miles (but little over three-quarters of that of Texas), has 3,000 miles of canals and 2,050 miles of canalized rivers, in addition to 1,850 miles of open rivers that are navigable. Of this extensive system only 355 miles of canal and 46½ miles of river, conceded to private companies, are subject to toll. Between 1814 and 1887 the French Government has spent nearly $266,000,000 on the improvement of its rivers and construction of canals; and since 1761, when its sea-ports began to receive real attention from the Government, over $233,000,000 have been expended on its harbors. Authorized harbor constructions require nearly $45,000,000 more for their completion. Of the above amounts nearly $92,000,000 have been expended for harbors, and $87,000,000 for rivers and canals since the Franco-German War, notwithstanding the great strain upon the finances of the country produced by the losses in that war and the large war indemnity that had to be paid to Germany. France, by her liberal expenditures, shows that it at least appreciates the value to its commerce of good harbors and cheap inland water navigation.

In England, much less attention has been paid during the last half century to inland water communications. Very little addition has been made, till recently, to the canals and canalized rivers existing before the railroad era, which are being held in short sections by different companies without consolidation. Many connecting pieces have been secured by the railroads themselves, thus making their improvement or competition with the railroads exceedingly difficult. There are about 3,813 miles of inland navigation in the United Kingdom, of which 2,644 miles are in England and Wales; and of the latter amount 1,225½ miles are owned or controlled by railway companies.

But the magnificent waterway so nearly completed from Manchester to tide water, and the projected canals for sea-going vessels from Birmingham to navigable water in the Mersey, and from the Forth to the Clyde in Scotland (expected to yield an annual traffic of six million tons), with the interest shown in this recent International Canal Congress, indicate an intention to make up for the neglect of the past.

In our country the strong interest now being shown, both at Pittsburg and in the Lake regions, in the construction of a canal from the Ohio to Lake Erie, for the interchange of high-grade Lake Superior ores and cheap Pittsburg coal, makes its early realization quite probable. The United States Government has given the nation a free canal at Sault Ste. Marie, through which already passes an annual tonnage greater than that of the Suez Canal; and its huge canal lock, 515 feet by 80 feet, capable of taking in at once from four to six vessels of average size, having proved insufficient for the constantly growing traffic, an additional one is now under way. This is to be still larger, measuring 800 feet by 100 feet with a depth of 21 feet on the miter sills.

Let us hope that the time is not far off when the Government will better appreciate the advantages of free internal waterways and will provide for building, in addition to the Ohio and Lake Erie canal already mentioned, ship canals connecting Lake Erie and Lake Ontario on American territory, connecting the Mississippi with the Great Lakes at Chicago, giving Baltimore an outlet to the sea across the Delaware peninsula, thus shortening the travel for its northern commerce by from 215 to 286 miles, crossing the Florida peninsula and thus diminishing the length of the voyage for the Gulf commerce by from 400 to 600 miles, and crossing the upper Michigan peninsula, thereby saving 271 miles from Duluth to Chicago, to say nothing of numerous other projected improvements in our internal navigatiou less striking but scarcely less important.

STREET AND ROAD MAKING DATA.

MAYOR HART, of Boston, recently addressed to James G. Blaine, Secretary of State, a letter suggesting that in view of the interest now attached to street and road making in this country, the U. S. Consuls in several of the foreign countries be asked to report upon the subject.

Among the important points to be considered were mentioned the materials used for streets having heavy and light traffic, the cost of building and maintaining such streets, and the assessment of first cost and maintenance. In the matter of material it was requested that the source and treatment of such should be stated, as well as the cost. Mayor Hart appropriately remarked that nearly every country and city has acquired some information upon these topics, and that the Department of State will deserve the special thanks of the country by making this information accessible.

It is gratifying to note that Secretary Blaine has taken the matter in hand at once, the different consular officers having been instructed to report upon the subject in their several districts. There can be no doubt of the great practical value which these prospective reports will have, and engineers and others, interested in street and road making, will have some reason to look forward to their completion as a means of making accessible the accumulated experience of a comparatively large number of men in this particular field.

A good, though independent, beginning in the matter has already been made by the American Consul at Liverpool, Mr. Thomas H. Sherman, whose report on the pavements, street-car lines, sewers and artisans' dwellings of that city form a valuable chapter in one of the recent numbers of "Consular Reports." Though this information was included in the articles on pavements and street railroads which appeared in earlier numbers of The Engineering Record, and have since been republished in "Pavements and Roads," we give in another column an abstract of Mr. Sherman's report. The specifications for street paving are particularly interesting, since the city of Liverpool boasts of having the best paved streets in the world. What Mr. Sherman has thus already accomplished in the collection of street-making data ought to serve as a fair indication of the kind of information likely to prove valuable, but, in any event, the movement started by Mayor Hart cannot fail to yield good matter.

THE SECRETARYSHIP OF THE AMERICAN SOCIETY OF CIVIL ENGINEERS.

In another column will be found an interesting letter from G. Leverich, a member of the American Society of Civil Engineers, and at one time its Secretary, regarding the nomination, made by the regular Nominating Committee, for the office of Secretary of the Society.

The objection made in this communication to the eligibility of the person nominated for the Secretaryship, upon the theory that he is not a "Member," and that the Constitution of the Society confines the right of holding office to such as are Resident Members, has also been made by the Executive Committee of the Board of Direction, in a circular issued to the members announcing the candidates nominated by the Nominating Committee. In spite of this circumstance, however, we have been unable to find any clause of the Constitution which sustains that view. Confusion has apparently arisen from the fact that Section 2 of Article 2 of the Constitution, provides that "the Active Members of the Society shall be divided into three classes, styled, respectively, Members, Associates, and Juniors. Associates and Juniors shall possess all the rights and privileges of members, excepting the right of voting." "Members," as designating a class, are, therefore, not more Active Members than are Associates and Juniors, and it cannot be claimed from this clause that the right to hold office is confined to any one of the three classes to the exclusion of the others. It is a recognized rule of the law of corporations that the right to hold office is not confined to persons owning stock and having the right to vote, unless the organic law of the State, or the charter of the corporation, or its constitution or by-laws specify such qualifications as being necessary. In so far as the question depends upon precedent, it would seem that the point raised is worthy of consideration; but we submit that the rights of the majority are not to be controlled by the mere fact that, in the past, the office has happened to have been filled from a particular one of the three classes named in its Constitution, since the question of the eligibility of the members of the other classes has not been before the Society.

We are unable to find in the Constitution or By-Laws of the Society, or in any laws under which it is organized, any restriction upon the rights of any grade of members to hold office. The contention that "the Secretary is, ex-officio, a director, and, therefore, under the laws, a trustee, having with his fellow-members of the Board of Trustees, a vote in the Society's affairs," etc., is not conclusive, for the reason that the duties of a trustee are imposed by law upon the secretary, and his right to vote and otherwise act as a trustee, is a creature of the law and not in any sense an act of the Society; in other words, the Society can, if it chooses, select a man as secretary, who, then, by operation of law, is entitled to vote *as a Director*, but who, at the same time, may not have the right to vote as a member.

The question of residence, as affecting the nomination, seems to us, after all, of little moment, since a secretary will, as a matter of course, live in New York. It was certainly never contemplated that the Society must limit its selection of candidates to the persons who were residents of the city at the time of the nomination, though it would seem that under a strict construction of Clause 4 of Article 7 of the Constitution, the nominee of the Committee should have become a resident member before his name could have been presented. It seems obvious that the intent was that the officers elected should be residents during their terms of office, and considering the ease with which a non-resident member may become a resident member, and the fact that engineers are a migratory class, it seems unreasonable that the Society should be practically restricted to the city of New York in its selection of a candidate for the office of Secretary.

The Nominating Committee have, however, apparently made a technical error in presenting the name of a non-resident member without first requiring that he change his residence, which could have been done in a single day. The fact remains that they have made the nomination, and that the time within which they shall do so under the Constitution has expired. Any other five members, however, can, before December 1, nominate the same gentleman for office under Clause 6 of the same Article, which imposes no limitation as to residence. This will get over that technical difficulty. It will be seen from all this that the so-called Constitution is a very loosely-drawn instrument, and the first thing the Society had better do is to authorize the committee who are considering its revision to employ competent counsel to advise them in regard to its provisions.

We confine ourselves simply to the constitutional questions raised. The other features of the case we shall be glad to have our readers discuss, and the use of our columns is offered to them for that purpose.

NOTES.

The Galveston, Tex., City Council, has entered into a contract with J. H. Miller & Co., of Chicago, to bore an experimental artesian well, 3,000 feet deep, for which the city binds itself to pay Miller & Co $75,000 on its completion. Should this well prove a success others will be bored, and the city thus supplied with water.

At a meeting of the Pennsylvania Ship Canal Commission, held at Pittsburg, on November 12, it was stated that the canal would probably cost $26,000,000, and the chances were that if the State or Government would not construct it that a private corporation would. The surveys thus far made show that the line of the canal will be 102 miles long. The deepest cut will be near the crossing of the New York, Pennsylvania and Ohio Railroad near Sharon, and a few miles south of that is a deep ravine which will either have to be bridged by an aqueduct or the route of the canal will have to be run several miles to the eastward.

If the writer of the letter on "Cements" will send us his name and address we will be pleased to give the matter attention. Anonymous communications will not be noticed.

Within the next few weeks the Galveston Dredging and Land Reclamation Company, of Galveston, Tex., will commence active operations in Galveston Bay.

THE STEVENS INDICATOR.

The October number of *The Stevens Indicator*, published at Stevens Institute, Hoboken, N. J., contains a variety of interesting and valuable matter.

The opening article is a continuation of an earlier contribution on "The Fabrication of 12-inch Mortars," by Messrs. Fuller and Connet. "Magneto-Motive Force" is treated of by Thorburn Reid, and "A New System of Steam Radiating Pipes for Railroad Passenger Cars" is described by Robert M. Dixon. Prof. Thomas B. Stillman contributes an interesting paper on "The Analysis of Water to Determine Scale-Forming Ingredients." Other papers are by William Whigham on "An Analysis of Tractive Force in the Locomotive;" Prof. H. A. Wood on "Pascal's Triangle Applied to the Solution of Problems in Combinations and Permutations, and to Determine the Co-efficients of the Binomial Formula;" Prof. J. E. Denton on "The Action of Lubricants;" H. P. Jones on "A Comparison of the Ball Automatic Cut-Off Gear and the Stephenson Link Motion," and Prof. Jacobus and Riesenberger on "Ledoux's Equations for the Latent Heat of Ammonia and Sulphur Dioxide." The last is a most valuable contribution to the literature of ice-making engineering.

OBITUARY.

Gen. Jacob W. Hoysradt, one of the most prominent citizens of Hudson City, N. Y., died on November 15.

Frank Hopke, a civil engineer in the service of the New York Central Railroad, died at Hastings on Hudson, on November 13.

Gilbert Peterson, a well-known contractor, and recently engaged on the Washington reservoirs and aqueduct work, died at Lockport, N. Y., on November 14.

Joseph Flannery, for many years prominently identified with the manufacture of gas in all parts of the United States, died of heart failure, at New York, on November 15.

William Bromley, a member of the firm controlling the Quintard Iron Works, New York, and the Superintendent of the company for the past 22 years, died on Monday last, of Bright's disease, at his home in Bloomfield, N. J. Mr. Bromley was 72 years old.

Daniel Runkle, President of the Warren Foundry and Machine Company, of 160 Broadway, New York, and also of the Rochester Gas Light Company, died of Bright's disease of the kidneys after nearly a year's illness, on November 17, at the home of his son, H. G. Runkle, at Plainfield, N. J., aged 68. Mr. Runkle was one of the founders of the Thomas Iron Company, and his home was in Asbury Park, N. J.

PERSONAL.

James Gaffney has been elected to the office of Plumbing Inspector at Tacoma, Wash.

William C. Irwin, Chief Engineer of the Cleveland, Cincinnati, Chicago and St. Louis Railroad, has resigned after nearly 30 years' service. From 1881 to 1885 he was Bridge Engineer.

Charles E. Webster, formerly Chief Engineer of the Schuylkill road, has been appointed Assistant Chief Engineer of the Lehigh Valley road.

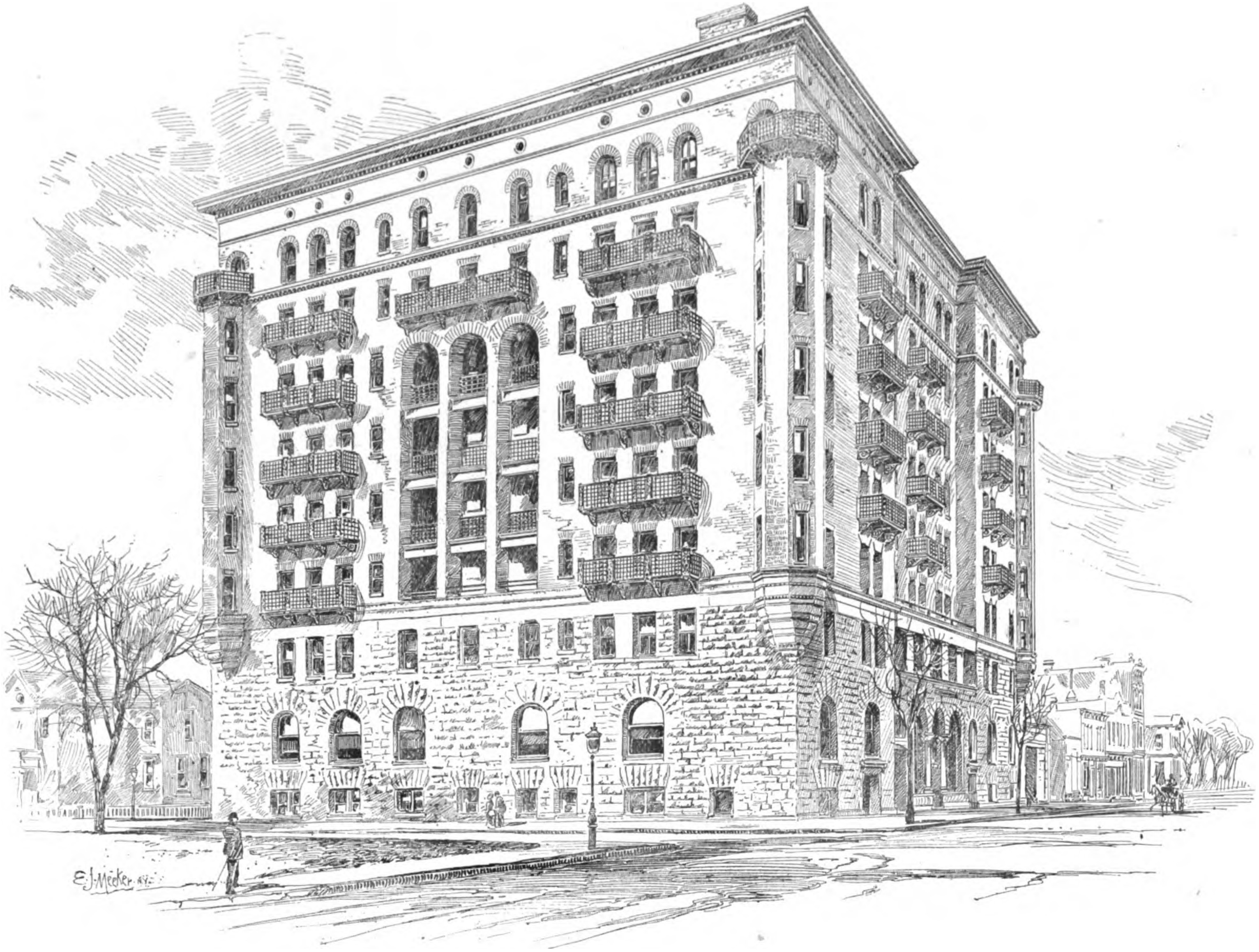
F. E. Abbott, has resigned his place as City Engineer of Gloversville, N. Y., and is now Inspecting Engineer for the Illinois Steel Company, with offices at The Rookery, Chicago, Ill.

General John Newton, formerly Chief Engineer, U. S. A., and more recently Aqueduct Commissioner of New York, has been invited to become Supervising or Consulting Engineer to the Hennepin Canal Board at Chicago.

OUR ARCHITECTURAL ILLUSTRATION.

THE "ABERDEEN" APARTMENT HOUSE, ST. PAUL, MINN.

CLARENCE H. JOHNSTON, ARCHITECT, ST. PAUL, MINN.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THE "ABERDEEN" APARTMENT HOUSE, ST. PAUL, MINN.

CLARENCE H. JOHNSTON, ARCHITECT, ST. PAUL.

NEW YORK, VOLUME XXII.

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ENGINEERING SOCIETIES.

Secretary Hutton of the American Society of Mechanical Engineers, has issued a circular announcing that the refitting, decoration and furnishing of the society's house, at New York, is now completed, and a definite policy has therefore been determined upon as to the general use of the building, more especially as to the two upper floors. On the ground floor the small front room has been fitted up as an office, committee and council room and will be used as a clerk's office when not otherwise required. It is brilliantly lighted at night, and will be particularly convenient for a writing room during evening hours. On the parlor floor is the main office, which is used as a members' rendezvous and general headquarters. Back of this is the auditorium, two stories high. On the second floor is the library, occupying the entire body of the house, and the gallery of the auditorium.

On the third and fourth floors six available rooms have been plainly but comfortably furnished as sleeping apartments; and it is intended by the House Committee that these rooms shall be at the service of our members. It is hoped that they will be frequently used, not only because they will be found to be in a convenient part of the city for members coming from out of town, but also because the revenue received will immediately aid the society's new enterprise. Meals are not supplied. A uniform rate of $1.50 per night is charged for all rooms, or $10 per week when taken in this way.

The library, with its system of individual incandescent lights, is very much more home-like than a hotel room can be; it is quiet and possesses congenial atmosphere.

Announcement is made, also, of the fact that there will be a semi-social and professional re-union of the society with their ladies on the evening of Friday, November 28, at the society's house. The occasion for this re-union is the official unveiling of the fine, life-size oil portrait of the late Alexander Lyman Holley, one of the founders of the society, and created honorary member in perpetuity. The date has been chosen as the day after Thanksgiving, in order that any Western members passing through the city on their way back from New England celebrations of the season, might be able to be present at this, the first re-union of the society in its new house since its redecoration and refitting for the society's use. There will be a short speech of welcome, to be followed by the address appropriate to the unveiling, which will be delivered by Mr. James C. Bayles of the society. After this will be a social re-union in library and reception rooms, and a collation in the society's banquet room, giving to the occasion the festal nature of a "house-warming"

If this re-union proves successful in attracting any considerable number of the non-resident members, it is proposed that there be inaugurated a series of re-unions for the members of the society and their ladies, during the winter, to give opportunity for social and professional intercourse in the society's house. The expenses of such re-unions are to be borne by those participating in them, or, at any rate, from a fund entirely outside of that which belongs to the society's regular work and income.

The annual meeting of the Mechanical Engineers' Library Association will be held at New York on the evening of Friday, November 28.

A regular meeting of the Track and Bridge Builders' Association was held in the Directors' room at the Union Depot, St. Paul, Minn., on November 14, at which John Copeland presided. The topic for discussion was a paper previously submitted by Mr. Amos, of the Soo line, upon the construction of pile and trestle bridges. Every road in the Northwest was represented at the meeting. Following this paper was one of more popular interest, by Mr. McMillan, also of the Soo, on the "Discipline and Management of Trackmen." At the December meeting of the Association the main topic for discussion will be a paper by Mr. McCutcheon, of the Chicago, Milwaukee and St. Paul, upon "The Best Time and Method of Renewing Ties."

A regular meeting of the Civil Engineers' Club of Cleveland was held on Tuesday evening, November 11. Twenty-three members and three visitors were present. James Wallace Kelly and Frank Walter Wilson were elected active members. Mr. Eisenmann reported the action of the committee at Chicago, appointed to formulate a plan for an International Congress of Engineers.

Prof. Harry Fielding Reid, Ph. D., presented a paper on the "Muir Glacier." It covers an area of 1,000 square miles, and has two termini, one at tide-water and the other several hundred feet higher. The lower terminus, one and one-half miles wide, is about 250 feet above the water, and extends an unknown depth into the water, which has been sounded to the depth of about 1,000 feet. From this terminus, immense masses of ice are continually breaking off, falling into the water, and floating away as icebergs. One most remarkable phenomenon was observed, the existence of a central moraine extending from end to end, moving in two opposite directions, and apparently having no beginning. After much difficulty the velocity at the lower end was found to be 8 or 10 feet per day; at the upper end it is probably between 2 and 3 feet. The belief is that the glacier is receding, and to determine this, permanent stations have been established from which observations will in the future be made, and other means taken to ascertain whether or not one part is not what is called a dead glacier. The ice was observed to have different colors, depending on the amount of sunlight it had been exposed to.

At the conclusion there was an interesting discussion of a number of the remarkable phenomenons observed.

A regular meeting of the American Society of Civil Engineers was held at New York, on November 19. The special topic for discussion before the members was the paper on "Self Purification of Water in Flowing Streams," which had been presented at a previous meeting by Charles G. Currier, M. D.

The Boston Society of Civil Engineers had an excursion to Salem, Mass., on Wednesday afternoon, November 19, and visited the works of the Massachusetts Broken Stone Company. The party, numbering about 25, were given every opportunity for inspecting this plant, and were much interested in the quarrying, crushing, elevating and sorting of stone for road metal, the crusher used being of the Gates pattern, and capable, it was stated, of crushing one ton of stone per minute.

In the evening the society held its regular meeting at the American House, Boston, at 7:40 o'clock, with President Clemens Hershel in the chair, S. E. Tinkham, Secretary, and about 75 members and visitors present.

Walter Jenney, of Boston, was elected a member. A communication from the Secretary of the International Engineering Congress having been read, it was voted that the Board of Government of the Boston Society should appoint a delegate to represent that society at the Congress. The feature of the meeting was the consideration of the subject of "Roads and Road-making." the first paper was presented by Prof. C. F. Allen, in which he dealt with the subject under the heads of location, form of cross-section, workmanship, and materials, maintenance, and, lastly, legislation. In the papers which followed, Mr. W. E. McClintock entered into a general consideration of the subject, and gave some interesting results of his experience, particularly when City Engineer, of Chelsea, Mass. Mr. E. W. Howe gave an account of the methods employed in road construction and maintenance, especially with reference to those of the Park system of the city of Boston.

In the general discussion which followed, Albert F. Noyes, City Engineer of Newton, Mass,, Mr. Aspinwall, and several other members and visitors took part.

UNDERGROUND ELECTRIC CABLES AT CHICAGO.

According to a paper by F. E. Degenhardt, recently read before the Chicago Electric Club, the cables laid underground in the city of Chicago are placed in conduits of various kinds—viz., iron pipe laid in the earth without other protection; iron pipe laid in concrete; iron pipe, cement lined, laid in concrete and multi-tubular blocks of bituminous concrete about 4 feet long.

Manholes in many cases are built circular in form, and in other cases rectangular shaped, the latter averaging 46 inches in length by 40 inches in width, and are from 4½ to 9 feet deep, with double iron covers, one of which is set below the grade and made water-tight by packing, the other set on a level with the street.

The iron pipe used for conduit is thoroughly reamed at the ends, thus removing the burr. Conduit is laid with a pitch of difference of grade from 6 inches to 1 foot, so as to draw into the manholes, thus disposing of all drip from condensed moisture.

The annual meeting of the Western New York Association of Architects was held at Buffalo, N. Y., on the 18th inst.

THE CALLIOPE DRY-DOCK AT AUCKLAND, NEW ZEALAND.

In a paper recently presented to the British Institution of Civil Engineers Mr. John H. Swainson gave substantially the following account of the Calliope dry-dock, at Auckland, New Zealand:

"Since 1879, the port of Auckland has had the use of a small dock, situated on the southern shore of the harbor, near the wharves and business portion of the town. This dock, until about the time of the wreck of the steamship 'Triumph,' at Tiri-tiri, had proved, with few exceptions, though limited to draughts of 13 feet or so, equal to the ordinary requirements of the mercantile shipping visiting the port. On several occasions, however, business has been lost to the city for want of a larger dry-dock.

"It was therefore decided to construct a new dock at Calliope Point, a small promontory midway between Depot Point and the entrance to Shoal Bay, on the northern shore of the waters of the Waitemata, which form the Harbor of Auckland.

"With the exception of a certain amount of mud at the entrance, the whole of the excavation was in soft gray sandstone rock, with occasional hard bars and laminated veins.

"Vertical fissures were met with here and there, but never of any size to cause trouble; and during the excavation of the rudder-well, the bottom of which was 55 feet below high-water mark and within 140 feet of the tide, the whole amount of leakage into the dock was only 83,121 gallons per diem.

"On the 5th of November, 1885, being one week less than a year from the signing of the contract, the first shovelful of concrete was laid by the engineer, Mr. Errington, and the dock was opened in February, 1888. The dock is 500 feet long, 40 feet wide on the floor, and has a width of 110 feet at the level of the cope, the center line running southeast half east.

"The excavation for this, the greater portion, is 116 feet wide to the level of the rock, or in the rock to a depth of 12 feet from cope level; a bench 5-foot in width reduces it to 106 feet for the next 8 feet in depth; again further reduced by another 5 feet bench, between 20 and 34 feet levels to a breadth of 96 feet; the bottom portion below this again is 76 feet wide, the floor of the excavation being formed concave to a radius of 149 feet, with a fall of 15 inches in the length of the dock, the center being 47 feet 1 inch below the surface of the ground at the head, and 48 feet 4 inches at the sill.

"Down the center of this runs the 9 inch earthenware drain, laid in concrete in a trench; above this, and all over the floor of the excavation, is a 12-inch layer of ordinary concrete without rubble. This is made in the proportion of 6 to 1 as follows: 2 parts of bluestone broken to 2½-inch gauge, 2 of gravel up to the size of an egg, and 2 of coarse sand to 1 of cement, tested after seven days to stand a strain of 450 pounds per square inch of cross section. Above this bottom layer of concrete there is an invert built of seven rings of brickwork set on edge in 2 to 1 cement mortar.

"This is 60 feet in breadth, and the portion forming the skewback between the edges of the invert and the sides of the excavation is filled in with rubble concrete. The floor of the dock above this invert is formed of rubble concrete, and is convex in shape on the surface, having a camber of 3 inches, all surface water being by this means kept to the sides, where it is conducted by channels to the rudder well and pump wells at the outer end of the dock; the workmen are thereby enabled to repair the keel or bilge of a vessel without standing in water meanwhile.

"The total thickness of this floor in the center is 7 feet, and it has the same fall as the excavation, 3 inches in 100 feet, the center being 40 feet 1 inch at the head and 41 feet 4 inches at the sill below cope level. Keel blocks, made of pohutukawa, a native timber, heavy, tough, and impervious to the teredo, are placed 5 feet apart, center to center, down the dock.

"The rudder well is 21 feet up the center line from the sill, and is directly opposite the culvert leading to the main pumps. It is 10 feet in diameter, and 15 feet deep, with a hemispherical bottom, and is built of brickwork 2 feet 3 inches in thickness, backed by 12 inches of concrete. Besides the 9 inch pipe discharging the leakage into this well, a 6-inch pipe conveys the surface water from the channel on the southwest side to it, and a 12-inch earthenware pipe conveys the drainage, etc., thence below the pumping culvert in the direction of the drainage pump, The coping round this well is made of local stone, 12 inches in depth, and is fitted with an iron grating in six sections, supported by one removable iron girder.

"At a distance of 20 feet from the center line on either side rises the first of the seven altars, each 2 feet in height, which form the lower series. The first two of these are 3 feet 7½ inches in width, including the batter, 1 in eight, which is used on all faces, except the caisson ledge and chamber buttresses, throughout the work. The next four are 2 feet 9 inches wide, the upper one or broad altar being 3 feet 9 inches wide. The breadth across the dock at this point, the foot of the deep altar, is 84 feet. Three flights of steps—one central and one 50 feet from either end—give access from the broad altar to the floor on each side of the dock. Above these rises the deep altar, 11 feet 4 inches high, and four 4-feet altars; these, with the exception of the top one, which forms the cope, 3 feet wide, have a width of 2 feet 4¾ inches exclusive of the batter. Four flights of steps, one at each corner of the dock, provide a means of communication between the surface and the broad altar.

"The head of the dock is formed by a battering wall, 40 feet in height, running at right angles across the dock, broken in the center by a recess for the bows of vessels which admits of two more flights of steps, from surface to floor, divided by a timber slide down the center.

"All these altars and walls were built of rubble concrete, in layers about 2 feet or more in thickness, and not less than 50 feet in length, composed of rough irregular blocks of basaltic rock, bedded in and surrounded by the ordinary 6 to 1 concrete. The faces of the altars were worked up smooth against frames formed of 2-inch boarding, braced, shored, and weighted on the outside, and accurately set to level line and batter.

"The walls at the head and the deep altars required more permanent framing; the ordinary frames were used for the first 2 feet, above which and affixed thereto were uprights, 6 inches by 3 inches, battering inwards, to which a face of 2-inch boarding was attached, the whole being shored up and kept in position, as the wall was built inside, by the gantry.

"The center portion, for a breadth of 41 feet, is struck to a curve of 140 feet radius; this is connected by a bilge curve of 20 feet radius, on either side, to the battering portion 21 feet in height, which gives a total breadth at the surface level of 80 feet. High water of ordinary spring tides gives a depth of 33 feet above the center of the sill. The rise and fall of the tide averages about 10 feet. The sill is constructed of large blocks of Melbourne stone, laid in 18-inch courses, in 1 to 1 Portland cement mortar, well grouted in; this is backed by rubble concrete to the bottom and sides of the excavation, a bulkhead of neat concrete, without any rubble, being inserted behind the caisson quoins to assist in forming a water-tight joint; the brick invert of the floor being also returned up to the underside of the stones composing the inner edge of the sill. The caisson quoins are alternately 5 feet and 4 feet in length, and for the first 24 feet, on either side of the center line, the courses are from 3 feet 9 inches to 4 feet in depth. Above this the courses are alternately 3 feet and 2 feet 6 inches deep, the coping being a 2-foot course 3 feet broad on the surface. The first five of the 5-feet caisson quoins on either side of the center line project into, and are checked down to the level of the floor of the caisson groove, thus bonding the work together.

"The caisson ledge on the end of the quoins is 16 inches in breadth, and is fine-axed and rubbed down to a perfectly vertical plane, to form the joint with the wood facing of the caisson; beyond this the end of the quoins where visible is checked back 1 inch to ensure the bearing face being clear. With the exception of the ledge all exposed portions of this stonework are tooth-axed.

"The caisson groove and chamber are 15 feet 6 inches wide upon the floor, which is level, 1 foot 6 inches below the center of the sill, 3 feet 6 inches in thickness, and 160 feet 9 inches in length; the walls of the chamber batter upwards to within 2 feet of the cope, and are 4 feet 6 inches thick at the level of the floor, where the excavation is in the rock, but are thickened out another 5 feet 6 inches above the level of the rock, the back of the wall being vertical. The end wall is rather thicker above the rock, in order to furnish a broad enough foundation for the discharge culvert, which is built in it, and the caisson hauling gear above. In addition to the vertical walls at the entrance, which are faced with dressed stone from below low water level, there are two vertical buttresses on each side, and one in each of the inner corners of the chamber, measuring 5 feet on the face. In the center of the face of each of these side buttresses there are grooves into which are dropped totara fenders, projecting 2 inches beyond the face in order to protect the timber facing of the caisson from being injured by the concrete walls. These buttresses also support horizontal kauri stringers and blocks, to which are attached, over and between the buttresses, cast-iron plates, with rollers, carrying the chain cables of the caisson hauling gear.

"The caisson hauling gear is fixed on a concrete floor at the northeast end of the caisson chamber, 5 feet below the cope level, and consists of a 6½-inch horizontal shaft, resting on three plummer-blocks, firmly bolted to stones bedded in the floor, with two chain pulleys, one at each end, and two toothed wheels, worked by worm wheels on the vertical shafts of capstans, fixed on the timber floor above on the surface level. Two corresponding pulleys, fixed on the vertical walls at the entrance to the chamber, complete the gear.

"The western end of the caisson groove forms a portion of the entrance walls, which are 83 feet apart at cope level, and extend seawards to the outer edge of the apron, which is level across, 1 foot higher than the floor of the caisson grooves the outer (seaward) edge being bevelled off. Beyond the apron, 31 feet from the sill; these walls have curved returns, at a radius of 10 feet on cope level, and form the eastern and western wing-walls, the former being 98 feet in length in the straight, and the latter 75 feet, including a flight of watermen's steps, which forms a finish in this direction.

"The western side of the dock-yard is protected from the wash of the sea by a pitched slope. The filling culvert is situated on the western side of the entrance, and is 5 feet 6 inches in height and 4 feet broad, with an invert floor and segmental arched roof.

"The mouth of this culvert, which is formed in the masonry of the west wing-wall, is slightly bell-shaped, to make up the amount of waterway lost by the iron grating fixed in a rebate at the outer edge to prevent the influx of timber, rubbish, etc.

"Directly opposite the rudder-well, on the east side of the dock, is the mouth of the culvert leading to the pumps; this is covered with an iron grating to prevent chips and other rubbish finding their way to the pumps. The penstock shaft is built of 14-inch brickwork backed with concrete. This portion of the culvert is level, the bottom being the same level as the floor of the main pumps, 51 feet 6 inches below the cope. Just beyond the penstock it opens with a bell-mouth into the suction chamber, 15 feet long by 5 feet wide and 31 feet high; this divides with two openings leading to the two main pump-wells, the lower openings being fitted with a framework of flap-valves.

"The lower portion of the pump-wells is 10 feet 6 inches in diameter by 11 feet in height, and contains three large standards, which carry the cage and glands in which the plunger works; a cast-iron floor with valves, etc., divides this from the middle portion, which is 12 feet in diameter, and, including the domed portion, 16 feet in height; this contains the cage, and a wrought-iron bulkhead divides the inlet from the outlet portion. The upper part of these wells is 25 feet deep, with a diameter of 8 feet. Two branch culverts lead from these shafts to the main discharge culvert, which issues through the east wing-wall, at a distance of 17 feet from the end.

"Each of the pumps is worked by a separate engine, which, with the pumps themselves, are made from the designs and at the works of Messrs. James Watt & Co., Birmingham. The pumps are calculated to empty the dock from high water, a quantity of over 40,000 tons, in 4½ hours.

"There is also a drainage-pump, connected by a 2-foot earthenware pipe laid in concrete with a sump in the main suction-chamber, directly opposite the mouth of the pumping culvert.

"The 12-inch pipe from the rudder-well discharges into this. his well is divided into two portions, the lower of which, containing the suction-pipe, is 4 feet 6 inches by 3 feet, and 19 feet 6 inches in height; the invert floor of this is 54 feet below the floor of the engine-house; access to it is obtained by a manhole in the invert of the upper portion, which is 7 feet by about 6 feet in breadth. This contains the valve-box and pump-barrels, three in number, and 11 inches in diameter, worked by toothed gear from a small vertical engine. The discharge from this well is conveyed by a 15-inch earthenware pipe round the end of the caisson chamber, and issues through the arch of the main discharge culvert, between the penstock and the back of the wing-wall.

"This pump is capable of forcing water to a proposed tank on the top of the cliff, 100 feet above the dockyard level, for fire-preventive purposes. Fresh water was obtained from a bore-hole sunk to a depth of 300 feet in the rock on the east side of the dock; this water was used for the boilers during the work, and will be of great service for the permanent boilers of the pumping engines.

"The caisson was designed and made by Messrs. Head, Wrightson & Co., of Stockton-on-Tees. It is built of wrought iron, and is 83 feet long on the deck, 15 feet wide over the timber facings, and 41 feet 6 inches deep over all; it is of the box-caisson type, the sides being vertical, 13 feet 6 inches apart; the ends batter downwards at 1 in 8 for 28 feet 6 inches, below which the stem and stern are cut off at an angle of 45 degrees, leaving a length of 48 feet on the floor. The keel pieces are of greenhart, 12 inches by 8 inches, one on each side of the bottom of the vessel, and are bolted to 5 inches by 5 inches by ½ inch angle-iron riveted to the floor-plates, which are ⅞ inch in thickness. The caisson is divided into four parts by bulkheads, and has a water-tight deck running the full length of the vessel, 16 feet below the covering plates, and a tank floor at the depth of the top plate, for a length of 24 feet in the center.

"There is a 12-inch valve opening from the water-tight deck to the sea on each side of the caisson, and also 9-inch ones from the water-ballast tank. A hand-pump on a small deck below the water-tight deck connects with either the bilge, the sea on either side, or the water-tight deck, and delivers either outside or into the tank, provision being made for affixing hydrants in case of fire."

Mr. John H. Swainson was appointed by the Harbor Board to superintend the construction of the work, under the direction of the engineer, Mr. William Errington, M. Inst. C. E., and was assisted in the work by Mr. G. Harden.

THE CORINTH CANAL.

THE Corinth Canal, which will sever the Peloponessus from the mainland of Greece, and will permit the largest ships to pass directly from the Gulf of Athens to the Gulf of Corinth, is said to be rapidly approaching completion. A recently published account gives some interesting particulars concerning the undertaking.

The work was begun some eight years ago by a French company. It was to have been finished in 1887, but various troubles delayed it, and now 1895 is named as the earliest date on which it can be opened for traffic. According to the original estimate, the total excavation was to be 12,065,000 cubic yards, including about 2,400,000 cubic yards for slips or eventual enlargements. The nature of the strata had, however, not been sufficiently investigated, the region being volcanic. When the cuttings had reached some depth a large number of faults were encountered and a considerable disturbance of the layers of deposit of the tertiary strata was revealed.

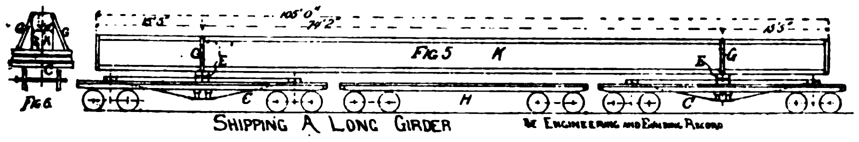
The canal will have no locks, but is level from end to end and perfectly straight. It is to be 96 feet wide and 36 feet deep. At the Corinth end it is crossed by a railroad bridge 164 feet high, under which the tallest ships may pass without lowering their topmasts. With the exception of about 200 yards in the center, the channel, it is said, has already been excavated almost down to sea level, and water has been admitted for about half a mile at the Corinth end and half that distance at the other. The total cost of the canal is reckoned at $14,000,000, or about $3,500,000 a mile. It is assumed that about 300 vessels from Trieste and Fiume, and as many from Italian ports, will pass through the canal annually, while it is calculated that 730 Greek ships will use the canal. This would give a total of 1,230 vessels annually, of an average tonnage of 1,500 each. It is proposed to levy a toll of 20 cents per ton on vessels coming from the Adriatic, and 10 cents on all other vessels, besides 20 cents for every passenger. This is estimated to yield an annual revenue of $300,000.

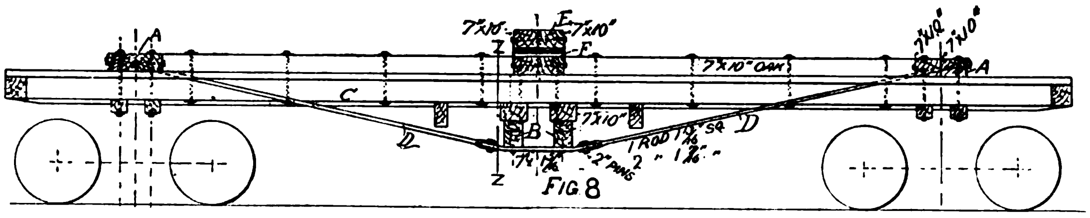
THE first case involving the right of the city of Philadelphia to pave streets occupied by streets railways with Belgian blocks, and compel payment for the same by the companies, was decided last week, when a verdict was given against the Ridge Avenue Passenger Railway Company,

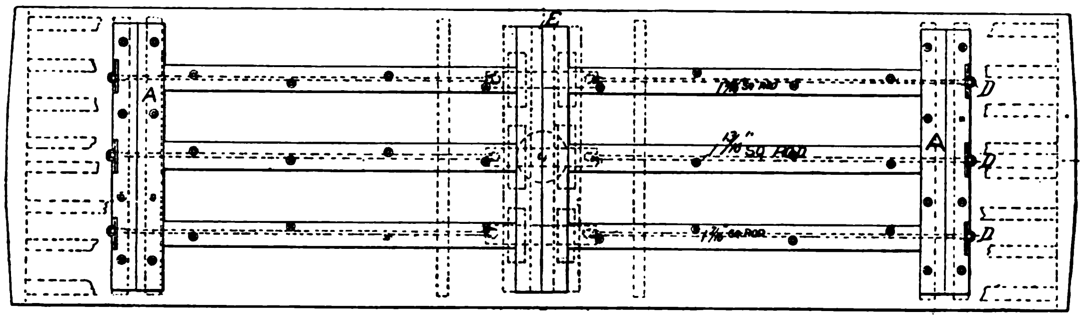
SHIPPING A LONG GIRDER.

FIGURES 1, 2, 3 and 4 show the construction of one of a pair of 105-foot box girders, 5½ feet high, that were built, assembled and riveted up complete in the shops of the Keystone Bridge Company, Pittsburg, Pa., and successfully shipped, on three platform cars each, to San Francisco, Cal. They are intended for the City Hall now being built there, for which William Patton, of San Francisco, is the architect. The girders are entirely of steel, with steel rivets, and weigh about 140,000 pounds each.

Figure 1 is a side elevation; Fig. 2 is a section at X X; Fig. 3 is an elevation along Z Z, and Fig. 4 is a section along Y Y, of Figs. 1 and 2. Owing to the great weight and length of the girders, special cars were required for their shipment, and were prepared and arranged as shown in Figs. 5 to 9. A girder is shown in elevation in Figs. 5 and 6 as it was shipped, supported by two trussed cars C C, the middle car H being merely a spacer, and not loaded or in contact with girder K. The girder rested on pillows at E and E, where it was vertically braced by struts G G, and had sufficient horizontal play to swing around the curves of the railroad track.







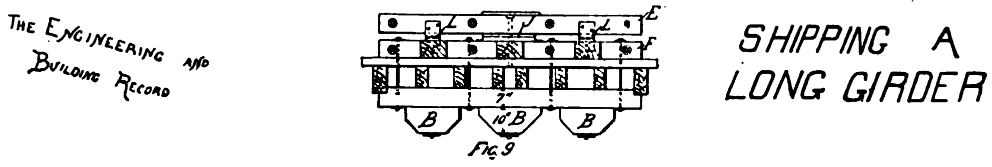
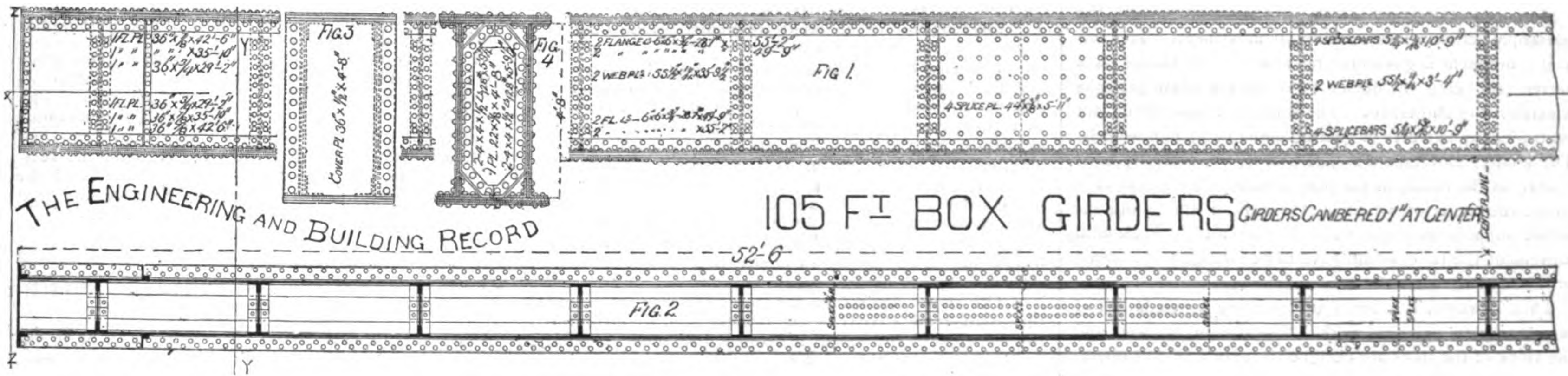


Figure 7 is a plan and Figs. 8 and 9 are elevations of the special cars C C. These were adapted from ordinary flat cars, to which were securely bolted the bearing beams A A and the strut blocks B B. When the truss rods D D were put on they practically formed the lower chord of a king post truss whose upper chord was composed of the bed of the car, and which was loaded at the pivot plate J and bearing plates L L, directly over its posts, B B B.

The arrangement worked satisfactorily, and after the first girder arrived in San Francisco the cars were sent back to Pittsburg and used to transport the second girder.



LIVERPOOL PAVEMENTS.*

THE city of Liverpool, which comprises an area of 5,210 acres, with an estimated population of 599,738, or 115 people per acre, and is said to be the most densely populated city in Great Britain, now points with pride to its 250 miles of "the best paved streets in the world." The American consul there, Mr. Thomas H. Sherman, says that the policy adopted by the corporation of Liverpool in the execution of public works in the best possible manner, and generally by their own workmen, has proved successful in every way; and, by a judicious capital expenditure, the cost of maintenance of the roads, sewers and other public works is reduced to a minimum, and the greatest economy is attained. He notes that the laying of the impervious pavement which was adopted in 1872 for the carriageways of the city has been continued without intermission, and is still in progress, resulting in nearly 1,750,000 yards superficial of impervious carriageway pavements and a saving by the execution of this class of work unprecedented in municipal experience.

Dealing with the year 1877, under the present City Engineer, the estimated expenditure for the general repairs to the roads in Liverpool was £23,000 ($136,080), the mileage of adopted roads at that time being 226 miles. Concurrently with the extension of the impervious carriageway pavements, the expenditure under the head of general repairs has been reduced year by year till the estimated cost for the year 1889 was only £8,400 ($40,824), with a street mileage under repair of 254 miles. Among the regulations worth noting are these:

1. Permission is never given to private companies or persons to cut through the pavement in any street for any purpose. When such work is necessary the city corporation will do it in its own thorough way, and the interested parties must pay the entire cost.

2. All the street railway tracks (tramways) are laid and owned and kept in condition by the corporation, and the company leasing them for traffic pays an annual rental of 10 per cent. on their cost. The manner in which these rails are placed is fully shown in an illustrated report of the former City Engineer, who says: "The Liverpool city lines as now laid are conclusive proof that when tramways are well designed and properly constructed they do not form the slightest impediment, even to the narrowest wheeled vehicles."

The streets are divided into three classes, the pavement designated as first class being usually laid down in the main streets in the central parts of the city where the traffic is heavy. The specifications read as follows:

First-Class Streets.—Excavate or fill in the ground, as the case may be, to the requisite level, and remove all surplus material. Properly form and trim off the surface and thoroughly consolidate the same, and then lay foundation of not less than 6 inches of Portland cement concrete, corporation standard. The paving shall consist of granite or syenite sets, 3¼ inches wide by 6¼ inches deep, from North Wales or other approved quarries, laid in regular, straight and properly bound courses, with close joints, and to be evenly bedded on a layer of fine gravel half an inch in thickness. After the paving is laid the joints shall be filled with hard, clean, dry shingle; the sets shall then be thoroughly rammed, and additional shingle added until the joints are perfectly full. The joints shall then be carefully grouted until completely filled with hot asphalt, composed of coal pitch and creosote oil, and, finally, the pavement is to be covered with half an inch of sharp gravel.

The crossings shall consist of three rows of 16 by 8-inch granite crossing stones, and the remaining space shall be paved on each side of the crossing stones to the full width of the footway, in a similar manner to the carriageway. The crossing stones shall be of granite of a quality to be approved by the engineer, dressed perfectly true, and out of winding on the face; the sides and joints to be perfectly square and accurately dressed throughout their entire depth; the stones to be bedded on cement concrete, the joints to be filled with shingle and grouted with hot asphalt. A triangular groove an inch wide by three-fourths of an inch deep to be run along the upper surface of each stone. No stone to be less than 3 feet in length.

The footways shall be paved with Yorkshire or Lancashire flags of the best quality, not less than 3 inches thick. No flag to measure less than 2 feet in width or to be of less area than 6 feet; to be solid, free from laminations, the upper surface to be true and free from windings or hollows; the joints to be squared the whole thickness. The flags to be laid on a bed of fine gravel, with close, neat joints flushed in mortar, and in uniform courses breaking bond. The joints to be dressed after laying, where necessary.

The channel stones to be of granite or syenite, of a quality to be approved by the engineer, and to be not less than 3 feet in length. The upper surface, if not self-faced and perfectly true, must be accurately worked out of winding, the bed even and parallel to the face, the sides and ends truly square; the stones to be bedded on cement concrete, and the joints to be filled with clean shingle and grouted with hot asphalt.

The curb-stones to be granite or syenite, straight or circular as required, 6 inches thick at top, 7 inches thick at 5 inches below, and not less than that thickness for the remainder of the depth; to be not less than 12 inches deep nor less than 3 feet in length; to be carefully dressed on top, 8 inches down the face, and 3 inches down the back; the remainder of each stone to be hammer dressed; the heading joints to be neatly and accurately squared throughout the entire depth.

Second-Class Streets.—Excavate or fill the ground, as the case may be, to the requisite level, and remove all surplus material; properly form and trim off the surface, and thoroughly consolidate the same, and then lay a foundation (*a*) not less than 6 inches of Portland cement concrete, corporation standard, or (*b*) not less than 6 inches of bituminous concrete, consisting of clean and angular broken stone, grouted with hot asphalt composed of coal pitch and creosote oil, covered with chippings, and thoroughly consolidated by rolling with a roller of sufficient weight. The paving shall consist of granite or syenite sets 3 inches wide by 5 inches deep, or of granite or syenite 4x4-inch cubes from North Wales or other approved quarries, laid in regular, straight, and properly bonded courses, with close joints, and to be evenly bedded on a layer of fine gravel half an inch in thickness. After the paving is laid the joints shall be filled with clean, hard, dry shingle; the sets shall then be thoroughly rammed, and additional shingle added until the joints are perfectly full. The joints shall then be carefully grouted until completely filled with hot asphalt composed of coal pitch and creosote oil, and, finally, the paving shall be covered with half an inch of sharp gravel.

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* This subject was treated of at length in earlier numbers of THE ENGINEERING AND BUILDING RECORD, and is reprinted in the book on "Pavements and Roads," published at this office.

The crossings, footways, channels and curbs shall be the same as specified for first-class streets.

Third-Class Streets.—Excavate or fill in the ground, as the case may be, to the requisite level, and remove all surplus material; properly form and trim off the surface and thoroughly consolidate the same, and then lay a foundation of hand-pitched rock six inches in depth, set on edge in the manner of a rough pavement. Over this a coating of gravel is to be laid of sufficient thickness to fill in the interstices and to form a smooth surface to the foundation, which must be thoroughly consolidated by rolling with a steam roller before the paving is laid. The paving shall consist of 4x4 inch granite or syenite cubes from North Wales or other approved quarries, laid in regular, straight, and properly bonded courses, with close joints, and to be evenly bedded on a layer of fine gravel half an inch in thickness. After the paving is laid the joints shall be filled with clean, hard, dry shingle; the sets shall then be thoroughly rammed, and additional shingle added until the joints are perfectly full. The joints shall then be carefully grouted, until completely filled up, with hot asphalt composed of coal pitch and creosote oil, and, finally, the paving shall be covered with half an inch of sharp gravel.

The crossings, footways, channels and curbs shall be the same as specified for first-class streets.

A NEW FORM OF HYDRAULIC DREDGER.

AN hydraulic dredger, embracing several new features, has just been tried in England, at the port of Littlehampton.

As described in *Engineering*, the vessel is 50 feet long, and 14 feet wide, the draught of water being 22 inches. The machinery consists of a pair of horizontal pumping engines, supplied with steam by an ordinary return tube boiler. The pumps deliver into an air vessel, from which leads a copper pipe 4 inches in outside diameter and ⅛-inch metal. This, in turn, is attached to a leather hose, which carries the flow up to the top of the small gantry built over an open-bottomed well in the center of the vessel. The gantry supports a telescopic pipe, which passes down through the well, and directs the stream of water to the bottom of the river or harbor requiring to be operated upon. The telescopic pipe is supported in the gantry by a gimbal arrangement which, in combination with the telescopic action, gives a universal movement. The vertical component is governed by a wire rope wound on a barrel, this being the device by which the telescopic tube is extended or shortened. The horizontal movements are controlled by two sets of gearing actuated by handwheels. These latter movements are, of course, not perfectly horizontal, as the nozzle of the pipe describes a segment of a circle, the center of which is the axis of the trunnions which support the apparatus. To get a truly horizontal movement the tube would have to be swung, and lowered or raised at the same time.

This, however, is a detail in operating which is not of importance in practical work. The size of the well and the slope of the sides are designed to give a field of operation without shifting the dredger, which is said to be 30 square feet in area. The telescopic pipe has at its lower end a copper pipe ending in a nozzle 1½ inches in diameter. When operating in rough water a length of flexible hose is substituted for the copper pipe.

The vessel works by cutting away the bed with the jet from the nozzle, the latter being kept a few inches from the bottom. To convey the material away dependence has to be placed upon the carrying power of the tide or stream; and for this reason the craft might more accurately be described as a "disperser" than as a dredger, as the spoil is not brought to the surface.

The results obtained with the apparatus on the occasion of the trial appear to have been, in general, of a satisfactory character. *Engineering* states that the bottom of the river Arun, at the spot where the trials were made, is a stiff blue clay of a very tenacious character. It is said that this material was artificially brought to the spot to act as a puddle when the mouth of the river was diverted from its original course to the present configuration, some time, we believe, near the beginning of this century. Whether that may be the case or not (certainly 5 feet 6 inches seems a very thick puddle, even for the substantial days of the Georges), the clay, a large piece of which was brought up from the bottom, is admirably adapted for that purpose; and it is a matter upon which Mr. Baker, the designer of the dredger, might boast, that his jet has cut a hole over 5 feet deep in the space of five minutes, into a material that has stood the scouring action of the impetuous little Arun for 80 or 90 years.

EUROPEAN INLAND NAVIGATION.

FROM the recently issued report of Lieut.-Col. William E. Merrill, of the U. S. Corps of Engineers, concerning the International Congress of Engineers interested in the utilization of water for navigation purposes, held at Manchester, England, in July, 1889, we extract the following:

"In preparing a report on such matters connected with the congress as might be of interest to American engineers, I was much struck with the immense expenditure which France had made, and was still making, on her waterways, and with the magnificent results of this expenditure. In view of the hostility with which the River and Harbor Bill is sometimes attacked in the press of the United States, and of the unfriendly or indifferent feeling of a portion of the American public to existing artificial waterways in our own country, it seemed opportune to quote European practice and opinion in such matters, and no better example could be taken than France, which probably has the best system of artificial waterways in the world.

"Tolls on French waterways were wholly abolished in 1880, but in 1888 a proposition was made in the French *Corps Législatif* to re-establish them. This proposition was referred to a committee, who made a unanimous report against it.

"The French system of inland navigation (excepting some detached canals and rivers on the seacoast that specially subserve maritime interests) forms a vast network, on which it is practicable to go from one point to another without breaking bulk or changing boat.

"Thanks to the artificial ways that have successively been opened either by extending natural ones or by crossing the various water-sheds by canals with summit levels, the Seine, the Rhine, the Rhone, the Gironde, and the Loire are connected together.

"Paris is the natural center of the network of waterways. From this point of departure, which is surrounded by a vast curve or belt formed by the St. Denis and St. Martin canals, together with a part of the Seine, different great waterways lead towards:

The English Channel (Havre and the Bay of the Somme).

The Straits of Dover (Calais, Gravelines, and Dunkirk).

The Belgian frontier (towards Furnes, Ghent, Mons, and Charleroi).

The Swiss frontier (towards Basle).

The Mediterranean (Bouc and Cette).

The Ocean (Nantes and Brest).

"This radiating system is completed by the line from Bordeaux to Cette, which connects the Ocean with the Mediterranean.

"The navigable ways of France are divided into canals, canalized rivers, and open rivers.

"The length of canals really frequented by boatmen is 3,000 miles, and that of canalized rivers is 2,050 miles. On the open rivers the length that is actually navigable may be estimated in round numbers at 1,850 miles. Except 355 miles of canal and 46½ miles of river, conceded to various companies, all these navigable ways are administered by the State and are free from toll. The maintenance and extension of these waterways is under the charge of the engineers of *Ponts et Chaussees*.

"Until 1830 the great expenditures had been made for artificial waterways, and little had been done for the rivers, except to build a few locks and some quays and levees, and to cut off a few bends; otherwise the rivers were in a state of nature.

"The improvements in transportation had increased the commercial activity of the country, and to secure the full benefits of the canals it became absolutely essential to do something for the rivers. This was especially important, as great agricultural and commercial interests depend on river traffic, because the best lands are found in the river valleys, and here are located the populous cities and the great manufacturing establishments.

"The invention of dams with movable trestles, due to M. Poirée, Inspector-General of *Ponts et Chaussees*, which was successfully tested in 1834 at Basseville on the Yonne, came just in time to show the possibility of damming a river of any width without intermediate piers, and of restoring this river to its natural state whenever necessity required it.

"In 1835 the great work of improving the rivers was formally begun.

"In 1852 the success of the railroads, whose advent had been viewed with uneasiness and distrust, gave rise to a public opinion very unfavorable to inland navigation. It was considered doubtful if the latter could henceforward render sufficiently great service to compensate for the financial sacrifices which they had already necessitated and would still necessitate, and for this reason the Government lessened its expenditures, while continuing the projects already begun.

"In 1860 a revival occurred in favor of the boating interest, which was hailed as an indispensable check on the monopoly of the railroads, and various measures were taken by the administration to assist the water roads in maintaining a legitimate opposition to the iron roads.

"The so-called subscription tariffs, by which the railroads offered commerce a reduction of rates on condition of subscribing an obligation to use no other means of transportation, were suppressed; several waterways not embraced in the law of 1853, were bought up by the State, and many new canal companies were chartered; tolls on all State canals were reduced in 1860, and still further reduced in 1867. Work was also begun on a large scale on the improvement of old canals, on the construction of canals already under way, and on the radical improvement of the rivers.

"The total length of the artificial waterways opened under the Second Empire did not exceed 300 miles, the principal effort of the Government having been directed to perfecting the navigable network rather than to increasing its length.

"The seventeen years from 1871 to 1887, inclusive, may be divided into two distinct phases. From 1871 to 1878 the annual budgets were devoted to the burdens imposed by the events of 1870 and 1871; it was impracticable to do much for public works, and inland navigation felt the effects of the general depression.

"In 1878 the Government felt able to resume on a large scale the work of improving the waterways of the country, and a statement was prepared of the works that appeared to be of public utility.

"The following conditions were stated in the law of 1879:

"The water-ways of France were to be divided into two classes, in accordance with the nature and importance of the wants subserved by them: (1) Main lines; (2) Secondary lines. The main lines were to be operated by the State; the secondary lines might be leased for a limited time to companies or individuals.

"The main lines were to have the following dimensions:

	Feet.
Depth of water	6.6
Width of locks	17.1
Length of Locks between chord of lift-wall and lower gate recess	126.3
Clearance under canal bridges	12.1

"These dimensions could only be modified by an act of the legislative body.

"Secondary lines were not required to conform to the above-named dimensions.

"Between 1814 and 1887 the French Government spent the following sums on the *improvement of its rivers* and on the *construction of canals*.*

"It is but just to add that the splendid results attained in France are wholly due to the French corps of civil engineers (*Ponts et Chaussees*), a body of men recruited from the highest graduates of the Polytechnic School, and afterwards carried through the course of the *Special Ponts et Chaussees* school. Entrance into the Polytechnic is secured by competitive examinations, and as the best scholars of this selected body pass on to the *Ponts et Chaussees* school, it is seen at once that France has at her disposal for all engineering work a thoroughly trained corps of the ablest men in the country. The splendid results of their labors in all branches of engineering are the best possible proof of the wisdom that created the corps, which has now a continuous record of 174 years of work on the highways, bridges, railroads, rivers, canals, seaports, and lighthouses of France.

"France is the only country of continental Europe where the system of tolls finds defenders. Austria, as well as Germany, absolutely rejects the suggestion. The tolls that remain in Belgium are unanimously condemned by public opinion as well as by the Government, and their abolition is considered imminent. In Holland the feeling is the same, and one of the highest officials of the Waterstaat recently said 'it is absolutely necessary that we should suppress tolls, at least on the main lines.'"

(TO BE CONTINUED.)

METEOROLOGICAL OBSERVATORY IN THE EIFFEL TOWER.

MESSRS. RICHARD BROS., of Paris, describe in the *Bulletin de l'Association Francaise pour l'Avancement des Sciences* the meteorological observatory established at the top of the Eiffel tower.

At precisely 300 meters above the level of the ground a platform is placed, 5 feet 4 inches in diameter, which has been fitted up as an observatory. The lightning conductor passes down through the center, and the observations are transmitted by electricity to the Palace of Liberal Arts, a distance of 890 yards from the tower. The apparatus in the observatory consists of a maximum and minimum, and an ordinary thermometer; anemometers, raised on three iron tubes to a height of 13 feet, which mark the direction, the force, and the velocity of the wind; two barometers, and a rain gauge. Double venetian blinds, strongly built of iron, inclose the platform on all sides but one.

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*$194,351,000 were expended in harbor work. This sum does not include the expenditure of $15,400,000 on the great breakwater at Cherbourg, as this is charged to seacoast defense.

Rivers	$113 268,400
Canals	152,678,700
Total	$265,947,100

SEWERAGE OF THE DISTRICT OF COLUMBIA.

In August of last year the President of the United States, in conformity with the act making appropriations for the expenses of the government of the District of Columbia, appointed a board of sanitary engineers, Messrs. Rudolph Hering, Samuel M. Gray, and Frederick P. Stearns, to formulate plans for the improvement and extension of the existing system of sewers in the District.

After a careful and thorough study of the problems involved, the Board has submitted its report.* The subject investigated appears to include somewhat unusual and difficult conditions. As in several others of our large cities, the sewers have gradually increased in number and magnitude (252.2 miles having been built), without any comprehensive plan having been adopted. Outlets which at first were unobjectionable, from the moderate amount of sewage discharged, with the great increase of population and consequent extension of the sewer have become sources of great offense, and even of danger to health. Large outlet sewers have been built, involving the expenditure of much money, and these have intensified, instead of improved, this condition of things; and, above all, a large area exists in the center of the city, a considerable portion of which is closely built up, which, from its slight elevation above tide, is exposed to flooding from freshets in the river — having, three times during the past thirteen years, been covered with water to the depth of several feet.

The report is divided into five parts. The first is introductory, giving a general idea of the topography of the city of Washington; a concise statement of what has been done up to the present time to provide for the discharge of the sewage, with an account of the nuisances thus created, and description of the main outlet sewers; a summary of the different suggestions and schemes proposed for improving the sewerage system; and an account of Captain G. W. Symons' plan for the reclamation of the central low district, which has been so frequently devastated by floods, by elevating the streets, alleys and reservations, one foot or more above the maximum height yet attained by any freshet in the Potomac.

In Part II. the final disposition of the sewage of the city is taken up and discussed. Speaking first of the fundamental necessity of directly or indirectly purifying the sewage, the report says:

> "The purification of sewage is accomplished by an oxidation of its organic substances through the agency of microbes in the presence of a sufficient supply of oxygen. In practice it can be brought about by allowing the sewage to percolate intermittently through a porous soil, or by highly diluting it with water. In both cases the necessary oxygen can be supplied from the air contained in the interstices of the soil or dissolved in the water. The bacterial work in converting the organic into inorganic matter is comparatively slow, particularly where sewage is turned into a body of water, as the quantity of oxygen required is large. Therefore, a considerable amount of land or very large quantities of water are respectively required. The solid particles containing less than half of the organic matter can, however, be removed more rapidly either by subsidence, by mechanical straining, or by chemical precipitation, leaving the sewage in a condition to require much less land or water for a final purification. The available opportunities and conditionss for purifying the sewage in each particular locality will, therefore, indicate the proper way by which it should be accomplished."

A partial purification of the sewage by subsidence or chemical treatment is disposed of not only as being quite expensive both in first cost and in annual expense, but also as being unnecessary in this particular case; more complete purification, by intermittent filtration or broad irrigation, is equally unnecessary, and is also unattainable within a reasonable distance of Washington on account of the lack of a sufficient quantity of suitable land.

The remaining method of discharging the sewage directly into the Potomac, the sand and other heavy substances being removed by subsidence, and the coarse floating substances intercepted by screens, is the one recommended.

From the best data attainable the ordinary low water flow of the Potomac is taken at 2,300 cubic feet per second, it being considered that the occasions at which the discharge may be much less will be at such infrequent intervals, and of such short duration, that no serious harm will then result from less dilution of the sewage than would be given by the above assumption. Various authorities, it is stated, have concluded that a flow of from 1.5 to 3.3 cubic feet of water per second will sufficiently dilute the sewage of 1,000 people. This, at the ordinary low water flow, would provide for a population of from 690,000 to 1,567,000. Even at the rate of 4 cubic feet per second per 1,000 inhabitants, recommended for Chicago, with its large amount of sewage from stock yards and slaughter houses—very different from the conditions prevailing or likely to prevail in Washington—the Potomac at its ordinary low stage would provide for 575,000 people. The opinion is given by the Board that the Potomac will dispose of the sewage of a population of at least 800,000 without causing offense "provided the sewage is mixed uniformly with the whole volume of water discharged by the river."

Three different points of outlet for the sewage, all in the Potomac, are considered: (1) Near Easby's Point. (2) Above the Eastern Branch opposite Gravelly Point. (3) Below the Eastern Branch, at the first projecting point above the Naval Magazine.

While estimates are given for projects discharging a portion or all of the sewage at each of these points, the project with the third point of outlet is the one recommended, on account of the much more rapid and complete diffusion of the sewage that will take place there, due to the much greater volume of water passing both during ebb and flood tides in low stages of the river (ten times as much as at Easby's Point), and the short period of slack water at turn of tide, and also on account of its being so far below the city as to prevent the return of the sewage on the flood tide.

The outlet opposite Gravelly Point is next in order of merit, and the one at Easby's Point the least desirable of all.

Part III. treats of the protection of the low district from floods, which though not specifically included in the problem submitted to the Board, yet has so many features in common with those required for flood prevention that it was deemed necessary to consider them jointly. The project of Captain Symons only includes raising the public streets, alleys and reservations to the requisite height, and replacing the public property in the same condition as before, including the improvement of the quality of some of the pavements. For this he estimates the cost to be $2,020,694.05. The cost of raising private buildings, tracks and other structures in the streets belonging to private corporations is not included, and these items, together with the cost of additional large sewers for storm water, the Board estimates, would probably swell the total cost to $5,000,000 This is one-third more than their estimate for the total cost of the proposed system of sewerage including the protection of the low district from floods. There is, moreover, no certainty that future freshets may not rise a foot or two higher and still flood this portion of the city after it has been raised.

In place of thus elevating the grade of the streets, it is proposed to construct a dike or levee at one end of the low district, from Virginia Avenue to the Monument grounds, and a second one at the other end across the valley of the James Creek Canal at N Street, both of them to have an elevation of six feet above the highest freshet line. High level sewers will be built to intercept all the storm water possible from the adjacent high lands, so as to diminish the amount to be cared for in the low district. A large trunk sewer will receive both sewage and storm water from this area and deliver them at the pumping station at the foot of New Jersey Avenue, on the Eastern Branch. Heavy rainfalls will discharge by gravity into the Eastern Branch at ordinary stages of the river. Light rainfalls will be pumped up and delivered with the rest of the sewage to the Naval Magazine outlet; and during high stages of the river all storm water will have to be pumped up, delivering heavy rainfalls directly into the Eastern Branch. The existing sewer on B Street it is proposed to utilize for discharging the comparatively pure storm water from the adjacent parks into the tidal basin during heavy rains.

Part IV. discusses the questions of the future population of the district, the amount of sewage requiring removal, the amount of storm water to provide for in proportioning the sizes of the storm water interceptors, and the form, material and minimum velocities assumed for the proposed sewers. It also gives a general description of the five different projects for which estimates have been made.

The future growth of the district was difficult to estimate on account of the abnormal increase of population during the war period—in the decade 1860 to 1870—since which time only two censuses of the United States (1870 and 1880) were available. The police censuses of 1885 and 1888 being taken with less care, could not be given the same weight. In forecasting the future growth it was preferred, therefore, to seek probable maximum and minimum curves rather than a single one, as usual. From these the Board gives as its judgment that it is sufficient to provide, in the proposed sewage works, for a population of 500,000.

The water consumption of Washington being unusually large, the sewage flow, including the ground water entering the sewer, is taken at 20 cubic feet per individual per day; and the intercepting sewers for carrying sewage are proportioned to carry this quantity when running half full. This is deemed sufficient to provide for a small amount of rain-water and the moderate fluctuation in the hourly consumption of water, the maximum being 14½ per cent. greater than the mean.

Much attention has been given to the subject of maximum rainfalls and amount of storm water reaching sewers. To assist in the determination of this point, tables and diagrams were prepared giving the amount of rainfall, duration and rate per hour of the maximum rainfalls for several years past in Boston, Providence, New York, Philadelphia and Washington.

The estimates for the five different projects considered are as follows:

No. of Project.	Main Outfalls.	Total Cost.	Cost of Interest and Depreciation.	Cost of Pumping and Maintenance.	Total Annual Cost.
I.	Near Naval Magazine....	$3,598,003	$143,920	$19,920	$163,840
II.	Opposite Gravelly Point..	3,343,002	133,756	19,920	153,676
III.	Four-tenths near Easby's Point and six-tenths opposite Gravelly Point....	3,393,825	135,753	11,474	147,227
IV.	Two-thirds near Easby's Point and one-third opposite Gravelly Point...	3,205,676	131,827	11,474	143,301
V.	Opposite Gravelly Point...	3,873,671	154,947	11,474	166,421

The first project, which is the one recommended, contemplates the construction of three high-level intercepting sewers for storm water and sewage (which will deliver their storm water respectively at Easby's Point, in the Washington channel at M Street, and in the Eastern Branch at the foot of New Jersey Avenue), besides the trunk sewer in the low district already mentioned. Three low-level interceptors, for sewage, will also be provided, to intercept the sewage from all local sewers now existing, or to be built in the future and also from the high-level interceptors above mentioned. These will discharge their contents into the trunk sewer, which, in its turn, will deliver the sewage of the whole city (excepting a part of Georgetown, which, it was considered, could continue to deliver its small amount of sewage directly into the Potomac) to the pumping station on the banks of the Eastern Branch. Here, after removing the heavy matters by settling tanks and the coarse floating matter by screens, the sewage will be pumped up to a sufficient height to enable it to flow by gravity through a triple line of 48-inch cast-iron syphons under the Eastern Branch, thence through a brick outfall sewer to the banks of the Potomac near the Naval Magazine, and finally through two 48-inch outlet pipes to the edge of the channel, about 500 feet from shore.

An appendix gives a detailed description of this project and of the pumping station, centrifugal pumps being recommended for lifting the sewage. Detailed estimates are given of the cost of the five different projects, the tables of rainfall already mentioned, etc. Twelve plates accompany the report, including a map of the city of Washington, showing the present main sewerage and sewage outfalls and territory flooded in June, 1889; sketches showing movement of sewage discharged, and comparative dispersion at the different outfalls; diagrams of growth of population in different American cities, with estimated curve for future growth of Washington; diagrams of maximum rainfalls in several cities; curve showing amount of rain water assumed to reach sewers for the conditions prevailing in Washington; plan and profiles of the recommended project for a system of sewerage and drainage for the district, and a sketch plan of the proposed pumping station and accessory works.

The report is one upon which the members of the Board have evidently expended much thought and study, and is a valuable contribution to the literature of sanitary engineering.

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* House of Representatives, Fifty-first Congress, First Session, Ex. Doc. No. 445, pp. 75. Plates XII.

BUILDING CONSTRUCTION DETAILS.

No. XXXIV.

(Continued from page 344 Vol XXI.

THE CHICAGO AUDITORIUM.

PART II.—MAIN ROOF TRUSSES.*

Figure 10 is a diagram of half of truss A (Fig. 1, page 296, Vol. XXI.) and its suspended ceiling, both of which are symmetrical about the center line Z' Z'.

Figure 2 shows details of the connections of Fig 10; X X is the floor line.

Figure 3 is a section and elevation at X X, Fig. 2, and Fig. 4 is a section and elevation parallel to Z Z, Fig. 1.

Figure 5 is a section and elevation at Y Y, Fig. 1.

Figure 6 shows the connection at the foot of the curved frame C, and Fig. 7 is a section and elevation at V V, Fig. 6.

Figure 8 shows the connection of the frame C with the foot of suspender rod E, Fig. 1; and Fig. 9 is a section and elevation at Z Z, Fig. 8.

Figure 13 is an elevation showing details of the truss N, Fig. 1 (page 296, Vol. XXI.).

Figure 15 shows the connection of the sloping ceiling beams A A, etc., to the curved frame C.

Figure 14 is an elevation at X X, Fig. 15. The end of the beam A, though not in section, is blackened for greater distinctness.

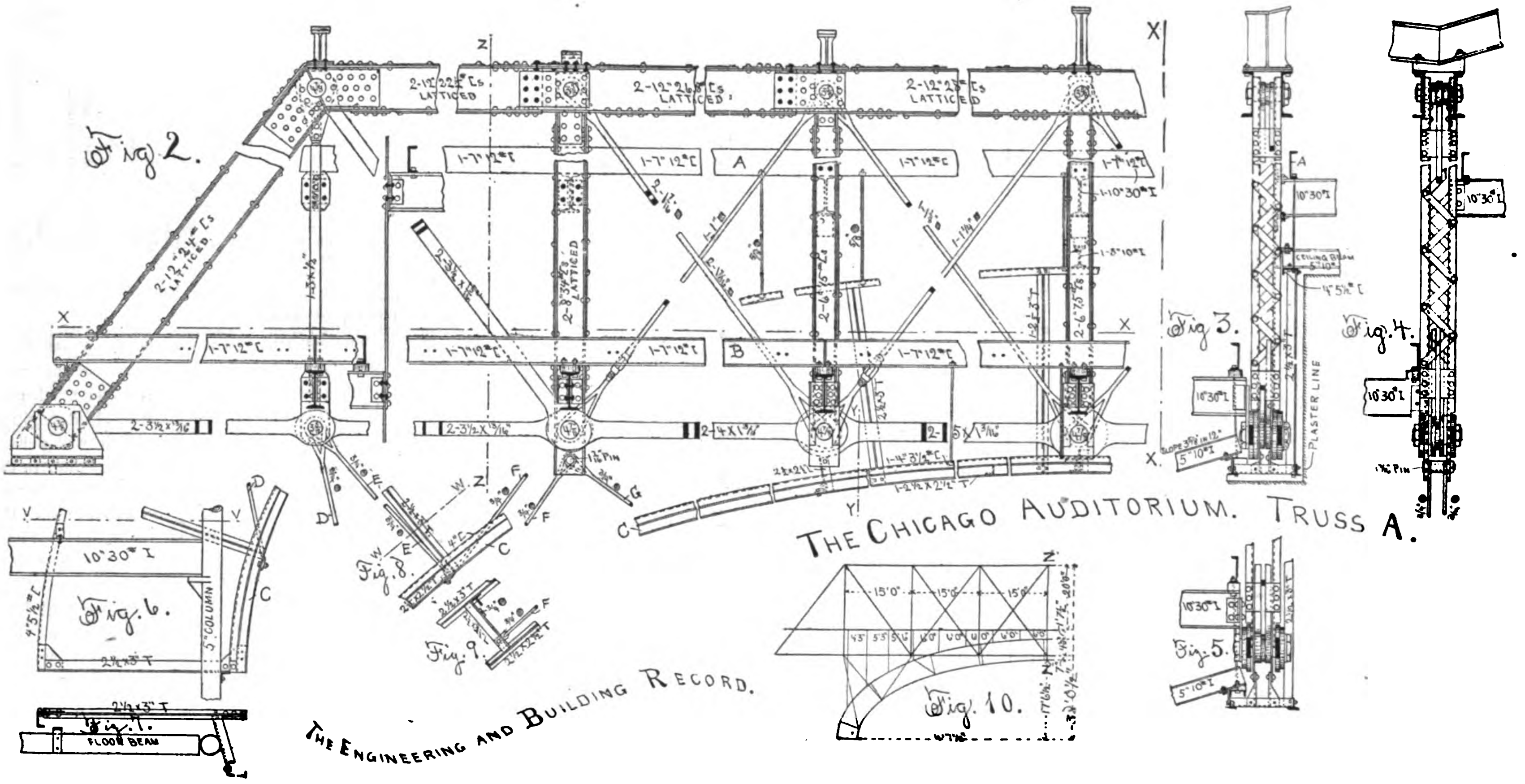

Figure 16 is a section and elevation at Z Z, Fig. 13.

Figure 17 is an enlarged section and elevation from Y Y, Fig. 13.

Figure 18 is an elevation of some of the connections of the truss J, Fig. 1 (page 296, Vol. XXI.).

There are eight panels in the truss, but the details shown here of the three end panels illustrate all the features of arrangement and construction.

Figure 19 is a section and elevation at Z Z, Fig. 18.

Figure 20 and 21 are in section and elevation from V V, Fig. 18.

Figure 22 shows the connection of the foot of the suspender B to the gallery girder E'.

(To be continued.)

At Sheffield, England, of which an English paper speaks as one of the smokiest towns in the world, the smoke prevention question is being vigorously agitated.

The Pittsburg *Commercial Gazette* complains that street railway franchises in that city are free as air, and that, in consequence, large sums of money are lost to the city.

THE FILTRATION OF NATURAL WATERS.*

In the study of the subject of filtration of water for drinking purposes, we shall arrive at no clear and valuable ideas unless we distinguish sharply between mechanical filtration, which deals only with the interception and retention in the filter of the solid particles suspended in the water, and filtration combined with the oxidation of organic matter, that in solution, as well as that in suspension in the water. This latter process—the purification of the water by the oxidation of its organic contents—can be accomplished only by *intermittent* filtration, the former—the mere removal of the solid particles in the water—may be accomplished by *continuous* filtration, as practiced in many large cities in Europe.

When we speak of the purification of water by filtration, we mean in a general way that a water is thereby rendered fit to drink which was unfit or unattractive before it was filtered. The change effected by filtration may be simply the removal of vegetable or earthy matters, whereby the water is made more palatable and more attractive in appearance, or it may be more radical in converting water which was positively harmful into a good drinking water. Widely different in action as are the two systems of filtration, the intermittent and the continuous, yet it is possible by both systems to improve the quality of a bad water.

In the system of continuous filtration, in which there is little or no change made in the dissolved organic matter, it might at first thought seem as if there could be only imperfect purification; but it must be borne in mind that it is possible in this system to remove in great part even those very minute organisms, the bacteria.

The germ theory of disease furnishes us with the simplest explanation of the way in which water does harm, and if we can, by simple mechanical filtration, remove the harmful germs from the water, we have effected a true and efficient purification of that water, whatever may be its chemical composition.

When water is said to be well, or moderately well, or completely purified by filtration we cannot know what is meant unless we know what is the standard of purity implied. Is it simply the removal of color, odor and suspended matter; is it chemical purity, meaning thereby the absence of unoxidized organic matter; or is it bacterial purity, or freedom from germs? Again, what shall we say of water of high chemical purity, with high bacterial contents; or what of a water with few or no bacteria which contains considerable organic matter capable of undergoing change?

Intermittent filtration is capable of giving water free from organic matter and free from germs; continuous filtration, if conducted very slowly, is capable of giving water free from bacteria, without odor and color, but which may contain much dissolved organic matter. Intermittent filtration effects the oxidation of the organic matter in solution as well as that in suspension; continuous filtration has little or no effect on the organic matter in solution.

After laying such stress on the removal from water of bacteria, it sounds like a paradox to say that purification both by intermittent and continuous filtration depends on the presence in the filter of bacteria in enormous number, and that without them the purification would in both cases be impossible.

The idea is not a new one that the bacteria of decomposition are benign and useful organisms which break up organic matter, rearrange its atoms and convert it into mineral matter so that it may again serve as food for plants. If we keep away the bacteria from a mass of dead organic matter it undergoes no change whatever. All processes of decay of organic matter are absolutely dependent on the presence of these micro-organisms, which, so far as we know, have no other than a beneficent role to play in nature. I say this is now a matter of common knowledge and one is therefore not unprepared to hear, that in the purification of water by intermittent filtration the ground or sand upon which the water is poured is full of bacteria, in fact, that it is the design of the process to cultivate them and have as many of the micro-organisms in a cubic inch of ground as possible.

If one pours over a column of clean, bright, sand, free from bacteria, impure water, as sewage, it will flow out about as bad as it entered the sand. But if it is poured over a column of sand in which septic bacteria have been cultivated, so that the sand may be said to be fairly reeking with bacteria by the million, the water may flow out as pure (organically) as spring water.

Sewage is a substance which contains all of its nitrogen in the unoxidized form. Its principal ingredient is free ammonia; it also contains considerable organic nitrogen, or albuminoid ammonia, but of nitrous or nitric acid it contains none. When sewage is exposed to the air in mass, oxidation goes on very slowly, because it can only get air from its surface; when it flows out into streams, the oxygen dissolved in the water of the streams quickly oxidizes the ammonia. When the sewage is exposed to the air in very thin layers, as when a porous material like sand is moistened with it, oxidation goes on with great rapidity. It was until recently considered that this oxidation was a direct chemical combination of the elements of the organic matter with the oxygen of the air, or the oxygen dissolved in the water, but we now know that nitrogen is not oxidized by the direct contact of decomposing nitrogenous matters with air, unless bacteria are present, and the inference seems a fair one that the greater the number of bacteria the more rapid the process of oxidation. Sewage itself usually contains hundreds of thousands of bacteria to the cubic centimeter which are dormant until air gets access to it. If sewage is preserved out of contact of air, the bacteria of decomposition will in time all die.

The experiments of the Massachusetts State Board of Health on the purification of sewage by intermittent filtration which have been carried on at Lawrence for the past two years, under the direction of Mr. Hiram F. Mills, the engineer member of the Board, have added largely to our knowledge of the conditions governing the purification of nitrogenous organic matter. Here are large tanks, $\frac{1}{200}$ of an acre in surface, filled with different materials—coarse sand, fine sand, river silt, muck, garden soil, clay, etc., to the depth of 5 feet, on which is poured from day to day sewage in known amount and of known composition. The effluent water from this sewage filtration is collected, measured and analysed and the precise amount of purification determined. The result of two years' work at this station will shortly be published in the Report of the Board now in press. I will at present give one or two of the facts that have been there developed. The purification of the sewage means the complete oxidation of all its organic ingredients both in solution and in suspension—the carbon to carbonic acid, the hydrogen to water, and the nitrogen to nitric acid. The filtering materials best adapted to the purpose are those which are fine enough to retain considerable sewage in their pores and also plenty of air at the same time.

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* Part I., General Description and Elliptical Ceiling was published April 12.

* From a paper by Thomas M. Drown before the Boston Society of Civil Engineers, published in the *Journal* of the Association of Engineering Societies.

The body of porous material is, when in good working order, a very delicate machine. It must be coaxed up to its highest efficiency by gradually increasing the amount of sewage. This means, in all probability, that we must develop in the pores of the sand an immense number of bacteria to be constantly on hand in the different layers to attend to the sewage as it reaches them. During the first winter there was no nitrification in these tanks, and, consequently, no perfect purification, but on the advent of spring, when the temperature of the effluent water reached 39° Fahr. nitrification began and has continued ever since, the cold weather of the second winter failing to stop it.

The tank which has given the best results, that is, a good purification of the largest quantity of sewage for a long period, is filled with coarse mortar sand, most of the grains of which average about 0.06 inch in diameter. This has given an effluent day after day organically as pure as many drinking waters, when receiving sewage at the rate of nearly 60,000 gallons per acre per day.

One would naturally ask why is not this the ideal system of purification of all surface waters, even those that are not polluted by drainage of any kind but which contain much vegetable suspended matter, and have, in consequence, sometimes, a bad odor; or waters which are unattractive in appearance by reason of dissolved coloring matter?

One of the tanks of the Lawrence Experiment Station has filtered Merrimack water intermittently for more than two years at the rate of 300,000 gallons per acre per day. The filtering material consists of 3 feet 8 inches of coarse and fine sand and fine gravel; 10 inches of yellow sandy loam, and 6 inches of brown soil in the same position as found on the river bank. During the day the surface of the sand is generally covered with a few inches of water, but at night and on Sunday air gets excess to the sand.

The water is free from microscopic organisms, and the bacteria rarely exceed 10 or 20 per cubic centimeter, while the water applied has generally a few hundred. During the two years that this tank has been in operation the surface has not been cleaned or disturbed in any way. The slow rate of filtration (being only about one-half an inch an hour per square foot of surface) is due to the considerable amount of very fine material contained in the soil and loam.

But one must bear in mind, in connection with the rate of filtration, that the thoroughness of the purification, meaning thereby the oxidation of the organic matter, is much greater in intermittent than in continuous filtration.

This system of intermittent filtration for natural waters has never, I believe, been carried out on the large scale, although the possibility of its being practicable in some localities has been discussed. It is the system that nature suggests, for it is intermittent filtration which supplies the springs which furnish the ideally pure and perfect drinking water. With intermittent filtration the deposit of organic matter in the pores of the sand would dry out or become oxidized when the ground was more or less dry.

It has been to many a difficult matter to explain how filters working continuously, and constantly covered with water, could intercept objects so much smaller than the spaces between the particles of sand. It was easy to imagine that some of the minute suspended particles might be caught between the particles of sand, but that practically all the suspended matter, even the minute bacteria, could be removed in a good-working filter, seemed to indicate that the efficient working of a filter depended on the fact that it became nearly clogged on the surface by the algæ and other matter which held back even the smallest objects. But if this were the case it would save time to use a finer sand at the outset, which experiment shows will not accomplish the purpose.

Piefke has given us the clearest conception of the action of sand filters in removing the suspended matters, including bacteria, from surface waters. The chemical effect is very slight, as might be supposed when one reflects that the duration of the passage of the water through the sand seldom, if ever, exceeds 5½ hours, and, since the filter is kept constantly covered, there is no oxygen present but that dissolved in the water. But the mechanical effect in removing suspended matter—mineral and organic—is very great. The Spree water, which forms part of the supply of Berlin, contains as high as 100,000 bacteria per cubic centimeter at times, and the number in the filtered water rarely exceeds 100, that is, the reduction of bacteria may reach 99.9 per cent. The thickness of the sand layer is generally from 2 feet to 3 feet, and this rests on a layer of coarser gravel, which is without any effect on the filtration. The size of the sand is seldom finer than one-fiftieth of an inch, which leaves channels between the grains that 500 micro-organisms could pass abreast. Smaller still are the particles of clay which give a milkiness to water, and yet when one of these sand filters is working well, both clay and bacteria are held back in the sand. It takes a new filter about two weeks to get to its maximum efficiency, and if the sand be first carefully cleaned and sterilized by heat, then it takes much longer, many weeks, before the filter works well.

On examining with the microscope the surfaces of the particles of sand when the filter is in perfect working order, they are found to be coated with a greasy, slimy substance, which is a mass of bacteria jelly. It is to this coating of bacteria jelly that Piefke attributes the efficiency of these filters, and until the jelly forms in sufficient amount to completely envelope each particle of sand, the filters work imperfectly. This then is his explanation of the fact that minute micro-organisms and particles of clay of infinitely smaller size than the channels in the sand are stopped in their passage through it—they are simply caught in this slimy coating and cannot get further.

A filter of this kind is, like that used in intermittent filtration, a very delicate instrument and it is very easy to disarrange it. Disturbance of the sand or suddenly increasing the pressure of the water may have, as a consequence, a rush of bacteria into the filtered water. Quite regular working is an essential condition of success. The rate of filtration is on an average only four inches vertically an hour, so that in the passage of the water through the sand, one-third of which is interstitial space, its rate is three times as great, or 12 inches an hour, and the sand layer being two feet thick, the water is in contact with the sand only two hours. In very turbid waters or waters very high in bacteria the filtration is often decreased to one-half this rate or even less, and in comparatively clear water, with low bacteria, the rate may be doubled. The working of the filters in Berlin is governed entirely by the number of the bacteria in the filtered water, this being the

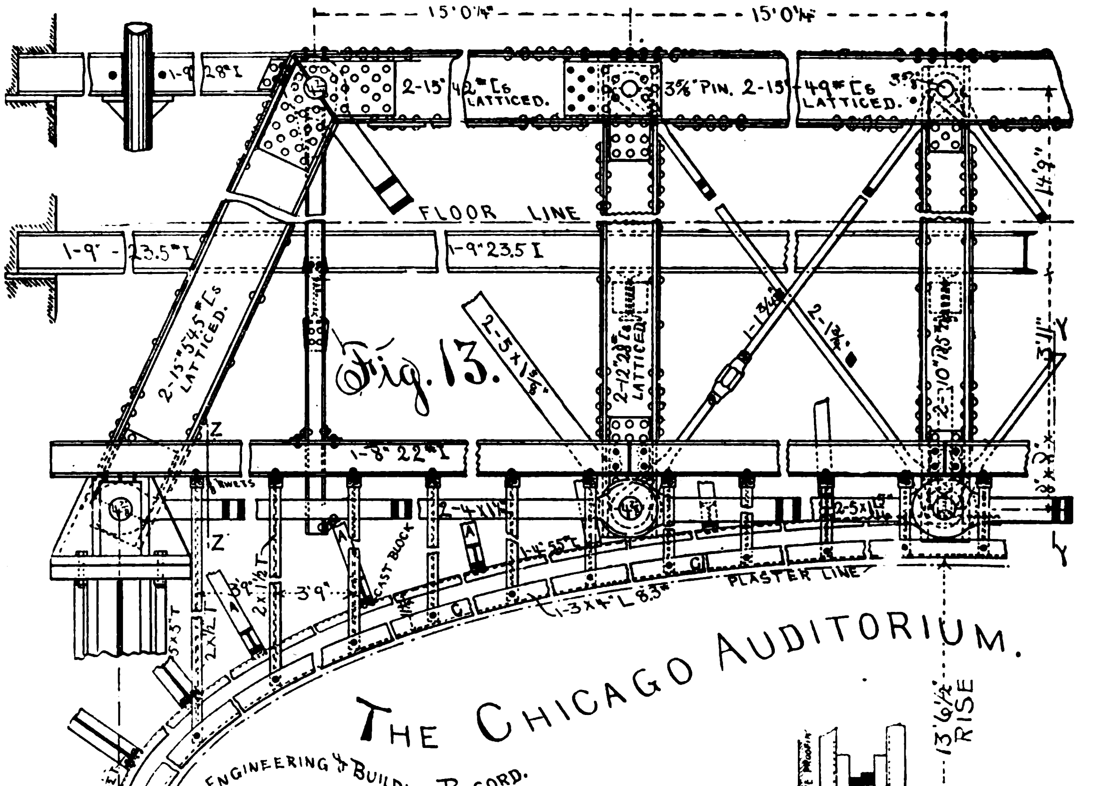


Fig. 13.

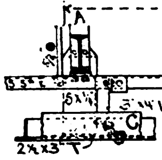


Fig. 14

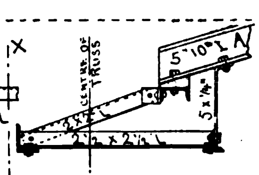


Fig. 15

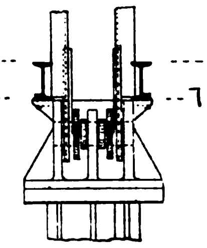


Fig. 16.

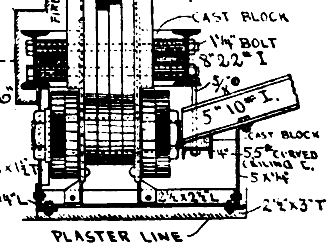


Fig. 17.

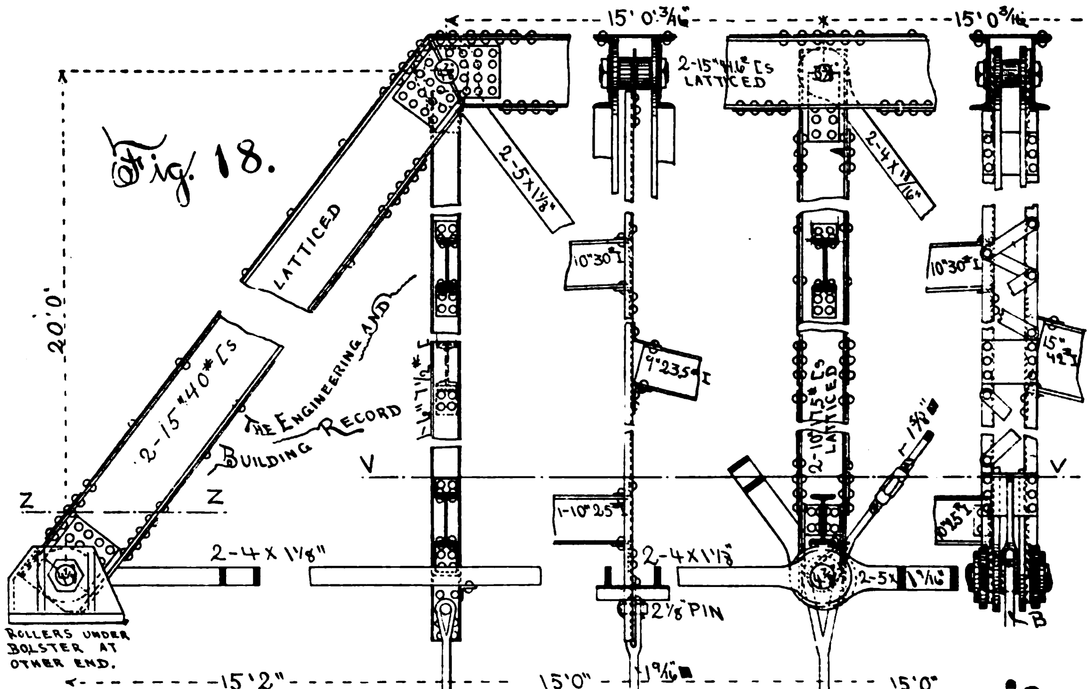


Fig. 18.

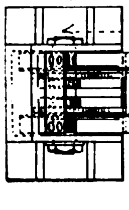


Fig. 19.

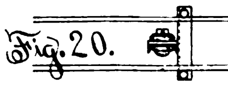


Fig. 20.

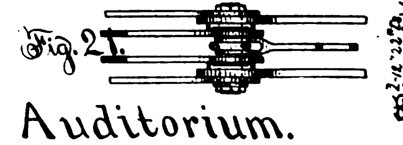


Fig. 21.

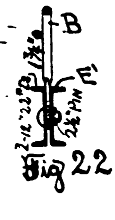


Fig. 22.

The Chicago Auditorium.

simplest way of judging of the efficiency of their working. One hundred bacteria per cubic centimeter in the filtered water is considered a good result on the Spree water, which contains always many thousands To give practically sterile water would require a diminished rate, say to one vertical inch an hour, which would be impracticable without enlarging the filtering plant.

The surface waters used to supply London from the Thames or the Lee are filtered by the method of continuous filtration, a surface of 100 acres being required for the purpose. The thickness of sand differs with the different companies supplying the city with water, from two feet at the East London and Grand Junction Companies to four and a half feet at the Chelsea Company, and the rate of filtration per hour, in imperial gallons per square foot of filtering surface, is two and one-sixth with the Lambeth Company, to two and one-half gallons with the Southwark and Vauxhall Company. Two and one-half gallons, or five vertical inches an hour (which is seldom attained) is considered the maximum consistent with good clarification. Complete analyses are made of the water supplied to the metropolis by the different companies. Some of the determinations, as for instance, color, and the amount of permanganate to oxidize the organic matter, are made daily, other chemical determinations are made weekly.

The only filtering plant in this country, that I know of, which at all compares with the plants in Europe is that at Poughkeepsie where the Hudson River water is converted into good clear water, though not absolutely free from color. Mr. Fowler, the superintendent of the works, writes me with regard to the details of the filtration: "Our usual rate of filtration is about six inches per hour, vertically, and this we regard as the maximum of efficiency, although we can sometimes do good work, so far as clarifying is concerned, at double that rate, and at other times are unable to do good work at one-half that rate, although the latter condition is exceptional. Very much depends upon the condition of the water in the river. The depth of water on the sand varies from one to three or four feet, and the difference of level between the surface of the water on the beds and that in the intermediate basins is usually two to four or five feet."

The rapid filtration of water through coarse gravel is not unfrequently carried out at water-works to remove the larger particles floating in the water. When a filter of this kind is cleaned it is surprising to see the amount of fine dirt of all kinds that has been intercepted by the coarse material. Filters of this character do not pretend to purify the water in the sense of removing bacteria or in oxidizing the organic matter, but they are useful just to the extent to which they clarify the water and thereby improve its appearance.

The American system of filtering large quantities of water may be said to be the mechanical filters working under pressure. These filters are composed of 4 or 5 feet of moderately fine sand (some have also a mixture of coke) inclosed generally in boiler iron cases. They work with tremendous rapidity, sometimes over a 100 vertical feet an hour, but 40 feet is said by some to be the highest rate consistent with good filtration. In this system alum is generally added to the water as a coagulent. Its effect in very small amount is quite remarkable—say a grain to a gallon or even less—in retaining the solid matters of the water in the sand of the filter. The alum is decomposed by the carbonates in the water and hydrate of alumina is precipitated. This is a gelatinous and slimy substance, and immediately surrounds the algæ, clay and anything else that may be suspended in the water, and the sand retains this coagulated mass. Alumina has also the effect of taking the color out of water, so that clear, colorless water may be obtained by this process from swampy waters full of growing algæ, with almost incredible rapidity.

These filters are in very general use in paper mills and other industrial works where a clear colorless water is needed, and where a colored turbid river water is the only natural supply available. They have also been introduced into some cities of considerable size as, for instance, Long Branch, Chattanooga and Atlanta, and they are said to give water that is satisfactory to those who use it. The objection to the system is the use of alum. If all the alum used were decomposed in the few seconds that it takes the water to pass through the filter, so that no undecomposed alum passed into the filtered water, there might be no objection to its use, but this is not always the case. The amount of alum used is ordinarily small, and it is claimed that if it even all went into the filtered water it would not injure it for drinking. This may be so, but the prejudice that exists against drinking water which has been treated with "chemicals" is so strong that it is not likely that any system using a coagulent in a soluble form will find general acceptance. Under some conditions, when the water has high color with much suspended matter, the alum has to be increased largely to give good results. I have known as high as 17 grains to the gallon to be used with a very bad swampy water.

In this connection should be mentioned the spongy iron filter of Bischof, which gives most excellent results both in taking out suspended matters from the water, including the bacteria, and also decreases the hardness of the water. This filter has been used on the small scale in houses, and also on the large scale in Antwerp to decolorize and otherwise purify the water of that city. The filter is composed of finely divided metallic iron made by reducing iron ore by means of carbon at a temperature below fusion. Its action was not understood for a long time, and the mystery that surrounds it was an additional recommendation for it. The rationale of its working seems to be this, namely, that the iron being in a very finely divided state is dissolved to a slight extent by the combined action of the oxygen and carbonic acid in the water, and the ferrous carbonate thus produced is further oxidized, forming hydrate of iron, and then this acts as a coagulent just as the alumina hydrate does. The system was said to be too expensive on a large scale, and it has now been replaced at Antwerp by the Anderson process in which the dark water is made to pass through a long revolving iron cylinder in which there is a large quantity of fragments of cast-iron. These fragments of iron in their friction one on the other are abraded, minute particles are broken off, which are dissolved in the way above described. The water coming from the revolving cylinder is exposed to the air, the iron oxidizes and precipitates, combines with the coloring matter in the water, incloses the solid particles, and is then filtered out through sand. The process is said to work satisfactorily and give clear colorless water. There is no objection to this use of iron as a coagulent provided that it is all oxidized and precipitated, and none is carried in solution into the filtered water; but this takes time.

Both alum and iron salts have a tendency to sterilize water. Their action may be both direct by killing the bacteria, and indirect by removing them with the precipitated alumina or iron hydrate. If a drop of a solution of alum, or of iron chloride be added to a gallon of turbid water, it will become perfectly clear in the course of a few hours, the alumina, or iron hydrate, which is formed in the water, settling to the bottom and carrying all the suspended matters with them. It has been proposed to clarify Mississippi water by adding a very small quantity of an iron solution to the water in the settling basins.

Correspondence.

Communications giving information or opinions on matters of general interest to the engineer, the architect, the contractor, or the municipal officer, will be welcomed in this column. Fairness will suggest that when communications are sent simultaneously to this and other journals we should be informed of it at the time. Anonymous letters will not be noticed.

THE SECRETARYSHIP OF THE AMERICAN SOCIETY OF CIVIL ENGINEERS.

BROOKLYN, November 12, 1890.

To the Editor of THE ENGINEERING RECORD.

SIR: The Nominating Committee of the American Society of Civil Engineers has recently submitted a list of offices to be balloted for at the annual meeting, among which is that of a non-resident associate for secretary.

This nomination conflicts with the organic law of the society. Its constitution divides the membership, with regard to location, into two classes; those who reside within 50 miles of New York City being resident, and all others being non-resident. It confers upon associates all of the privileges of membership except the right of voting; it makes the secretary a director, who is a trustee under the act of incorporation and the laws of New York State, upon whom, with his colleagues, devolves the management of the society's affairs (requiring him to vote, which an associate may not do), and it prescribes that of those named for offices by the Nominating Committee, one vice-president, three directors, the secretary and treasurer, shall be resident members.

The nomination is inconsistent with the usages and policy of the society up to the present time. Those active in its councils and familiar with its history have heretofore uniformly held that its officers should be elected from its resident membership. The nomination is also contrary to precedent. The first Nominating Committee first named for secretary a non-resident member, and afterwards substituted a resident member, who was elected and has served since.

It would seem that of all classes of men engineers should be strictly obedient to law, particularly that of their own making. In his practice and of his standing among his professional brethren, the crucial test is his interpretation of "what is written" in contract or what is understood by agreement between those with whom he has to do, and his decision thereon without fear or favor. "Mr. Fisher," said the president of a leading railway to his chief engineer, "Why are you regardless of your own interests?" "In what particular," was inquired. "You take the part of contractors against the railroad." "Do not you know," was the reply, "that in my position I have always to determine that which is right and just between the parties?" Those whose good fortune it was to know the chief engineer never doubted that he did this faithfully and well.

It is said that now to the members will be given the opportunity of voting in favor of the policy (*first*) that "the secretary shall be one not practicing as civil engineer;" and (*second*) who will give "his entire time and effort to the society and the furtherance of its interests." Waiving the contention that the irregularity of the pending nomination renders it void, it is difficult to see how any decision upon the *first* proposition may be had at the present time unless two candidates are offered for ballot, each understood to represent the one or other diverse view as to the grade of membership from which the secretary shall be chosen. The result as to the *second* proposition will also be indefinite. Without action by the society before the annual meeting otherwise determining the secretary may continue to accept other engagements, and to devote thereto such of his time and energy as may to him seem right, having due regard for the interests, personal to himself and accruing to his benefit, with which every true man is charged.

Whatever unfavorable criticism of this practice heretofore has been made, no matter how intended, has really not been of the secretary, but of the society itself, because of its peculiar conception of the position of its chief executive officer. Formerly the secretary received $3,000 per year, out of which he paid his assistants—a plan which ingeniously lessened his own compensation, as by his faithfulness and efficiency he increased the measure of service to be rendered. Now he is paid the full sum and permitted to occupy a part of the society's house not otherwise used. Such, heretofore, has been the gauge of value by the society of the important and exacting duties discharged by a leading member. Is it strange that non-professional men fail to duly appreciate an engineer's worth and standing?

Generally there is more or less complaint that the society does not, in the public mind, take the rank or exert the influence which it should. Its publications, issued at irregular intervals and long after the date they bear, fail to keep the membership promptly informed of the advances made in professional knowledge and of the transaction of the society's business. In quality of matter *and typographical style* they are surpassed by some of those of kindred associations. Its library, rich as it is in rare and valuable material for study and reference, is consulted with difficulty by those who visit it, and to all others its treasures are practically inaccessible.

The efficiency of the requisite measures to enhance the worth, influence and strength of the society depend greatly upon the secretary. His powers should be amplified and increased; his duties enlarged and definite; his responsibility, clear and undivided; and, last but not least, he should be generously sustained and supported by the membership. His whole time and energy should be devoted to the service of the society, it being understood that during the official term he shall not accept other permanent engagement; for which his salary should be that of a chief engineer, and not less than $5,000 per year.

Whoever fills this office should also possess abundant theoretical and practical knowledge due to a thorough training and a wide experience in the practice of engineering, together with those personal qualities which fit him to shape the opinions and direct the consequent action of those associated with him. In brief, he should either be the incumbent if he will longer serve, or one so nearly like him as the society may fortunately elect.

G. LEVERICH.

[Editorial reference to this letter is made in another column.]

DISPOSAL OF PUBLIC SEWAGE.

DR. BENJAMIN D. LEE, Secretary of the Pennsylvania State Board of Health, has issued a circular on "The Disposal of Sewage of Public Places." The general tendency is to conduct the sewage of all large institutions into large streams, polluting them and making this one of the most urgent problems with which the sanitarian has to deal.

The city of Philadelphia was enjoined recently against the use of a small stream into which a sewer emptied and contaminated the water which had been clear prior to the introduction of the conduit.

Secretary Lee, in arguing upon the question, says:

"It is evident that if a city, which possesses the right of eminent domain, and is, by the terms of its charter, especially authorized to construct sewers, can be enjoined from discharging its filth into a small stream running through private property, so much the more can a hotel, school, hospital or jail.

"This matter is forcing itself upon the attention of borough authorities, hotel proprietors, mill owners, and other employers of large bodies of operatives throughout the entire commonwealth.

"The State Board of Health is especially desirous that all State establishments, such as asylums, hospitals, colleges and schools and all county institutions, such as jails and almshouses, which derive a portion, if not all of their support, from the public funds, and which are generally looked upon as models by the communities in the midst of which they are placed, should set the example to municipalities and private individuals of making proper provision for the purification of their sewage before it is permitted to enter any stream. The Board, therefore, earnestly represents to the trustees or other responsible heads of all such institutions the seriousness of this growing evil, urging that no time be lost in remedying any offensive and dangerous conditions which may be found to exist."

"MODERN RURAL HOMES" for September, October and November, 1890, published by the National Architects' Union, Philadelphia, Pa., contains, like the earlier edition, a number of suggestions for country houses in the shape of perspective views and plans, with brief descriptive particulars. The latter explain more clearly, than do the plans to the non-professional reader, the main details of the dwellings considered, and refer to the natur of the material to be employed, proposed methods of heating, etc.

DOMESTIC PLUMBING HEATING LIGHTING & VENTILATION ENGINEERING

ELECTRIC MOTORS.

(Continued from page 382.)

THE THONE MOTOR.

THE Thone Motor is built by the Hawkeye Electric Manufacturing Company, of Davenport, Ia. The most characteristic feature of the motor is its field magnets and the armature. The field magnets consist of two heavy and powerful horse-shoe magnets, of a form corresponding with the natural lines of force and terminating with their like poles in a massive pole-piece. There are no abrupt corners.

The motors are used for various kinds of work. When the motors are to run at a constant speed, the plain shunt winding is used. They are also made for speeds which require a maximum and minimum—such, for instance, as ice cream freezers, coal mining hoists—in fact, where various speeds are required. The method of regulating the speed for this kind of work is simple and positive in its action. The armature is of the well-known Gramme type. The core is built up of soft charcoal-annealed iron wire, laid in sections on a true drum, which is securely fastened to the shaft. The shaft is of steel, and runs in bronze bearings, firmly bolted to the pole pieces. The commutator segments are of drop forged copper, insulated with mica between the segments, as well as under the heads.

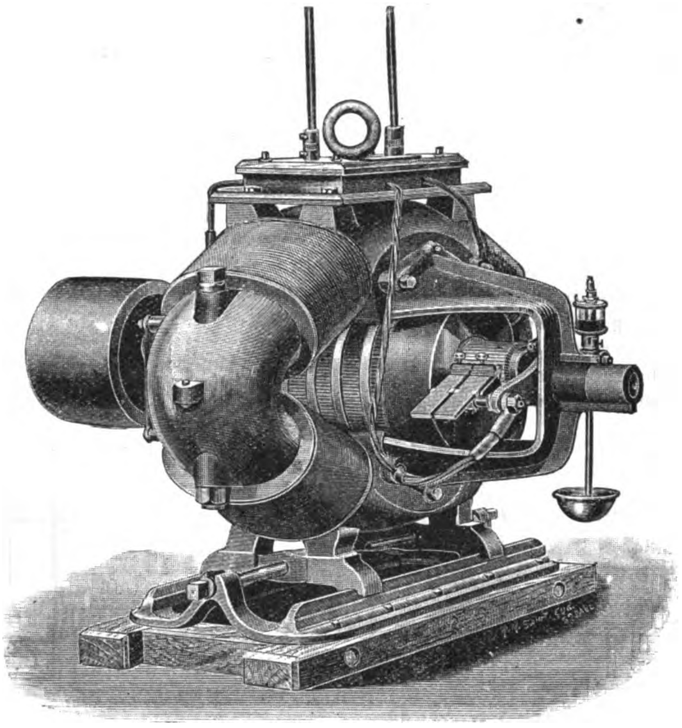


FIG. 27.—GENERAL VIEW.

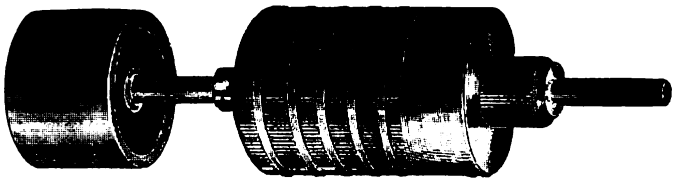


FIG. 28.—ARMATURE AND COMMUTATOR.

THE THONE MOTOR.

The motors are manufactured in sizes from ½ to 100 horse-power. Figure 27 represents a general view, and Fig. 28 shows the armature and commutator complete.

THE PERRET MOTOR.

The Perret motor, made by the Elektron Manufacturing Co., 79–81 Washington Street, Brooklyn, N. Y., is illustrated by Figs. 29, 30, and 31.

The chief distinctive feature of the Perret machines is the lamination of the field magnet. Instead of casting or forging this in several solid pieces, as is usually done, it is built out of thin plates of soft charcoal iron, which are stamped directly to their finished form and clamped together by bolts in such a manner as to secure great mechanical strength. The advantages of such a construction are claimed to be a magnetic field of much greater intensity than can be obtained otherwise, and the prevention of all wasteful induced currents in magnets and pole pieces. The armature core is also laminated, and the plates have teeth, which form longitudinal channels on its periphery in which the coils are wound. The plates in both field and armature are in the same plane, and are of soft charcoal iron, with its grain running in the direction of the line of magnetic force, and there is no air gap between the iron of the field and the iron teeth of armature, except that required for clearance in rotation. The armature coils being practically imbedded in the armature are claimed to receive the highest inductive effect from the magnetized iron

The Perret motors are all of the slow-speed type, running, it is claimed, at less than half the speed of many other motors of equal power and weight. The advantage of this is pointed out to be less rapid deterioration, and the absence of expensive gearing. The regulation of the motors is entirely automatic, freedom from sparking at the commutators is claimed, and the mechanical details are said to be well worked out.

Figure 29 shows the form of two-pole motor used for from ¼ to 2 horse-power. Figure 30 represents an end view of a motor of the multipolar type. This pattern has been adopted by the company for all sizes above 2 horse-power. Figure 31 is a diagram showing the magnetic circuit, the dotted lines representing the direction of the lines of force.

The Perret motors are made in sizes from $\frac{1}{12}$ horse-power up to 20 horse-power.

(TO BE CONTINUED.)

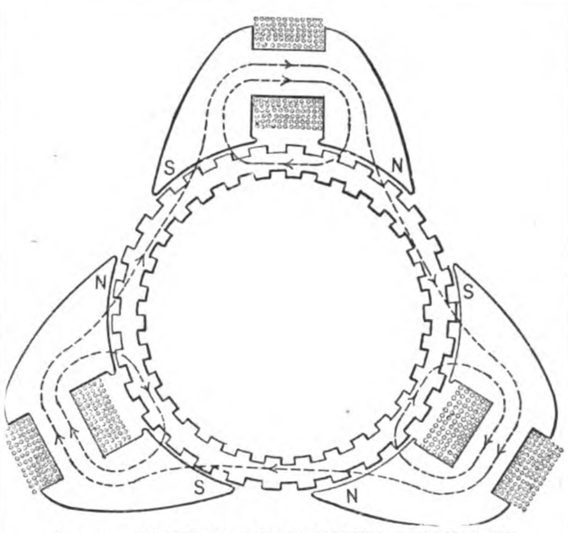


FIG. 31.—DIAGRAM OF MAGNETIC CIRCUIT OF PERRET MOTOR.

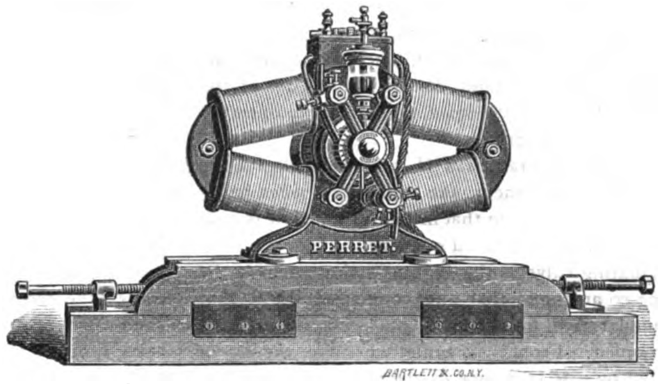


FIG. 29.—TWO-POLE MOTOR.

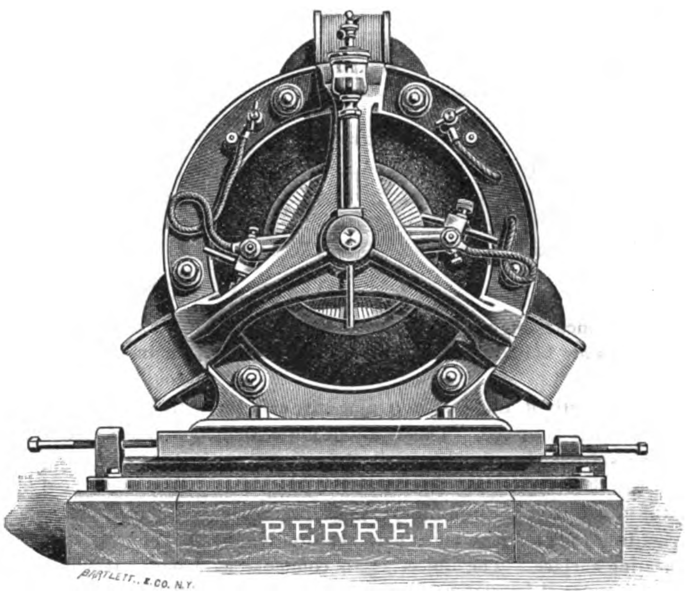


FIG. 30.—MULTIPOLOR MOTOR.

THE PERRET MOTOR.

STEAM HEATING FOR PASSENGER CARS ON THE PENNSYLVANIA RAILROAD.

A DESCRIPTION of the passenger car steam heating system with which the Pennsylvania Railroad has been experimenting is given by Theodore N. Ely, of Altoona, Pa., in the November number of the *Journal* of the Franklin Institute.

Mr. Ely states that the Pennsylvania Company's experiments have confirmed their belief that the return system is the one which must finally prevail if the best results are desired.

A return system, he explains, is one which, by the aid of a pump or other vacuum producing device, brings back to the tender of the locomotive the water of condensation derived from the steam which has given up its heat in warming the cars.

In the Pennsylvania Railroad system, as shown in the accompanying illustration, an ordinary pump is used as a means of obtaining the necessary vacuum, and is located conveniently on the inside of the tender.

The steam to supply the system is taken from the bridge pipe X of the locomotive and passes into a reducing valve, R, where the pressure is reduced to about 40 pounds; it then crosses over to the tender by means of a hose pipe, and enters a second reducing valve. The first of these valves is set to protect the hose pipe, the latter to protect the train from extreme pressure.

Before the steam enters this second reducing valve a branch is taken off to drive the pump P, and on the other side of the valve, the exhaust steam from the pump connects so that this steam may be turned in to heat the train.

Leaving the second reducing valve the supply pipe runs to the back of the tender and here crosses over and connects with the main supply pipe S under the car. This pipe runs the entire length of the car and connects to the next car, and so on, forming, when the train is coupled up, a supply pipe running the entire length of the train.

In the center of each car a branch leaves the main pipe to supply the car with steam. At this point a three-way cock, C, is placed on the main pipe and arranged so as to allow the steam to flow along the main pipe and into the branch at the same time; this is the same in all of the cars, except the last, where it is turned in such a position as to allow the steam to flow into the branch pipe only, further communication back of this on the main pipe being cut off. This cock is operated from the inside of the car and obviates the necessity of placing a cock at each end of the pipe, which cock when closed, as in the case of the rear of the last car, forms a pocket in which the condensed water may freeze. The main pipes leading through this three-way cock have a pitch to either end, and are so arranged that when uncoupled they will drain themselves. This branch pipe conducts the steam to a reversing valve, V, which will be explained later on. By means of this the steam is distributed to both sides of the car, the two pipes conveying this steam coming up through the floor on opposite sides of the car and connecting with regulating valves D, placed to control the heat; these two valves stand, one on either side of the aisle under the center of the seats, and are easily operated without disturbing passengers.

The arrangement of radiators H, pipes, etc., inside the car on both sides are exactly the same, both sides being operated independently, so that in case of a leak it is only necessary to shut the steam off one side.

The regulating valve is the highest point reached, the pipes being so arranged that any condensed water that may accumulate will find its way out when the cars become uncoupled. From the regulating valve, the steam is conducted by a ¾-inch pipe to the radiators, which are located in the corners of the car, and from them back to the center, by means of a cast-iron radiator pipe B, two inches wide, four inches high, with radiating ribs one inch apart; these pipes are bolted together in lengths of about six feet.

In the center length of the cast-iron pipe, the exit for the condensed water is placed. This is a foot lower than the regulating valve, so arranged that all the water condensed in the radiators, etc., will find its way to this point.

A piece of 2-inch wrought iron pipe, capped, is screwed into the cast-iron radiator pipe under each seat to give additional heating surface. The object is to condense as much of the steam in the radiators as possible, and this is done by throttling the exit from the cast-iron pipe. The two exits are connected with the reversing valve by two pipes which go through the floor and are brought by the reversing valve again into one pipe. The arrangement from this point is the same as in the supply pipe—namely, the pipe leaving the reversing valve connects with a three-way cock R, situated on the main return pipe S', which runs the entire length of the car, and on the ends of which the couplings are placed, forming again when coupled a main return pipe running the length of the train; the object of the three-way cock here is the same as in the former case, and is operated from the inside of the car.

This return pipe connects with the suction end of the pump so that all of the condensed water is drawn out of the system into the return pipe, which conducts it to a condensing coil in the tank, to insure all of the steam being condensed before entering the pump; after passing through the pump it is discharged into the tank. The connection T, from the pump, leads to the tank.

Reference was made to a reversing valve. The conclusion that will have been drawn from the foregoing is that there are two main pipes under each car, one a supply, the other a return.

Should a car or a train be reversed, the pipes will change places; that is, instead of having the supply pipe on the left-hand side, it will be on the right-hand side; the object of the reversing valve is to obviate this difficulty, and is so arranged that by a simple movement, from inside the car, the pipe that was performing the duty of a supply will now perform the duty of a return. Another important feature of this valve is that by further movement a connection is made with the exit from the radiator pipes to the atmosphere, thereby changing the system to a direct one; the advantage of this is that in the event of the pump failing it would be the work of a minute to set the valves for the direct steam. Again, should it be necessary to couple one of these cars to a train fitted with the direct system, it would work equally well. The couplings used are what may be termed as "male and female," and so arranged that one of the same kind is on opposite diagonal corners of the same car; the male coupling is attached to the main pipe by means of a rubber hose pipe in the form of an "S" in a horizontal plane, which allows for all of the movements between the cars, while the female is screwed on the main pipe on the opposite side.

The male coupling has placed on it a spiral spring inclosed in a case, movable in a longitudinal direction; upon this case are placed two trunnions; the female coupling has fastened to its end a joint ring for making it tight against the end of the male coupling; upon it are also placed two trunnions which serve as the hinges for the latch. This latter consists of a forked bell-crank fulcrumed upon the trunnions, and has its short arms furnished with recesses arranged to engage with trunnions on the male coupling.

When two cars are brought together, the latches are thrown back and male and female couplings brought end to end; a movement of the latch in opposite directions causes the recesses on the short arms of the latch to engage with the trunnions on the male coupling, the two arms brought tight against each other, and in so doing, the spiral spring is compressed, which allows for small variations in length of the couplings and insures the same pressure between their faces.

The long arm of the latch is fastened by means of a chain to the platform of the car upon which the male coupling is placed, and this chain is made of such length that when the cars are uncoupled, it will pull the latch over and release the steam coupling.

The operation of the system is clearly indicated by the arrows of the diagram.

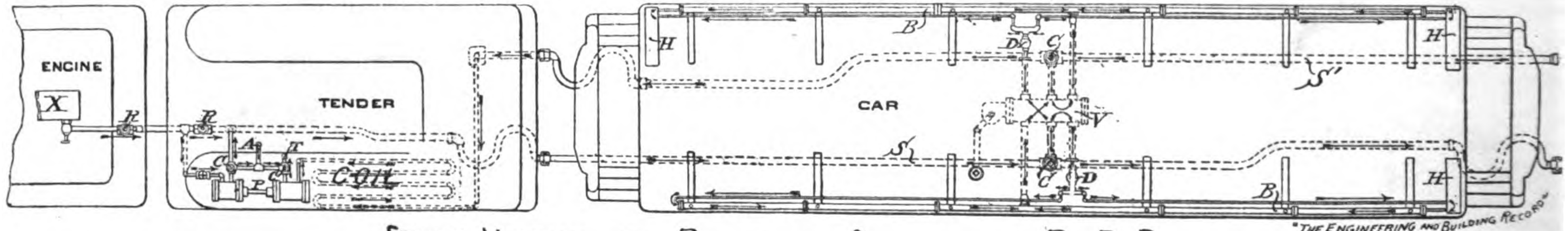
The problem of heating a train on a cold day is a simple one as compared with that of heating a train on a mild day. It will be understood that the direct system requires steam at some pressure for distribution, and so in the pipes there can never be a temperature of less than 212° Fahr.

With such a temperature on a mild day it is difficult to regulate the temperature of the cars. The Pennsylvania Railroad Company have arranged their system so that in mild weather only the exhaust steam from the pump is used; the pump creates a vacuum and this exhaust steam passes through the system in the form of a vapor, making it comparatively an easy matter to maintain the temperature at not more than 1° Fahr. above the atmosphere, if necessary. The pressure in the radiator pipes, etc., inside the cars, varies from zero to one-half pound; this latter pressure is required in the coldest weather only. In case of accident, there would be no danger from escaping steam.

When it is necessary to heat a train quickly, the pump is started, and a pressure of twenty pounds is turned into the train pipe; this will raise the temperature 15° to 20° Fahr. every five minutes.

When the car becomes warmed to the required temperature, the pressure is reduced to the normal working.

Cars when once heated are found to retain their heat for considerable time. Ten minutes before the train arrives at its destination, it is usual to shut off all the steam from the train; the pump is kept going to draw all the water out of the system, so that when the couplings are undone there are seldom more than a few ounces of water to come out.



STEAM HEATING FOR PASSENGER CARS ON THE PA. R. R.

In connection with the heating, much care has been given to secure ventilation, and with the following simple arrangement excellent results have been obtained.

Beneath the cast-iron radiator pipes, are placed a series of air tubes, one under each seat; these make a connection with the outside air through a 2-inch opening. The hot air rising from the radiator pipes naturally draws the fresh air in from these tubes, which becomes heated, and rising up passes out through the deck ventilators inducing a current of warm, fresh air which is made to pass through the car at all times.

In the return system, the steam taken from the boiler does not seem to affect the steaming of the locomotive.

During the winter of 1889-90, seventy cars were put in use and performed satisfactory service.

KEOKUK, IOWA, appears to have experienced a building boom during the year just closing. Eight hundred thousand dollars are said to have been expended in the construction of new buildings, and architects, contractors, builders and artisans have been kept unusually busy to complete the various structures for industrial, mercantile and residence purposes.

ADVICES from Boston state that applications for fuel gas are coming in in large numbers to the Boston Gas Light Company, and the company is busily engaged in putting in services along the lines of the mains it will use for this purpose.

PITTSBURG citizens are at present actively discussing the merits of vulcanite asphaltum pavement, which is being put down in several streets. Considerable dissatisfaction has been expressed with it.

ACCORDING to a San Antonio, Tex., dispatch, the Aransas Harbor Company has succeeded in perfecting financial and other arrangements for deepening the water over the bar at Aransas Pass, Tex.

Questions and Answers.

All questions relating to building construction, paving, sewerage, water supply, or kindred subjects, will be welcomed in this column provided they relate to matters of general interest and are not such as should properly be referred to a consulting engineer. Answers will be carefully prepared and a proof of both question and answer mailed to the inquirer as early as proper consideration will permit. They will be published for the benefit of other readers as soon as convenient. The full name and address should be given, not necessarily for publication, but as a guarantee of good faith, and to facilitate further correspondence in case the question is not sufficiently explicit.

Inquiries of the Editor, in order to secure prompt attention, should *not be written on the same piece of paper as a communication* to the *Publishing Department*. Letters renewing subscriptions are sent to a clerk in the publishing office, and matter for the Editor, if in the same enclosure, is likely to be overlooked unless it is on a separate piece of paper, so that it may be promptly sent to the Editor.

WATER ANALYSTS.

B. D. MCCONNELL, Superintendent of Water-Works Montreal, Can., writes: "The Water Committee of the City Council of Montreal has instructed me to have samples of our city water supply analyzed by the best experts in that line in the United States. Being unacquainted with the standing of gentlemen of the profession in New York, may I ask you whom you consider I should do best to apply to. Chemical and biological examinations of the samples are both required."

[It is obviously inadmissible for us to recommend either special persons or appliances in cases of inquiries of this general class. We would say, however, that in our professional columns will be found the names and addresses of several men who make a specialty of the kind of work in question.]

IT is stated that nickel-in-the slot hot water apparatus is now available in some of the streets of Paris. For 5 centimes about nine quarts of water are delivered. The machines are described as containing gas burners and coils of pipe designed for very rapid heating.

Notes and Queries

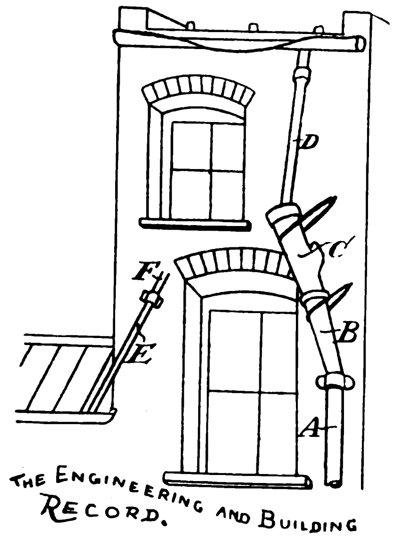
on Domestic Engineering.

Communications relating to the practical details of plumbing, heating, lighting and ventilation will be welcomed in this column. The writer's true name and address must always be given, but an assumed name may be used for publication if preferred.

AN EXAMPLE OF PLUMBING BOTCHING.

J. W. CLARKE, London, Eng., writes: "The following illustration represents a piece of botched plumbing work found in a house in London, the rental of which is about £56 per annum. In the sketch A is a length of common light iron rain-water pipe; B is a 4-inch by three-inch stoneware taper pipe; C is a 4-inch stoneware junction. B and C were suspended by means of pieces of common flat hoop-iron nailed to the wall. The junction pipe was to receive the outlet end of the trap of a new water-closet, fixed inside the building. The pipe D, connected to the top end of the junction pipe, was to convey the rain-water from the eaves gutter to the soil-pipe, and also act as a drain ventilator.

The pipe E is a 2-inch light cast-iron pipe, the bottom end discharging into the eaves gutter of a small conservatory and the upper end receiving a 1-inch lead pipe, F, which is used as a waste pipe from a new bath fixed in the same room as the water-closet. The ground near the conservatory is saturated with the waste water which overflowed the guttering when the bath was emptied.



Anyone would know at a glance that a plumber did not fix the work, but that it was done by one of those pests in all trades, known as "handy men," who can do almost anything (?) and are a disgrace to the craft to which they attach themselves. The strange part of the problem is that there are enough idiots in the world to employ such men, and thus encourage them to persevere in their evil ways without check of any kind. The Plumbers' Registration Council is powerless to act in such matters, and there is no authority to prevent such work being done."

EXHAUST STEAM HEATING.

"PLUMBER," St. Thomas, Ont., writes: "I inclose you sketch of a building to be heated by steam. I want to know if I can heat it with exhaust steam only, and how to arrange pipes; also, if I were to use live steam and exhaust together, and if I used the boiler steam to run an engine, how would I manage to run a low pressure system of heating without interfering with the working of engine? Should I use a steam trap to return condensed water to boiler? I should like, also, a short rule to find the number of feet of 1-inch pipe that it will take to heat any size room. Give me all the information you can to help me in a job of this kind."

[You can use the exhaust steam from an engine to warm a building. This, of course, will be a "low pressure" system, but not a direct return system. It will be a pumped return system.

Set your boiler, then connect and pipe your engine in the ordinary manner, running exhaust pipe to roof. Put back-pressure valve in the exhaust pipe at any suitable position near roof. Take a branch of the exhaust pipe from below the back-pressure valve to a grease separator; thence, from the grease separator to the main pipe of the heating apparatus. Pipe the building as you would for ordinary low-pressure work, but instead of returning to a boiler, return to a receiving tank. From this receiving tank pump condensed water into the boiler with duplex pump and pump governor. This is the ordinary exhaust system of low-pressure heating.

It may be that your engine will not make enough exhaust steam to fill the heating pipes at all times. In that case you must make a live steam connection between boiler and heating pipes, in which there will be a pressure regulating valve. This, if properly arranged, will open and give live steam to the heating pipes should the exhaust steam prove insufficient.

You must see that the arrangement of your pipes is such that no live steam will pass into the heating pipes and be lost to the roof through the exhaust pipe.

In recent back numbers—our issues of March 2 and April 6, 1889, for example—we show arrangements of exhaust piping for heating apparatus that may be studied to advantage.

We have not reproduced the sketch mentioned by our correspondent as it represents simply a vertical section of an ordinary flat roof building with dimensions of rooms marked on it. The amount of heating surface to be provided for each room cannot be determined by any set rule. It will vary with locality, exposure, purpose of the rooms to be heated, etc. One square foot of heating or radiating surface may be allowed for from about 30 to about 70 cubic feet of space to be heated, with exhaust or low pressure steam and direct radiation. The number of square feet of surface in given lengths of pipes of different diameters is given in some of the books devoted to the subject of heating—Baldwin's book on "Hot Water Heating and Fitting," for example.]

STEAM HEATING SURFACE FOR DRYING-ROOMS.

"STEAM GAUGE," Kingston, Ont., writes: "Will you please state what radiating surface at a steam pressure of 100 pounds will be required to heat a drying tunnel 6x7 feet in cross-section by 75 feet long to a temperature of 300 degrees?

Also, what amount of radiating surface will heat an unplastered brick building 76x40x13 feet to a temperature of 160 degrees with steam at 70 pounds pressure?"

[You have omitted a very important item of data in asking the first question. You make no mention of the amount of air that is to be changed in any given time. With the tunnel absolutely closed up and well protected we have no doubt but that a coil of ten one-inch pipes run the whole length will be sufficient. This surface, however, being only about 37 degrees hotter, at 100 pounds pressure of steam, than the temperature at which you wish to keep the air of the tunnel, will not more than make up the heat that is carried off through the brickwork, and when steam is first turned on, if the brickwork is fresh and contains much moisture, it may take a considerable time before it will bring it to this temperature. This does not take into consideration the moisture to be driven off from the materials to be dried. The moisture in the air of a drying kiln plays an important part in the rise of temperature. If the air can be kept absolutely dry or nearly so, it can be warmed considerably above 212° Fahr. When moisture is present, however, evaporation first goes on, and afterwards the moisture held in the air and the air itself may readily advance to a temperature of about 212 degrees (the temperature of the vapor of water at atmospheric pressure). But to warm the vapor beyond this point it requires to be superheated and kept from contact with walls, or elsewhere from which it can draw additional moisture. If this is done the temperature of the drying kiln or tunnel may be advanced by a further application of heat, and we have no doubt that temperatures of 300 may be obtained, if moisture and the passage of air be cut off. High temperatures are best obtained within metal lined chambers backed with some non-conducting surface. Air at 300 degrees can also be obtained by forcing it between steam coils at high temperatures, but not allowing it to come in contact with the moisture afterwards. The specific heat of air is low, and though it is easily warmed on that account, the same reason accounts for its being unable to evaporate moisture to any considerable extent without materially lessening its own temperature. To make a drying-room effective, therefore, large quantities of dry air must be moved through it, and our experience is, that when a temperature of 300 is required to be maintained, and drying by evaporation is required, the only way is to force hot dry air through the tunnel, the air being heated outside. If a baking oven only is required to harden varnishes, then it may be done with direct steam heat, and we are of the opinion that fully 700 square feet of surface will then be required.

In reply to the second question, you give us no data in regard to the window surface or the amount of air to be moved, so that it becomes almost guesswork to reply to this question. According to Baldwin's rule it would require about 360 square feet of surface, at 70 pounds steam, provided there were no windows in the building, and no air move, or no great amount of moisture to evaporate, and that, with ordinary proportioned windows, it would require from two to three times as much surface, say 700 to 1,000 square feet.]

HEATING A SWIMMING BATH.

A. T. ROGERS, of New York, writes: "This problem has been put to me: 'How much coal is required to heat the water in a swimming bath, containing, say 85,000 gallons of water, by hot-water circulation?' The system proposed is to connect the flow pipe from the heater at one end of the tank, near the top, and the return at the bottom at the other end, thus causing all the water of the bath to pass through the heater. From data which I have obtained, I have calculated that to raise this amount of water from, say, 40° to 90° Fahr., would require the consumption of about 2,800 pounds of coal. Allowing a consumption of 5 pounds of coal per hour per square foot of grate surface, a grate containing 56 square feet of surface would be required to do the work in ten hours. I should like to hear from the experience of others in this kind of work.'

[The 85,000 gallons of water would weigh, approximately, 708,333 pounds. To raise the temperature of this weight of water from 40° to 90° Fahr., or through 50° Fahr., would call for the expenditure of about 708,333x 50, or 35,416,650 heat units. Assuming that 10 pounds of water can be evaporated by 1 pound of coal (good ordinary practice), it will require about 3,541 pounds of coal to do the work required in ten hours, or at the rate of 354 pounds of coal burned per hour. Allowing, say, 10 pounds of coal to be burnt per square foot of grate surface per hour, which is a fair figure, 35.4 square feet of grate area would be required to do the work.

TRADE PUBLICATIONS.

STEEL RULES AND TAPES.

THE Lufkin Rule Company, of Cleveland, O., has brought out a new catalogue, dated October, 1890, and containing illustrations, price lists, and descriptive particulars of their different varieties of rules and tapes, among them board and log rules and miscellaneous specialties for lumber men. The pamphlet covers 28 pages, and is neatly arranged.

WATER-WORKS SPECIALTIES.

Catalogue No. 25, recently issued by the Union Water Meter Company of Worcester, Mass., illustrates and describes a number of the water-works specialties made by them. Among the devices shown are a water pressure regulator, several forms of water meter, and apparatus for tapping water pipes under pressure.

STEAM AND WATER SPECIALTIES.

The Curtis Regulator Company, of Boston, Mass., describe their several steam and water specialties in a new pamphlet issued a few weeks ago. Their steam and water pressure regulators, expansion and return traps, damper regulators, combined separator and trap, and other similar appliances, are explained by general and detail illustrations, and tables of sizes and prices are given.

PRIZE ROAD ESSAYS.

A COMMITTEE of citizens of Philadelphia recently offered, through the University of Pennsylvania, prizes amounting to $700, for the best papers on Road Making and Maintenance, embodying the engineering, economic and legislative features of the problem. The contributions received were referred by Dr. William Pepper, Provost of the University, to a Board of Adjudicators, composed of Alexander J. Cassatt, C. E., Chairman; William Sellers, M. E.; Joseph M. Wilson, C. E.; William H. Wahl, Ph. D.; Thomas M. Cleeman, C. E.; Hon. Wayne MacVeagh, and Prof. Lewis M. Haupt, C. E., Secretary. The Board awarded the first prize, of $400, to Henry Irwin, B. S., C. E., Assistant Engineer, Canadian Pacific Railway, Montreal, Canada; the second prize, of $200, to David H. Bergey, B. Sc., M. D., North Wales, Pa.; and the third prize, of $100, to James Bradford Olcott, practitioner and writer upon the subject, South Manchester, Conn.; and honorable mention, without reference to order, to Edwin Satterthwait, President of the Cheltenham and Willow Grove Turnpike Company, Jenkintown, Pa.; Charles Punchard, former Surveyor of Roads in England, Philadelphia, Pa.; George B. Fleece, C. E., Memphis, Tenn.; Frank Cawley, B. S., Instructor in Engineering, Swarthmore, Pa.; and Francis Fuller McKenzie, C. E., Germantown, Pa.

Novelties.

Devices are described under this head purely and strictly as news; because believed to be new and calculated to interest readers.

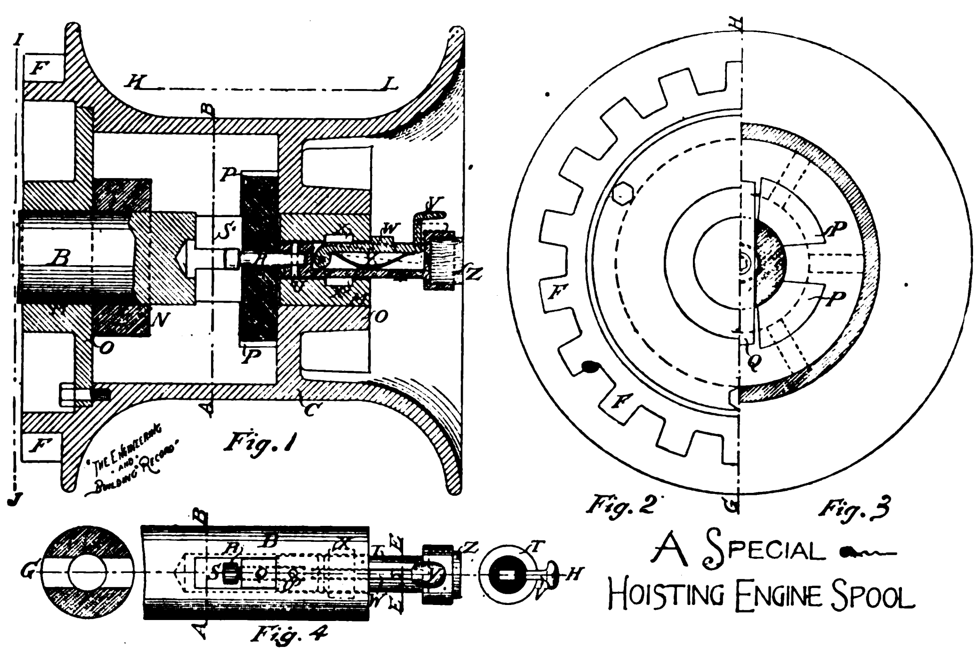
In no case is pay accepted, directly or indirectly, for publishing a novelty notice.

As the subjects are selected for their supposed novelty and interest merely, it will, of course, be understood that the selection does not imply indorsement.

A SPECIAL HOISTING ENGINE SPOOL.

IN erecting the St. Paul High Bridge* the most of the viaduct members, pieces weighing up to 10 tons each, were hoisted from the ground, many of them nearly 150 feet, and for this purpose three steam hoisting engines were used, each fitted with two drums and four spools, any one of which could be worked independently of all the others. The device is illustrated herewith. Figs. 1, 2, 3 and 4 show the shifting arrangement for throwing the spools in and out of gear.

Figure 1 is a section of the spool, shaft, etc., at G H, Figs. 2, 3 and 4, Fig. 2 is a half elevation at I J, Fig. 1, and Fig. 3 is a half section at A B, Fig. 1. B is the driving shaft which runs constantly and has a winding drum in the middle and a loose cast spool C at each end. O is a cast end plate, and the shaft has a journal fit at M and M. M is a wrought collar fastened by set screws to shaft B.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"THE ENGINEERING AND BUILDING RECORD"
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Fig. 2
Fig. 3
G
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Fig. 4
A SPECIAL HOISTING ENGINE SPOOL

Figure 4 is an elevation from K L, Fig. 1, of the end of the shaft B, and attached clutch mechanism, with the spool removed. The left-hand portion of the shaft B and the pins R and Q are all actually in cross section, but are shown in elevation for greater prominence. P P, etc., Figs. 1 and 3, are bosses cast on the spool to form the clutch. The driving shaft B has a slot S in which the cross key Q slips freely. When Q is at the right of the slot, in the position shown, it engages the clutch P P and, rigidly connecting the shaft and spool, causes the latter to revolve with the former. If the key Q is pushed to the extreme left of the slot S it is disengaged from the clutch P P and revolves freely in the hollow of the spool without turning it. The key Q is operated by the wooden handle Z and hollow bar T to which it is attached by a pin R and cotter U. It is held in place by the lever V, whose boss W, in the position here shown, engages the end of the shaft B and prevents Q from slipping to the left. The lever Z is always raised by a spring Y; if it be depressed to the position shown by the dotted lines the boss W can enter the end of the shaft B and the key Q may be pushed to the left hand end of the slot S, disengaging the clutch P P and allowing the shaft B to run loose in the spool. As soon then as the lever V is released the spring Y will force the boss W into the chamber X and keep the key Q securely in the new position The teeth F F can be made to engage a large gear wheel on the main shaft that is provided to give special power.

The above details were designed and used by Horace E. Horton, C. E., contractor for the erection of the High Bridge. These spools have been since used elsewhere and are said to give good satisfaction.

MORTAR MIXER.

FIGURE 1 is a plan and Fig. 2 a section at X X of a rocking basin for mixing mortar, slaking lime, sifting sand, etc.

The semi-cylindrical basin A receives the mortar and is rocked by the handle E, the teeth B B meshing in rack B to secure steadiness; C is a cast-iron mixer (shown in detail in Fig. 3), whose half-round bars slope in opposite directions, and which is loosely pivoted on centers P P so as to oscillate whenever basin A is moved; D is a screen confining the contents of the basin, and secured by the bar E fastened to both ends of band F which encircles the basin; G is a wooden block to prevent clogging.

The mixer C is removed when the machine is used to slake lime, and also when it is used as a sand sifter. The block G is then pivoted in its place and the sieve H is added as shown, and the sand passed through it. In Fig. 1 parts of screens D and H are shown removed.

The apparatus was invented by J. H. Poorbaugh, of Burrton, Kansas.

ANNUAL REPORTS.

REPORT ON DISPOSAL OF THE SEWAGE OF THE CITY OF TORONTO. By W. T. Jennings, City Engineer, August, 1890.

Reports upon the disposal of the sewage of Toronto have already been made by Messrs. Shanly, Brough, McAlpine and Tulley, Sproatt and Hering and Gray. This report of the City Engineer seems to be for the purpose of enabling the city to settle definitely upon some plan from the various ones which have been submitted to it. There seems to have been considerable similarity in these plans, and Mr. Jennings states that, after examining them and considering the subject, the opinion which he submits "is much in keeping with the expressions of my [his] predecessors, especially Messrs. Hering and Gray."

The project contemplates intercepting the sewage (including a small percentage of storm water) of existing and projected sewers, for a greater part of the city, by two main intercepting sewers—one high level and the other low level, and both located for most of their course approximately parallel to the shore of the lake. According to the plan of Messrs. Hering and Gray, there would be a single outlet for both sewers, into deep water in Lake Ontario near the eastern limits of the city, over six and a quarter miles from the intake of the water works, the sewage from the low level being pumped into the high-level sewer. Mr. Jennings, to do away with the pumping station, proposes to discharge the low-level sewer into the lake by gravity, at a separate outlet, to be four and a quarter miles from the water-works intake.

SEVENTEENTH ANNUAL REPORT OF THE BOARD OF WATER COMMISSIONERS OF THE CITY OF YONKERS, N. Y., for the year 1889.

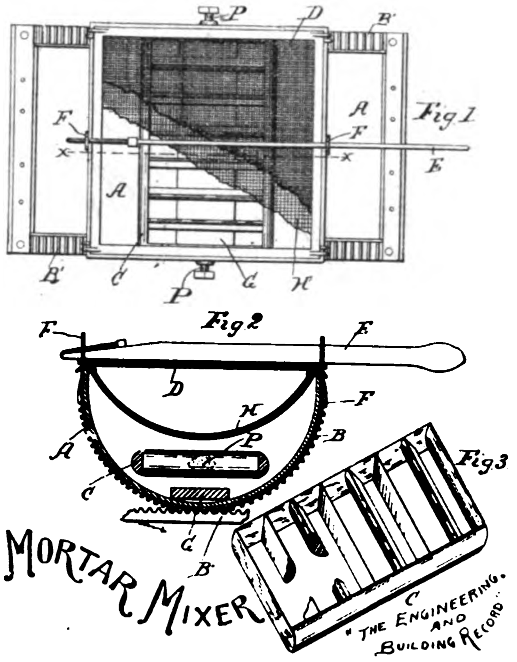
According to the report of the Superintendent, Joseph A. Lockwood, 8,415 feet of 4 inch to 18-inch pipe have been laid during the year, the total length of mains being now 36½ miles. The average cost of pumping for the year per 100 cubic feet was 1.33 cents, and the total cost of 100 cubic feet, including maintenance and interest on bonded debt, 8.06 cents. Per million gallons these items of cost are $17.78 and $107.75, respectively, the total amount pumped in the year being 736,094,975 gallons.

The report of the engineer, William H. Baldwin, is devoted to an account of the construction of additional sewers.

THE MUSCLE SHOALS IMPROVEMENT IN THE TENNESSEE RIVER.

IN our last issue we briefly announced the completion of the Muscle Shoals improvement in the Tennessee River.

The latter, which Major McFarland, of the U. S. Engineer Corps, says is a larger river than the Ohio, averaging broader and deeper, is 808 miles long from Kingsport, at the junction of the North Fork of the Holston with the Holston, to its mouth at Paducah, 50 miles above Cairo. From Kingsport to Knoxville, 150 miles, the river is only navigated by flat boats, etc., and from Knoxville to Chattanooga, some 200 miles, steamboat navigation depends on the stage of water, but from Chattanooga down to Paducah there would be fair navigation if it were not for the Muscle Shoals, 38 miles long, between Brown's Ferry and Florence, which is 255 miles from the Ohio, at Paducah. This obstruction, which has a fall of 134 feet, renders 360 miles of navigation above unavailable for anything but local traffic, and has been effective in retarding the improvement of both the 150 miles of the main river above Knoxville, and some 300 miles of improvable tributaries in the French Broad, the Hiawassee and the Clinch; or, in other words, has tied up a possible navigation of over 1,100 miles in extent in the main river and tributaries.



The improvement of the Muscle Shoals, which is now completed by the building of locks, dams, and 28 miles of canal and aqueduct, is historic. In 1824 John C. Calhoun, the Secretary of the Treasury, called attention to its necessity, and in 1827 the general Government gave the States interested a land grant, by the aid of which a canal was completed in 1838, but the improvement was of insufficient length. Though boats could pass through it, they could only reach it in favorable stages of the waters, and its use was soon abandoned.

From that time until 1871 Government appropriated only about $53,000 for the whole river. But from 1871 until now $3,112,500 has been appropriated, toward a total estimate of $5,056,000, for the improvement of the river below Chattanooga. It will be noticed that this expenditure has been stretched out over nearly 20 years, and the interest account compounded semi-annually at 5 per cent. per annum amounts to $2,145,300, or about two-thirds of the cost. If the deterioration of plant by decay and the loss consequent on the uncertainty of appropriations is added to the interest account, the aggregate of the direct losses from delay will probably amount to fully one-half of the cost of the improvement up to this time. And this has been a dead loss; for, with the exception of one cargo boat that passed through the canal about a year ago, the improvement during the 20 years it has been prosecuted has been of no use to those living on nearly 900 miles of stream above it.

DURING the past year the Manhattan Elevated Railway Company, of New York, carried 188,203,877 passengers. The receipts were over nine and a half million dollars, and the net earnings amounted to $4,246,828.

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*See Builders' and Contractors' Engineering and Plant, Series Nos. LXXX and LXXXII, pp. 38 and 56, Vol. 21.

CONTRACTING NEWS DEPARTMENT.

A WEEKLY RECORD

OF SPECIAL INTEREST TO CONTRACTORS, BUILDERS AND MANUFACTURERS OF ENGINEERING AND BUILDING SUPPLIES.

THE ENGINEERING AND BUILDING RECORD,
277 Pearl Street, New York.
November 22, 1890.

ARCHITECTURAL COMPETITIONS.

ASYLUM. LOS VEGAS, N. M.—Plans are wanted until January 20, for an insane asylum to be erected in this city. For circular of instruction, address William A. Vincent, President of the Board of Trustees of the New Mexico Insane Asylum, as above.

CONTRACTING INTELLIGENCE

Our readers will oblige us by notes, clippings, or any information which will put us in the way of obtaining early and reliable news for our "Contracting Intelligence." *Information of importance sent to us exclusively, and not elsewhere published will be liberally paid for.*

For works for which proposals are requested see also the "Proposal Columns," pages i-ii-403-404

WATER.

For Additional Water Items see Proposal Columns.

YORKSHIRE CENTRE, N. Y.—Town Clerk D. S. Churchill writes: "There has been no steps taken here in regard to the water-works, except a petition for a permit from the Town Board to grant a franchise to a company from Stamford, N. Y., the capital stock of said company to be $18,000. The distance from town to water-supply, one-half to one mile. Elevation, 150 to 200 feet, of easy access."

ALBION, N. Y.—Town Clerk Fred. Butler writes, regarding the water-works question, as follows: "A survey of the village has been made, at a cost of $800, and a report thereof sent to the State Engineer and by him approved and returned to the village authorities and await their action."

TOCONY, PA.—Improvements, to cost $50,000, are to be made to the plant of the Disston Water Company at this place.

CANAAN, N. H.—Reports say that a system of water-works is to be established at this place.

SEATTLE, WASH.—Plans for the proposed water-works system for this city are being prepared by Benezette Williams, and at their completion decisive action will be taken.

SALT LAKE CITY, UTAH.—The Expert Water Commission has submitted a part of its report on the water question to the City Council, but no action will be taken until the final report is handed in.

DALLAS, TEX.—Mayor W. C. Conna and several members of the City Council are visiting nearby cities and inspecting their water-works, with a view of making improvements in the system at this place. Particulars can be obtained by addressing the Mayor, as above.

HUNTINGTON, N. Y.—The plans for a system of water-works at this place, prepared by Engineer Oscar Darling, have been adopted, and it is likely that steps towards the construction will be made at once.

SELLWOOD, ORE.—A company has been organized to establish a system of water-works at this place, the estimated cost of which is $25,000. Richard Leaman is one of the incorporators, and can probably furnish particulars.

CRANFORD, N. J.—Town Clerk N. R. Foster writes: "There is nothing definite regarding water-works as yet—mostly rumor—but there will probably be something done in the spring."

WHITEHALL, MICH.—Recorder George E. Covell writes: "The water-works at this place are to be put in by M. Walker, of Fenton, Mich."

SAN ANTONIO, TEX.—Extensive improvements are to be made to the water-works plant of the Southern Pacific Railroad in the vicinity of this city.

SAN ANGELO, TEX.—The following bids for furnishing material for the San Angelo Water-Works were received by J. L. Millspaugh, President San Angelo Water-Works Company, November 10:

A. W. Morgan Manufacturing Company, Buffalo, N. Y.—Size A, No. 4, base for 4-inch valves, $4; A, No. 6, $4.35; A, No. 160, $4.90; freight paid to San Angelo.

Thomas Ashburner, Kansas City, Mo.—Boiler, 52-inch by 14 feet, with 56 3-inch tubes, full front, and all fittings complete, $825. Eddy standard valves, 4-inch, $9.75; 6-inch, $16.25; 8-inch, $23; 10-inch, $33; 12-inch, $42.75. Hydrants, 2 nozzle, 2½-inch, 4-inch inlet, 3 feet from pavement to inlet, $27; freight paid to San Angelo.

Shickle, Harrison & Howard Iron Company, St. Louis, Mo.—Cast-iron pipe, 4 to 12 inch, $39 per ton; specials, $67 per ton; freight paid to San Angelo.

H. M. Sciple & Co., Philadelphia, Pa.—One 11x12 inch Idel automatic engine, $1,105; one boiler, 52-inch by 14 feet, 56 3-inch tubes, half front, no stack, $665; one duplex compound pump, 12-inch by 18 feet steam, 10-inch water, 18-inch stroke, $1,633; one geared power pump, 12x12 inch, $1,830; on board cars in New York and Philadelphia.

George F. Blake Manufacturing Company, New York.—12"x18"x10¼", 18-inch stroke compound duplex pump; one power pump, 12x12-inch: both pumps delivered to San Angelo, $4,440.

The McNeal Pipe and Foundry Company, Burlington, N. J.—Twelve-inch pipe, $27.25 per ton; 10 inch, $27.50; 8-inch, $27.75; 6-inch, $28; 4 inch, $29; specials, 2¾ cents, delivered to Galveston.

Sioux City Engine Works.—Giddings automatic engine, 60 horse-power, $750; on cars in St. Louis.

Gordon Steam Pump Company, Hamilton, O.—One compound duplex pump, 12"x18"x10¼", 18-inch stroke, $1,660; one duplex power pump, 12x12 inch, $1,375; delivered at San Angelo.

Pond Engineering Company, St. Louis, Mo.—One boiler, 52-inch by 14 feet, 56 3-inch tubes, full front, and fittings complete, $793; one Gaskill compound duplex pump, 12"x18"x10¼", 18-inch stroke, $3,200; one Holley duplex power pump, 10½x12 inch, $1,700; Holley hydrant, $28.61; Holley valves, 4 inch, $9.15; 6-inch, $14.63; 8-inch, $22; 10-inch, $30.31; 12-inch, $39.71; one 12x12 inch Armington & Sims automatic cut-off engine, $1,298; all delivered at San Angelo.

The Addyston Pipe and Steel Company, Cincinnati, O.—Twelve-inch, 10-inch and 8-inch cast-iron pipe, $36.10 per ton; 6-inch and 4-inch, $37.10. Special castings, 3 cents; all delivered to San Angelo.

Clinton Iron Works, Buffalo, N. Y.—Size A, 4-inch valve boxes, $3.95; A, 6 and 8 inch, $4.30; A, 10 and 12 inch, $4.85.

Pierce & Thomas, New York.—11x12-inch Porter automatic, high speed engine, $788; 15x24-inch variable cut-off, $1,275; delivered in New York.

Chattanooga Foundry and Pipe Works, Chattanooga, Tenn.—Cast-iron pipe, $38 per ton; fittings, 3¼ cents; delivered at San Angelo.

Anniston Pipe Works, Anniston, Ala.—Cast-iron pipe, $37.60 per ton; special castings, 3 cents; delivered in San Angelo.

Chapman Valve Manufacturing Company, Indian Orchard, Mass.—Post hydrants, two 2½-inch outlets, no frost case, pavement to bottom 3 feet, $24.18; 4-inch water-gates, $10.04; 6-inch, $15.13; 7 inch, $18.63, 8-inch, $22.52; 10 inch, $34.17; 12-inch, $46.41; 12 inch check valve, $73.76; delivered in San Angelo.

R. D. Wood & Co., Philadelphia, Pa.—Twelve-inch cast-iron pipe, $35 per ton; 10-inch, $35; 8-inch, $35 80; 6-inch, $35.80; 4-inch, $36.70. Special castings, $3\frac{2}{10}$ cents per pound. Eddy valves, 12-inch, $41.50; 10-inch, $31.40; 8-inch, $22.15; 6-inch, $15.25; 4-inch, $9.30. Twelve-inch check valve, $67.90; adjustable valve boxes, $3.45; service boxes, $1.50. Mathews fire hydrant, 4-inch 3-foot double nozzle single valve, $27; double valve, $35 50; all delivered in San Angelo.

Ludlow Valve Manufacturing Company, Troy, N. Y.—Four-inch double gate, brass mounted Ludlow valves, $8.96; 6-inch, $15.25; 7-inch, $19.40; 8-inch, $22.65; 10-inch, $31.80; 12-inch, $41.50. Twelve-inch check valve, $51; valve boxes, 4-inch, $3.50; 6, 7 and 8-inch, $3.30; 10-inch, $2.93; 12-inch, $2.30. Fire hydrants: Ludlow rubber faced slide gate hydrants, stand pipe, 5¾ inches diameter, 3½ feet to pavement, two 2½-inch nozzles, $26; all delivered in San Angelo.

Bourbon Copper and Brass Works, Cincinnati, O.—Fire hydrants, with loose casing, double 2½-inch discharge, 4-inch stand pipe, 3 feet to pavement line, $28 50; without frost case, $21; 12-inch check valve, $65; 12-inch stop valves, $39.50; 10-inch, $28; 8 inch, $21; 7-inch, $16; 6-inch, $12.50; 4-inch, $8; delivered in San Angelo.

The Eddy Valve Company, Waterford, N.Y.—Four-inch Eddy fire hydrants, two 2½-inch nozzles, 3 feet to pavement line, $21.50; extra heavy I. B. B., Class 4, water-works valves, 12-inch, $36; 10-inch, $27; 8-inch, $20.25; 7-inch; $16.65; 6-inch, $13.95; 4-inch, $8.10. Twelve inch check valve, $45; delivered in New York.

Valk & Murdoch Iron Works, Charleston, S. C.—Steel boiler, 60 inches by 16 feet, 48 4-inch tubes, half front and fittings complete, on cars at Charleston, for $850.

Buffalo Steam Pump Company, Buffalo, N. Y.—Compound duplex pump, 12"x18½"x10¼", 18-inch stroke, $2,900; duplex power pump, 10¼x12-inch, $1,400; on board cars in San Angelo.

Keating Implement and Machine Company, Dallas, Tex.—Westinghouse compound non-condensing engine, 10 and 18x10-inch, $1,425; F. O. B., Pittsburg, Pa.

Ball Engine Company, by Em E. Davis, Albuquerque, N. M.—12x12-inch Ball automatic high speed engine, steel boiler, 60 inches by 14 feet, 82 3-inch tubes, full front, all fittings complete, $2,600; delivered in San Angelo.

Casey Boiler Manufacturing Company, Chattanooga, Tenn.—Steel boiler, 54 inches by 14 feet, 46 3½-inch tubes, half arch front, all fittings complete, $721; delivered in San Angelo.

The Ellicott Machine Company, Baltimore, Md.—Sixty horse-power tubular boiler, half arch front, $610; 62 horse-power automatic cut-off engine, $645; delivered in Erie, Pa.

Joseph B. Miller, Wilkesbarre, Pa.—Tubular boiler, 54 inches by 15 feet; 64 3 inch tubes, $575; at factory.

Haxton Steam Heater Company, Dallas, Tex.—Horizontal tubular boiler, 54 inches by 14 feet, 53 3½-inch tubes, full front, all fittings complete, $940; delivered in San Angelo.

The Warfield Manufacturing Company, Baltimore, Md.—Sixty horse-power horizontal tubular boiler, full front, complete, $745; at factory.

F. A. Estep, Chattanooga, Tenn.—Sixty horse-power steel boiler, half front, $840; delivered at Brownwood, Tex.

W. A. Hoffman Implement Company, Fort Worth, Tex.—Steel boiler, 52 inches by 14 feet; 56 3-inch tubes, half front, complete, $650; at Indianapolis, Ind.

Dean Steam Pump Company, Holyoke, Mass. St. Louis agency.—Compound duplex non-condensing pump, 12"x18'x10¼', 18-inch stroke, $2,400; same pump, 10-inch stroke, $1,700; duplex power pump, million gallon capacity, $3,000; delivered at San Angelo.

S. S. Mayo & Co, Fort Worth, Tex—Cast-iron pipe, 4 to 12 inches, $35.85 per ton; specials, $3.33 per 100 pounds; delivered in San Angelo.

Sioux City Foundry and Machine Works.—10x16 inch automatic engine; steel boiler, 52 inches by 14 feet; 56 3-inch tubes, full front, all complete, $1,649; delivered in San Angelo.

Ripley & Bronson, St. Louis, Mo.—Cast-iron pipe, 4 to 12 inches, $34.38 per ton; specials, $3.25; empire hydrant, $23.65; gate valves, 12-inch, $41; 10-inch, $30.65; 8-inch, $22; 6-inch, $14.65; 4-inch, $8.75. Horizontal tubular steel boiler, 52 inches by 14 feet, 56 3-inch tubes, fittings complete, $828.50; yarn, 8 cents; lead, lowest market price; all delivered in San Angelo.

Dean Steam Pump Company, Holyoke, Mass.—Compound duplex pump, 12"x18"x10¼"; 18-inch stroke, $1,990; duplex power pump, million gallon capacity, $1,600; delivered in San Angelo.

Beaumont Valve and Hydrant Works, Kankakee, Ill—Double nozzle fire hydrant, $23.50; delivered in San Angelo.

Contracts were awarded to the following bidders:

Ripley & Bronson, St. Louis, Mo.—Pipe and special fittings, yarn and lead, gate valves and covers.

Pond Engineering Company.—Boiler.

Dean Steam Pump Company.—Pumps.

Beaumont Valve and Hydrant Works.—Fire hydrants.

Sioux City Foundry and Machine Works.—Engine.

BELVIDERE, ILL—George H. Hurlbut, City Clerk at this place, writes: "The city will put in a complete system of water-works. Bids will be opened December 16." For further particulars see our Proposal Columns.

HARRIMAN, TENN.—Postmaster W. C. Shaw writes: "Temporary water-works have been constructed by the East Tennessee Land Company. For information concerning permanent water-works for this city address W. H. Russell, General Manager East Tennessee Land Company, Harriman, Tenn."

LISBON FALLS, ME.—W. H. Newell writes: "A party of gentlemen have petitioned for a charter for the purpose of introducing water into the village of Lisbon Falls. Nothing has been done except to give the required notice that they will ask for private legislation at the coming session of the Legislature."

FRANKLIN, N. H.—Town Clerk H. K. Smith writes: "This town, on November 15, voted to construct a system of water-works, to be placed under the control of a Board of six Water Commissioners, to be appointed by the Selectmen, and to be built under the supervision of said Board. Also voted to authorize Selectmen to borrow $80,000 on credit of town to do the work. The Commissioners are not yet appointed. It is intended to let contracts during the winter and begin work in early spring."

GROVETON, N. H.—According to published reports this place is to have a system of water-works.

UNIONVILLE, CONN.—Reports say that the sum of $20,000 is to be expended on a water-works system for this town.

SOUTH BERWICK, ME.—The people of this place will, it is reported, establish a system of water-works.

TOPEKA, KAN.—The following bids for furnishing 1,700 tons cast-iron pipe for Topeka Water Company, were received by Geo. H. Pierson, Consulting Engineer, November 12: Anniston Pipe Works, Anniston, Ala., $36.25 per ton; Gloucester Iron Works, Gloucester, N. J., $37.71; Chattanooga Foundry and Pipe Works, Chattanooga, Tenn., $35; Addyston Pipe and Steel Co., Cincinnati, $31.45; Dennis Long & Co., Louisville, $30.40; Shickle, Harrison & Howard Iron Co., St. Louis, $32 50; R. D. Wood & Co., Philadelphia, $34; Thomas Ashburner, Kansas City, $31.

ROXBOROUGH, PA.—John B. Reilley, of Lancaster, has obtained the contract to build the 148,000,000-gallon reservoir at this place, his bid being $509,000, according to the items of the specifications.

HALIFAX, N. S.—At a meeting of the Board of Works, held November 17, it was decided to engage an expert engineer to examine the water supply, with a view of making such improvements as may be necessary to improve and increase the supply. E. H. Keating, City Engineer, can furnish details.

SAN FRANCISCO, CAL.—The Rio-del-Llano Water Company has been incorporated, to distribute water in this State. Directors William C. Alberger, George W. Wickes, and others. Capital stock, $1,000,000.

LIMA, O.—Further extensions to the water-works system of this city are contemplated.

BATESVILLE, ARK.—John F. King and others have a franchise to build water-works at this place.

LOWELL, MASS.—The Water Board, of this city, contemplates calling for bids soon, for pumping machinery of about 10,000,000 gallons capacity.

BOISE CITY, IDAHO.—The question of water supply has been deferred by the City Council until the latter part of this month.

PERTH AMBOY, N. J.—The people of this place have voted in favor of a new water system. It is proposed to build an aqueduct from Mill Brook to Perth Amboy, a distance of six miles. The reservoirs and plant of the company which supplies water are, it is said, to be bought. The complete plant will cost about $200,000.

LEICESTER, MASS.—Several hundred feet of 10-inch pipe have been added to the supply main for bringing water from the source of supply in Paxton to this place, and more such pipe will be laid later on, as one source of supply, a circular well 30 feet in diameter and about 15 feet deep has been completed, and there still remains a number of springs to be developed. This work is being carried on under the direction of F. L. Fuller, C. E., of Boston, Mass.

WATER-WORKS.—See our proposal columns for information regarding water-works and water-works furnishings at the following places: Harrison, O.; Ballinger, Tex.; Toronto, Ont.; Belvidere, Ill.

SEWERAGE.

For Additional Sewerage Items see Proposal Columns

WEST OAKLAND, CAL.—Efforts are being made to improve the sewerage system of this place. For particulars, address Dr Huntington, as above.

SEATTLE, WASH.—Engineer Benezette Williams is preparing plans, etc., for a sewerage system for the whole city. For particulars, address Mr. Benezette Williams, as above.

ALBUQUERQUE, N. MEX.—The following bids for the construction of sewers were received by Henry Lockhart, Recorder, November 1:

BIDDERS.	23,670 feet 8-inch pipe.	3,829 feet 9-inch pipe.	4,512 feet 10-inch pipe.	2,562 feet 12-inch pipe.	540 feet 18-inch pipe.	3,120 feet 21-inch pipe.	2,900 feet 24-inch pipe.	90 manholes.	30 lampholes.	9 flush tanks.	
Rose & Riley, Albuquerque, N. Mex...	$14,202.00	$2,603.72	$3,654.74	$2,382.66	$880 20	$6,177.64	$6,470.00	$2,904.00	$175.00	$450.00	$40,099.90
Mitchell Bros., Pueblo, Cal....	13,018.50	2,454.54	3,519.36	3,253.74	999.00	5,865.64	6,786.00	5,314.00	484.00	846.00	42,528.76
Michael Walsh, Kansas City, Mo.......	16,569.00	2,871.75	3,600.64	2,485.14	783.00	6,021.64	7,105.00	3,993 00	350 00	675 00	44,463 09

EXTRAS.

BIDDERS.	24-inch junction	8-inch junction.	9-inch junction.	10-inch junction	12-inch junction	18-inch junction	21-inch junction	Additional excavation. Cubic yard.	Additional embankment. Cu. yard.	Concrete. Cubic yard.	Piling. Lineal foot.	Additional brick Per M.	Additional timber. Per M.
Rose & Riley, Albuquerque, N. Mex...	$2.30	$0.60	$0.68	$0.81	$0.93	$1.63	$1.98	.40	.40	$12.00	$1 00	$20.00	$25.00
Mitchell Bros., Pueblo, Cal	7.00	.90	1.15	1 50	1.84	4.00	5.00	.75	.50	9.00	0 25	24.00	24.00
Michael Walsh, Kansas City, Mo.......	8.00	1.60	2.00	2.40	3.00	6.00	7.00	.30	.25	12.00	1.00	29.00	29.00

SIOUX CITY, IOWA.—The Sioux City Gas Light Company is about to build a private sewer from the gas works to the river.

BRISTOL, CONN.—Engineer T. H. McKenzie, of the Southington Water Co., is preparing plans, etc., for a system of sewerage for this place.

MINNEAPOLIS, MINN.—The Council Committee on Sewers has awarded a contract to Berg & Co. for 250,000 sewer brick, at $8.40 per 1,000. The committee had advertised for bids on 2,000,000 brick, but the other bids were rejected. Bids will be advertised for on 1,000,000 more of brick, which the sewer department will soon need.

BELFAST, ME.—City Clerk L. H. Mursch writes: "A plan for a complete sewerage system for this city has been made by Wheeler & Parks, of Boston, and they estimate that the entire cost of the system will be from $45,000 to $50,000. The city has just completed a small part of the proposed system, having laid an 8-inch tile pipe through a part of main street, at a cost of some $2,500, the work being done by the city direct and not by contract. Probably some $3,000 or more will be expended in building sewers during the year 1891."

MERIDEN, CONN.—It is probable that steps will soon be taken towards establishing a system of sewerage for this city. Particulars can be obtained by addressing Mayor Page, as above.

CANTON, O.—Our correspondent writes: "This city will build a sewage disposal works on the city's sewage farm, in the near future. Plans by Samuel M. Gray, of Providence, R. I., are in the hands of R. R. Marble, City Civil Engineer.

SPOKANE FALLS, WASH.—The plans for a new system of sewerage for this city have been completed by City Engineer Oscar Huber, who can furnish particulars regarding the undertaking.

SEWERS.—See our Proposal Columns for information regarding sewer construction at the following places: Poughkeepsie, N. Y.; Denver, Col.; Mount Vernon, O.

BRIDGES AND IRON STRUCTURES.

For Additional Bridge Items see Propoals Columns.

ELLINGTON, CONN.—A new bridge is to be erected at Sadd's Mill by the New York and New England Railroad Company.

DES MOINES, IOWA—The plans for the proposed bridge at Walnut Street, this city, which are being prepared by City Engineer Schreiner, are almost completed, and it is expected that proposals will be wanted in a few days.

TOPEKA, KAN.—It is now said that it has been decided to expend the sum of $65,000 on the proposed suspension bridge over the Kansas River, at this place.

HASTINGS, MINN. — Measurements are being taken for the proposed railroad bridge over the Mississippi River, at this place, the cost of which is estimated at $175,000. A. J. Hart, of Minneapolis, Minn., can furnish particulars.

ROTHVILLE, MO.—The following bids for the erection of a bridge over Yellow Creek were received by John A. Lee, Clerk Chariton County Court, November 5: Kansas City Bridge and Iron Company, Kansas City, Mo., $1,390; Heidenreich Company, Chicago, Ill., $2,166, St. Louis Bridge and Iron Company, St. Louis, Mo., $1,625; Wrought Iron Bridge Company, Canton, O., $1,475; Lane Bridge and Iron Works, Chicago, Ill., $1,391; Youngstown, Bridge Company, Youngstown, O., $1,630.

WEST BAY CITY, MICH.—The Board of Public Works has decided that the proposed viaduct over the Michigan Central tracks, at Washington Street, is a necessity, and it is thought, therefore, that one will be ordered.

PITTSBURG, PA.—The movement to establish the projected South Side bridge appears to be gaining favor, and recent reports indicate that a conclusion may be arrived at in the near future. Particulars can be obtained by addressing Mayor Gourley, as above.

ALTON, ILL.—Reports say that General Manager Fisher, of the Bluff line, has stated that the Chicago, Burlington and Quincy officials had assured him that both the Alton bridge and the one across the Missouri River would be built.

PHILADELPHIA, PA.—The following bids for constructing wrought-iron western approach to Walnut Street Bridge were received by Louis Wagner, Director of the Department of Public Works, November 17: Levering & Garrigues, Philadelphia, Pa., $203,400; A. & P. Roberts & Co., Philadelphia, Pa., $203,402; Pottsville Bridge Company, Philadelphia, Pa., $199,725.

DETROIT, MICH. — Our correspondent writes: "The tracks of four railroads cross Woodward Avenue, within the city limits, at a point called the 'Woodward Avenue Crossing.' The companies are the Michigan Central, the Grand Trunk, the Detroit Grand Haven and Milwaukee, and the Lake Shore and Michigan Southern. The present crossing is on the surface, but the increased traffic of the road, and the rapid growth of that portion of the city renders a change necessary. The railroads are now considering which is the more desirable scheme—to elevate these tracks about nine feet or to lower them to same extent."

ALBANY, GA.—Reports say that an iron bridge is to be erected over Kinchafoonee Creek, near this place, by the Central of Georgia.

ZANESVILLE, O.—The following proposals for the construction of the overhead bridge across the Muskingum River, at Fifth Street, this city, to replace the present structure, have been opened by the County Commissioners: Variety Iron Works, Cleveland, O., superstructure, iron piling and substructure, $59,499; Edge Moor Bridge Works, Wilmington, Del., Plan A, superstructure, $58,354; Plan B, superstructure, $60,189; earth excavation, 50 cents; under water, $1; timber foundation, coffer dam, etc., $23; piles used in foundation, etc., 40 cents per lineal foot; iron, etc., 4 cents per pound; brick pavement, $2.50 per square yard. Milwaukee Bridge and Iron Works, Milwaukee, Wis., superstructure, Plan 1, $77,077; Plan 2, $72,007; Plan 3, $79,000; Plan 4, $75,677. Pittsburg Bridge Co., Pittsburg, Pa., superstructure, $74,980. Champion Bridge Co., Wilmington, O., superstructure, $79,868. Wrought Iron Bridge Co., Canton, O., superstructure, Plan A, $65,950; Plan B, $67,200; Plan C, $54,000; Plan D, $71,600; Plan E, $72,850; Plan F, $59,650. Mt. Vernon Bridge Co., Mt. Vernon, O., superstructure as per accompanying plan, $81,000. Wisconsin Bridge and Iron Co., Wauwatoso, Wis., superstructure, Plan A, $69,000; Plan B, $8 ,300; Plan C, $81,000. King Iron Bridge and Manufacturing Co., Cleveland, O., superstructure as per accompanying plan, $86,500. Smith Bridge Co., Toledo, O., superstructure, Plan A, $132,0 0; Plan B, $100,000; Plan C, $89,000; Plan D, $70,000; Plan E, $65,000. Penn. Bridge Co., Beaver Falls, Pa., superstructure, bridge and viaduct approaches complete, $79,416. Massillon Bridge Co., Massillon, O., superstructure, Plan A, $73,383; Plan B, $63,125.75; Plan C, $71,132; Plan B, light, $66,725.75; Plan C, light, $74,732. Youngstown Bridge Co., Youngstown, O., superstructure, $73,590; if steel is purchased, $75,510, if reamed. Berlin Iron Bridge Co., East Berlin, Conn., superstructure, $91,980. Chicago Bridge and Iron Co., Chicago, Ill., superstructure $66,559, Groton Bridge and Manufacturing Co., Groton, N. Y., superstructure, Plan A, $57,293; Plan B, $55,293. Columbus Bridge Co., Columbus, O., superstructure, Plan A, $80,260.69; Plan B, $73,649.17; Plan C, $72,464.51; Plan D, $70,639.69; Plan E, $70,165.59; Plan F, $69,785.59; Plan G, $68,285.49; Plan H, $67,694.21.

Substructure: Smith Bridge Co., $8 per cubic yard for masonry, $25 per b. m., for timber. J. B. Townsend, first item, $6.75; second item, $25. Jolly Brothers, first item, $8.25; second item, $28. J. C. McDonnald, first item, $6.80; second item, $25. Milwaukee Bridge Co., first item, $7.95; second item, $24.50. Pittsburg Bridge Co., first item, $9; second item, $30. Edgemoor Bridge Co., first item, $8 75; second item, $23.

CHARLOTTSTOWN, P. E. I.—Mr. Palmer, C. E., has been retained by the Local Government to examine the site of the proposed bridge across the Hillsborough River. He has been furnished with measurements and soundings; and it is said that the Government will obtain from him an estimate of cost, etc. It is reported that the action of the Government in respect to this matter, will be commended by the people of the Province.

JOLIET, ILL.—Fourteen bids were received for the construction of the Third Ward bridge, the figures ranging from $5,000, bid by the Groton Bridge and Manufacturing Co., of Groton, N. Y., to $8,200 bid by the George E. King Bridge Co., of Des Moines, Iowa. The proposals have been referred to the Committee on Bridges, of which Mayor Kelly is a member.

EASTON, MD.—A bridge is projected across the Tuckahoe River at this place, by the Talbot County Commissioners.

BIRMINGHAM, ALA.—It is stated that the North Birmingham Railroad Company proposes to erect a $20,000 bridge on Twenty-sixth Street, this city.

BRIDGES.—See our Proposal Columns for information regarding bridge construction at the following places: Sheboygan, Wis.; Hamilton County, O.

NEW DEPOTS.

PUYALLUP, WASH.—The Northern Pacific Railroad Company has decided to erect a new depot at this place.

TRENTON, N. J.—It is said the Pennsylvania Railroad Company has plans for a new depot at this place.

STREET-WORK AND PAVING.

CAIRO, ILL. — Considerable paving and other street improvements will be done in this city.

CANTON, O.—Considerable street work has been authorized at this place. Address Alderman Dumoulin, as above, for particulars.

MERIDEN, CONN.—Numerous of the public streets of this place are to be repaved and otherwise improved. Mayor Page can furnish particulars.

GENEVA, N. Y.—It is proposed to bond this place for the purpose of making a general improvement of all the public streets.

WESTCHESTER, N. Y.—The citizens of this place have voted the sum of $155,000 for the purpose of improving the streets and highways.

GAS AND ELECTRIC LIGHTING.

ALEDO, ILL.—The taxpayers of this place have decided in favor of electric lights, and a plant is to be established at once. The Electric Light Committee can furnish particulars.

HARRISBURG, PA.—The Oakland Square Electric Light Company has been incorporated, at this place, with a capital stock of $10,000. Incorporators, E. C. Godfrey, T. H. McGowan, and others.

PORTLAND, MICH.—The Town Council of this place has decided to establish an electric lighting plant.

BOISE CITY, IDAHO.—Reports say that the plant of the Capital Electric Light, Motor and Gas Company, at this place, is to be improved throughout.

INDIANA, PA.—It is probable that immediate steps will be taken in the matter of electric lighting for this place. The estimated outlay is $20,000, Edward Rowe can furnish particulars.

GREENVILLE, ILL.—C. D. Holles, W. V. Weise and Vallie Harrold, organized the Greenville Electric Light and Power Company, with a capital stock of $10,000. They will put in a system of public and private lights for this city.

BURLINGTON, VT.—The local electric light company is to make important improvements to its plant.

MONTICELLO, ILL.—A stock company has organized at this place to establish an electric light plant at a cost of $25,000. The Town Clerk can furnish particulars.

KNOXVILLE, TENN.—The Knoxville Electric Light and Power Company has been incorporated at this place.

PHILADELPHIA, PA.—At a meeting of the City Councils' Electric Light Committee, held November 19, permission was granted to the Western Union Telegraph Company, the Diamond Electric Light Company, the Kensington Electric Light and Power Company, and the Manufacturers' Electric Company, to make certain extensions and improvements to their plants in this city. The ordinance authorizing the United Electric Light and Power Company to open streets and lay and maintain underground conduits and wires was referred to a sub-committee consisting of Messrs. Heins, Patton, and others.

CINCINNATI, O.—At a meeting of the City Council, held November 14, the Ball Electric Co. filed a petition for permission to lay underground wires in suitable conduits through the streets, alleys and public places of the city for supplying and maintaining electric lights. The petition was signed by N. G. Kenan, President of the company. It was referred to the Committee of the Whole, and the company notified to submit its plans and such data as it has for information of the Board. Engineer Stewart can furnish particulars.

DAVENPORT, IOWA.—The following proposals for public lighting were opened November 12, by the Light Committee of the Common Council: People's Light and Fuel Co., any number of arc lights above 130, at $98 per annum. Davenport Gas Light Co., 123 arc lamps; 40 on towers, 61 on mast-arms and 22 on poles, $95 per annum for pole lights and $125 for tower lights. The Electric Illuminating Co., of Chicago, put in a complex bid, ranging from $72 to $95 per lamp for arc lamps and from $15 to $18 per year for incandescent lamps. The Thomson-Houston Co., $100 per lamp for arc lights for three years, $90 for five, and $80 for seven; $20 added if lights are placed on towers, according to the plan submitted, or $22, $21 and $20 per lamp for same time on 900 incandescent lamps. The Hawkeye Electric Manufacturing Company submitted a bid varying from the others in form. The proposition is to erect a plant for the furnishing of light in this city, to erect 33 arc lamps on masts or poles, and 500 incandescent lamps to be placed on the hill districts, and for the operation of this plant for the term of seven years to receive the sum of $1,500 monthly rental, at the end of that time the city to become the possessor of the plant without other expense than the formal payment of $1. The proposition carries with it a condition for exemption from taxation for the time proposed.

At a meeting of the City Council, held November 14, the Committee on Lighting reported in favor of granting the contract for city lighting to Electric Illuminating Company of Chicago. An ordinance entitled "An Ordinance authorizing the Thomson-Houston Electric Light Company to erect poles and wires, and to maintain and operate an electric light plant or system in the city of Davenport," was introduced for second reading, and was laid over until the question of city lighting was disposed of. Mayor C. A. Ficke can furnish particulars.

TOLEDO, O.—Efforts are being made in this city to raise $100,000 for the purpose of continuing work on the natural gas pipe line during the winter months. Mr. Jones, of the Board of Natural Gas Trustees, can furnish particulars.

BATESVILLE, ARK.—John F. King and associates have a franchise to erect an electric light plant to be run by the boilers from the proposed new water-works.

MONROEVILLE, O.—The taxpayers of this place have decided to issue bonds in the sum of $20,000, for the purpose of establishing an electric lighting plant.

BRADFORD, PA.—Important improvements are about to be made to the plant of the Bradford Electric Company.

AUBURN, ME.—Important extensions are to be made to the plant of the Lewiston and Auburn Electric Light Company.

BARBERTON, O—An electric light plant is to be established at this place,

MEMPHIS, TENN.—It is proposed to make an increased appropriation for public lighting in this city to enable certain improvements to the plant.

PARKER, PA.—An electric light plant is to established at this place. Address the Town Clerk for details.

ELECTRIC RAILWAYS.—New electric railways are projected, and improvements are to be made to those already established at the following places: Englewood, N. J.; Rockland, Me.; Camden, Me.; Biddeford, Me.; Saco; Me.; Ruston, Iowa; Albuquerque, N. M.; Opelika, Ala.; Providence, R. I., Newton, Mass.; Lowell, Mass.; Beaver Falls, Pa.

BIDS OPENED.

PHILADELPHIA, PA.—Mayor Fitler has awarded to William Steele & Son the contract for the erection and completion of the new buildings for the insane at Blockley Almshouse, at $175,685 for the buildings, $525 for the gas mains, and $3,283 for the kitchen fixtures.

BROOKLYN, N. Y.—City Works Commissioner Adams has opened the new bids for the erection of the Fifteenth and Twenty-second Precinct Police Stations. The former bids were rejected, it is said, because the lowest bidders were not satisfactory to the Commissioner. These are the new figures: Fifteenth Precinct, J. T. Hanlon, $41,380; John E. Williams, $42,600; John J. Cody, $44,200; F. Jezick, $45,750. Twenty second Precinct, John T. Hanlon, $36,050; William J. Moran, $37,485; John J. Cody, $41,500; Peter Clerry, $37,681.

PROPOSALS.

(Continued from page ii.)

ELECTRIC LIGHTING.—Proposals are wanted until December 19, 1890, for lighting, by electricity and gas, the public streets, etc., of FRANKFORT, INDIANA, for a period of five years. Address S. A. COOK, City Clerk.

PROPOSALS FOR BREAKWATER.—U. S. Engineer Office, Duluth, Minn.—Sealed proposals, in triplicate, will be received at this office until 2 o'clock P. M., December 17, 1890, and then opened, for constructing 240 linear feet of **BREAKWATER** at MARQUETTE, MICHIGAN. Preference will be given to articles of domestic production or manufacture, conditions of quality and price being equal. The attention of bidders is invited to the Acts of Congress approved February 26, 1885, and February 23, 1887, Vol. 23, page 332, and Vol. 24, page 414, Statutes-at-Large. The United States reserves the right to reject any and all bids. All information may be obtained at this office. JAMES B. QUINN, Major, Corps of Engineers. 1

PROPOSALS FOR PIER WORK, DREDGING, etc.—U. S. Engineer Office, Duluth, Minn.—Sealed proposals, in triplicate, will be received at this office until 2 o'clock P. M., December 29, 1890, and then opened, for extending and remodeling shore ends and repairs to outer ends of canal **PIERS**, and **DREDGING** at GRAND MARAIS, MICHIGAN. Preference will be given to articles of domestic production or manufacture, conditions of quality and price being equal. The attention of bidders is invited to the Acts of Congress approved February 26, 1885, and February 23, 1887, Vol 23, page 332, and Vol. 24, page 414, Statutes at Large. The United States reserves the right to reject any and all bids All information may be obtained at this office. JAMES B. QUINN, Major, Corps of Engineers. 3

PROPOSALS FOR PIER WORK AND Dredging.—U. S. Engineer Office, Duluth, Minn.—Sealed proposals, in triplicate, will be received at this office until 2 o'clock P. M., December 22, 1890, and then opened, for building **SUPERSTRUCTURE** and for **DREDGING** at ONTONAGON, MICHIGAN. Preference will be given to articles of domestic production or manufacture, conditions of quality and price being equal. The attention of bidders is invited to the Acts of Congress, approved February 26, 1885, and ebruary 23, 1887, Vol. 23, page 332, and Vol. 24, page 414, Statutes-at-Large. The United States reserves the right to reject any and all bids. All information may be obtained at this office. JAMES B. QUINN, Major, Corps of Engineers. 2

PROPOSALS FOR DREDGING AND PIER WORK.—U. S. Engineer Office, Duluth, Minn—Sealed proposals, in triplicate, will be received at this office until 2 o'clock P. M., December 6, 1890, and then opened, for **DREDGING**, and for repairs to breakwater at GRAND MARAIS, MINN. Preference will be given to articles of domestic production or manufacture, conditions of quality and price being equal. The attention of bidders is invited to the Acts of Congress, approved February 26, 1885, and February 23, 1887, Vol. 23, page 332, and Vol. 24, page 414, Statutes at Large. The United States reserves the right to reject any and all bids. All information may be obtained at this office. JAMES B. QUINN, Major, Corps of Engineers. 26

PROPOSALS FOR DREDGING.—U. S. Engineer Office, Duluth, Minn.—Sealed proposals, in triplicate, will be received at this office until 2 o'clock P. M., December 6, 1890, and then opened, for **DREDGING** in the harbor of DULUTH, MINN., on west side of Rice's Point. Preference will be given to articles of domestic production or manufacture, conditions of quality and price being equal. The attention of bidders is invited to the Acts of Congress approved February 26, 1885, and February 23, 1887, Vol. 23, page 332, and Vol. 24, page 414, Statutes at Large. The United States reserves the right to reject any and all bids. All information may be obtained at this office. JAMES B. QUINN, Major, Corps of Engineers. 26

PROPOSALS FOR DREDGING.—U. S. Engineer Office, Cleveland, Ohio, November 10, 1890.—Sealed proposals, in duplicate, will be received at this office until 12 o'clock M., on TUESDAY, the 2d day of December 1890, when they will be opened in the presence of bidders, for **EXCAVATING** 925,000 cubic yards, more or less, of material from Maumee River and from Maumee Bay along line of proposed straight channel for TOLEDO HARBOR, OHIO. Preference will be given to materials and plant of domestic production or manufacture, conditions of quality and price (import duties included) being equal. The attention of bidders is invited to Acts of Congress approved February 26, 1885, and February 23, 1887, Vol. 23, page 332, and Vol. 24, page 414, Statutes at Large. All information can be obtained at this office. The United States reserves the right to reject any or all proposals. L. COOPER OVERMAN, Major of Engineers. 26

NOVEMBER 15, 1890.

SEALED PROPOSALS WILL BE RECEIVED at the office of the Supervising Architect, Treasury Department, Washington, D. C., until 2 o'clock P. M. on the 10th day of December, 1890, for all the labor and material required for the **APPROACHES** to the U. S. Court House, Post-Office and Custom-House at VICKSBURG, MISS., in accordance with the drawing and specification, copies of which may be had on application at this office or the office of the Superintendent at Vicksburg, Miss. Each bid must be accompanied by a certified check for $100. The Department will reject all bids received after the time herein stated for opening the same; also, all bids which do not comply strictly with all the requirements of this invitation. Proposals must be inclosed in envelopes, sealed and marked "Proposal for the Approaches to the U. S. Court-House, Post-Office, and Custom-House at Vicksburg, Miss." and addressed to JAS. H. WINDRIM, Supervising Architect. 26

PROPOSALS.

PROPOSALS FOR EXTENSION OF PIERS and Repairs.—U. S. Engineer Office, Cleveland, O., November 15, 1890.—Sealed proposals, in duplicate, will be received at this office until 12 o'clock M., on SATURDAY, the 6th day of December next, at which time they will be opened in presence of bidders, for extending pier and making general repair to **PIERS** at the following harbors on LAKE ERIE: Ashtabula Harbor, O.; Fairport Harbor, O.; Black River Harbor, O.; Huron Harbor, O. Preference will be given to materials and plant of domestic production or manufacture, conditions of quality and price (import duties included) being equal. The attention of bidders is invited to Acts of Congress approved February 26, 1885, and February 23, 1887, Vol. 23, page 332, and Vol. 24, page 414, Statutes at Large. All information can be obtained at this office. The United States reserves the right to reject any or all proposals. L. COOPER OVERMAN, Major of Engineers. 26

OFFICE CONSTRUCTING QUARTERMASTER, Fort Thomas, Ky., October 27, 1890.—Sealed proposals, in triplicate, subject to usual conditions, will be received at office of Constructing Quartermaster, U. S. A., FORT THOMAS, KY., until 11 A. M., November 27, 1890, and then opened, for construction there, of a **HOSPITAL** and hospital steward's quarters, and for the steam heating apparatus for the hospital, and for the plumbing of each building. The United States reserves the right to reject any or all bids, or parts thereof. Plans and specifications to be seen at this office, with full instructions as to bidding. Envelopes containing proposals should be marked, "Proposals for Hospitals, etc.," and addressed to 1st Lieutenant R. B. TURNER, 6th Inf'try, A. A. Q. M., U.S.A.

PROPOSAS FOR PILES, STONE, ROPE, Wire, Nails, Spikes and Screw Bolts.—United States Engineer Office, Custom House, St. Louis, Mo., November 20, 1890.—Sealed proposals, in triplicate, will be received at this office until 12 o'clock M. on SATURDAY, December 20, 1890, for furnishing and delivering the following articles for use in improving the Mississippi River below ST. LOUIS, MO.: Piles, Stone, Manilla and Sisal Rope, Wire, Nails, Spikes and Screw Bolts. Preference will be given to articles of domestic production or manufacture, conditions of quality and price (import duties included) being equal. Specifications and blank forms for proposals will be furnished bidders on application. A. M. MILLER, Major, Corps of Engineers.

PROPOSALS FOR CONSTRUCTION OF Breakwater at Rockland, Maine—United States Engineer Office, Portland, Maine, November 11, 1890.—Sealed proposals, in triplicate, for construction of **BREAKWATER** at ROCKLAND, MAINE, will be received at this office, No. 537 Congress Street, until 3 P. M. of TUESDAY, December 2, 1890, and then opened. Attention is invited to Acts of Congress approved February 26, 1885, and February 23, 1887, Vol. 23, page 332, and Vol. 24, page 414, Statutes-at-Large. All necessary information furnished by JARED A. SMITH, Lieut.-Col., Corps of Engineers, U. S. Army. 26

U. S. ENGINEER OFFICE, CHARLESTON-Kanawha, W. Va., November 3, 1890.—Proposals for building the **FOUNDATIONS**, and the pier, abutment, etc., for a movable dam at lock No. 8 of the great KANAWHA RIVER improvement, will be received at this office until 3 P. M. of December 19, 1890, and then opened. The attention of bidders is called to the Acts of Congress approved February 26, 1885, and February 23, 1887, Vol. 23, page 332, and Vol. 24, page 414, Statutes at Large. Information can be obtained by application to ADDISON M. SCOTT, Resident Engineer. WM. P. CRAIGHILL, Colonel of Engineers, U. S. A. 1

NOVEMBER 17, 1890.

SEALED PROPOSALS WILL BE RECEIVED at the office of the Supervising Architect, Treasury Department, Washington, D. C., until 2 o'clock P. M., on the 9th day of December, 1890, for all the **LABOR AND MATERIAL**, and fixing in place, complete, the low-pressure, return-circulation, steam heating and ventilating apparatus for the U. S. Court-House, Post-Office, etc., building at AUGUSTA, GEORGIA, in accordance with the drawings and specification, copies of which may be had on application at this office or the office of the Superintendent at Augusta, Georgia. Each bid must be accompanied by a certified check for $100. The Department will reject all bids received after the time herein stated for opening the same; also, bids which do not comply strictly with all the requirements of this invitation. Proposals must be inclosed in envelopes, sealed and marked, "Proposal for the Low Pressure, Return Circulation, Steam Heating and Ventilating Apparatus for the U. S. Court-House, Post Office, etc., building at Augusta, Georgia," and addressed to JAS. H. WINDRIM, Supervising Architect. 26

NOVEMBER 10, 1890.

SEALED PROPOSALS WILL BE RECEIVED at the office of the Supervising Architect, Treasury Department, Washington, D. C., until 2 o'clock P. M., on the 29th day of November, 1890, for all the **LABOR AND MATERIALS** and fixing in place, complete, the low-pressure, steam heating and ventilating apparatus for the U. S. Post-Office, etc., building at HOUSTON, TEX., in accordance with the drawings and specification, copies of which may be had on application at this office or the office of the Superintendent at Houston, Texas. Each bid must be accompanied by a certified check for $100. The Department will reject all bids received after the time herein stated for opening the same; also, all bids which do not comply strictly with all the requirements of this invitation. Proposals must be inclosed in an envelope, sealed and marked, "Proposal for the Low-Pressure, Steam Heating and Ventilating Apparatus for the U. S. Post-Office, etc., building at Houston, Texas," and addressed to JAS. H. WINDRIM, Supervising Architect. 25

PROPOSALS.

U. S. ENGINEER OFFICE, BURLINGTON, Vt., November 20, 1890.—Sealed proposals, in triplicate, addressed to the undersigned, will be received at this office, until 11:30 o'clock, A. M., December 23, 1890, and then opened, for **DREDGING** 10,000 cubic yards, more or less, from TICONDEROGA RIVER, NEW YORK, and 20,000 cubic yards, more or less, from OTTER CREEK, VERMONT, and depositing the dredged material in deep water of the lake, 2 miles average haul at Ticonderoga River and 4 miles at Otter Creek. Attention is invited to the Acts of Congress, approved February 26, 1885, and February 23, 1887, Vol. 23, page 332, and Vol. 24, page 414, Statutes-at-Large. Detailed information can be had on application to this office. M. B. ADAMS, Major of Engineers. 26-3

PROPOSALS FOR HARBOR IMPROVEments.—United States Engineer Office, No. 366 Milwaukee St., Milwaukee, October 27, 1890.—Sealed proposals, in triplicate, will be received at this office until 12 o'clock, noon, November 25, 1890, and opened immediately thereafter in the presence of bidders for the following harbor improvements: Menominee River, Mich. and Wis., dredging about 200,000 cubic yards; Green Bay Harbor, Wis., dredging about 36,000 cubic yards; Kewaunee Harbor, Wis., pier extension 300 feet, more or less; Manitowoc Harbor, Wis., pier superstructure 600 feet, more or less; Sheboygan Harbor, Wis., pier extension 150 feet, more or less; Harbor of Refuge, Milwaukee Bay, Wis., breakwater extension and superstructure 400 feet, more or less; Racine Harbor, Wis., pier extension 200 feet, more or less; Kenosha Harbor, Wis., pier extension 150 feet, more or less. The attention of bidders is invited to the Acts of Congress, approved February 26, 1885, and February 23, 1887, Vol. 23, page 332, and Vol. 24, page 414, Statutes at Large. Proposals will be accompanied by a guarantee that if the bid is accepted contract will be entered into within ten days after notice of acceptance. Preference will be given to materials and plant of domestic production and manufacture, conditions of quality and price (import duties included) being equal. For blank proposals and information apply at this office. The United States reserves the right to reject any or all bids. Proposals will be indorsed on the envelope, "Proposals for Menominee River, Mich. and Wis.," or "Proposals for .... Harbor," and addressed to Major CHAS. E. L. B. DAVIS, Corps of Engineers, U. S. Army. 25

NOVEMBER 10, 1890.

SEALED PROPOSALS WILL BE RECEIVED at the office of the Supervising Architect of the Treasury Department, Washington, D. C., until 2 o'clock P. M., on the 2d day of December, 1890, for all the **LABOR AND MATERIALS** required to put in place, complete, the iron vault and closet doors for the U. S. Court-House and Post-Office building at PITTSBURG, PA., in accordance with the drawings and specification, copies of which may be had at this office, or the office of the Superintendent at Pittsburg, Pa. Each bid must be accompanied by a certified check for $100. The Department will reject all bids received after the time herein stated for opening the same; also, bids which do not comply strictly with all the requirements of this invitation. Proposals must be inclosed in an envelope, sealed and marked, "Proposal for Vault Doors at Pittsburg, Pa.," and addressed to JAS. H. WINDRIM, Supervising Architect. 25

NOVEMBER 11, 1890.

SEALED PROPOSALS WILL BE RECEIVED at the office of the Supervising Architect, Treasury Department, Washington, D. C., until 2 o'clock P. M., on the 29th day of November, 1890, for all the **LABOR AND MATERIAL**, and fixing in place, complete, the low-pressure, return circulation, steam heating and ventilating apparatus for the U. S. Court-House, Post-Office, etc., building at HUNTSVILLE ALABAMA, in accordance with the drawings and specification, copies of which may be had on application at this office or the office of the Custodian at Huntsville, Alabama. Each bid must be accompanied by a certified check for $100. The Department will reject all bids received after the time herein stated for opening the same; also, bids which do not comply strictly with all the requirements of this invitation. Proposals must be inclosed in envelopes, sealed and marked, "Proposal for the Low Pressure, Return Circulation, Steam Heating and Ventilating Apparatus for the U. S. Court-House, Post-Office, etc., building at Huntsville, Ala.," and addressed to JAS. H. WINDRIM, Supervising Architect. 25

ELECTRIC LIGHT PLANT, Washington, D. C.—Proposals are wanted until December 16, for an electric light plant for the New York Navy Yard. Address N. H. Farquhar, Chief of Bureau of Yards and Docks, Navy Department, as above.

STONE, Boston, Mass.—Proposals are wanted until December 15, for the delivery of quarry faced granite ash for the extension of Gallop Island sea wall, Boston Harbor. Address Lieutenant-Colonel S. M. Mansfield, U. S. A., as above.

BRIDGE WORK, Hamilton County, O.—Proposals are wanted until December 13, for the erection of a bridge and repairs to another bridge. Address John Haggerty, Auditor Hamilton County, as above.

ROAD WORK, Atlanta, Ga.—Proposals are wanted until November 27, for the construction of a macadamized road at this place. Address Major J. A. Scully, U. S. A., as above.

SEWERS, Poughkeepsie, N. Y.—Proposals are wanted until November 28, for the construction of certain sewers in this city. Address Charles E Fowler, Superintendent of Water-Works, as above.

WATER-WORKS, Belvidere, Ill.—Proposals are wanted until December 16, for the construction of a complete system of water-works. Address George H. Hurlbut, City Clerk, as above.

SEWERS, Mt. Vernon, O.—Proposals are wanted until December 11, for the construction of certain sewers. Address P. B. Chase, City Clerk, as above.

(Continued on page 404.)

GOVERNMENT WORK.

ST. AUGUSTINE, FLA.—Abstract of proposals for improving St. John's River, Fla., opened November 15, by Captain W. M. Black, Corps of Engineers, U. S. Army:

BIDDERS.	Stone, per ton, of 2,000 pounds.			Oyster shell, per cubic yard.			Mattresses, per square yard, in the work.	Total.
	In the jetty, outside the shore, mean low water line.	In the jetty, inside the shore, mean low water line.	On shore, between mean high and low water lines.	In the jetty, outside the shore, mean low water line.	In the jetty, inside the shore, mean low water line.	On shore, between mean high and low water lines.		
J. F. Slaughter....	$2.24 8/10	$2.34 8/10	$2.30 8/10	$0.60 8/10	$0.74 8/10	$0.74 8/10	$0.75	$133,940.00
J. A. Bryan....	2.23	2.40	2.70	1.00	1.25	1.50	.70	132,780.00
E. H. Gaynor....	2.77	2.90	3.00	1.35	1 50	1.60	.60	159,010.00
Marcus Connant....	2.07	2.32	2.57	1.20	1 40	1.40	.70	126,420.00
Joseph Erins....	2.69	2.74	2.84	.95	1.05	1.15	.70	153,600.00
R. G. Ross....	2.25	2.45	2.45	1 25	1.25	1.25	.60	131,350.00

WASHINGTON, D. C.—The following proposals for the work specified at the places named were opened on the given dates by the Supervising Architect of the Treasury Department:

El Paso, Tex.—Superstructure and completion of the United States Custom House, Court House and Post-Office, except heating, elevator and approaches. Opened November 12. Bidders: John Myers, San Antonio, Tex., $136,793, Parsons & Richards, Kerville, Tex., stone. Chas. McDonagh, Toledo, O., $167,300, Austin, Tex., Ohio blue sandstone or Buff Bedford. L. L. Leach & Son, Chicago, Ill., $141,969, Ohio blue stone; $148,210, Portage entry. Justin McCarthy, Washington, D. C., $143,217.25, New Mexico sandstone. Anderson Bros., St. Louis, Mo., $143,000, Buff Bedford stone. W. H. Sternberg, Wichita, Tex., $144,290, Pecos red sandstone.

Springfield, O.—Decorative painting, etc., United States Post-Office. Opened November 14. Bidders: Pedrelto & Son, Cincinnati, O., $2,500; Phillipson Decorative Co., Chicago, $2,000; Jas. T. Hall, New York, $5,200; Wildt & Scharsten, Cincinnati, O., $1,875; Wm. Harris, Cambridge, O., $4,500; O. J. Kover & Son, Fort Wayne, Ind., $2,478; Chas. A. Davis & Son, Springfield, O., $3,000; Hudson & Stricby, Washington, D. C., $2,150.

New Bedford, Mass.—Sandstone in lieu of granite for the erection and completion, except heating and approaches, of the United States Custom House and Post-Office. Opened November 14. Bidders: Justin McCarthy, Washington, D. C., $80,830; Sam'l C. Hunt, $87,987; E. Irving Bell $85,850; Darling Bros., $93,742; Gow W. Gay, $87,989.

St. Joseph, Mo.—Tower clock for custom-house and post-office. Opened November 17. Bidders: Joseph Barbarka, Iowa City, Iowa, $675; Seth Thomas Clock Co., New York, $875; E. Howard Watch and Clock Co., Chicago, $750.

Pittsburg, Pa.—Joinery work, wood flooring, etc., for the United States Custom-house and Post-office. Opened November 18. Bidders: Robert Mitchell Furniture Co., Chicago, $165,050; William Russell, Philadelphia, Pa., $169,790; Cochran & Davis, Allegheny, Pa., $411,155; Otto Decker & Co., Baltimore, Md., $159,768; Woods, Jenkins & Co., Cleveland, O., $122,000; Ardell & Blumenthal, Chicago, $196,900.

CHICAGO, ILL.—The following bids for 300,000 cubic yards of dredging in Calumet River, Illinois and Indiana, were received by Captain W. L. Marshall, Corps of Engineers, U. S. A., November 19: Wheeler & Pursell, Portsmouth, O., $36,750; M. A. McGillis & Co., South Chicago, Ill., $45,000; Green's Dredging Company, Chicago, Ill., $42,000.

CHICAGO, ILL.—The following bids for 90,000 cubic yards of dredging in Calumet Harbor, Ill., were received by Captain W. L. Marshall, Corps of Engineers, U. S. A., November 19: W. A. McGillis & Co., S. Chicago, Ill., $12,150; McMahon & Montgomery, Chicago, Ill., $20,700; Green's Dredging Co., Chicago, Ill., $22,500.

CHARLESTON, S. C.—The following bids for furnishing about 110,000 tons of riprap stone on the south jetty, at this place, were received by Capt. F. V. Abbot, U. S. A., November 18: Roderick G. Ross, Jacksonville, Fla., $249,400; Jacob Freday, Pittsburg, Pa., $224,000; Grant & Egan, Charleston, S. C., $267,550.

PROPOSALS.

(Continued from page 403.)

HARBOR WORK, Grand Rapids, Mich.—Proposals are wanted until December 1, for doing certain dredging and general harbor work. Address Major William Ludlow, U. S. A., as above.

CRUISER, Norfolk, Va.—Proposals are wanted until December 2, for furnishing a quantity of materials for Cruiser No. 8. Address Edwin Stewart, Paymaster General, U. S. A., as above.

DREDGING, ETC., San Francisco, Cal.—Proposals are wanted until December 16, for furnishing stone and doing certain dredging at Oakland Harbor. Address Col. G H. Mendeel, U. S. A., as above.

PIER WORK, Cleveland, O.—Proposals are wanted until December 4, for doing certain pier work at numerous harbors on Lake Erie. Address Major L. Cooper Overman, U. S. A., as above.

STREET WORK, New York City.—Proposals are wanted until November 25, for the improvement of certain streets of this city. Address the Department of Public Works, as above.

PAVING, ETC., Des Moines, Iowa.—Proposals are wanted until December 3, for doing certain street work in this city. Address R L. Chase, of the Board of Public Works, as above.

CURBING, ETC., Providence, R. I.—Proposals are wanted until December 3, for doing certain street work in this city. Address John A. Coleman, Commissioner of Public Works, as above.

LEVEES, New Orleans, La.—Proposals are wanted until November 25, for the construction of certain levees. Address Lieut. John Millis, U. S. A., as above.

NAVY DEPARTMENT, Washington, D. C.—Proposals are wanted until December 20, for the construction of one harbor defense ram, one torpedo boat, and one Swift torpedo cruiser for the U. S. Navy. Address B F. Tracy, Secretary of the Navy, as above.

HARBORS, Wilmington, N. C.—Proposals are wanted until December 15, for doing certain harbor work at this place. Address Captain W. H. Bixby, U. S. A., as above.

LIGHTING, Des Moines, Iowa.—Proposals are wanted until November 29, for lighting the public streets, etc., of this city for a term of two years. Address R. L. Chase, of the Board of Public Works, as above.

WANTED.

TOO LATE FOR CLASSIFICATION.

CIVIL ENGINEER, GRADUATE, WITH ALSO some experience during the past summer in surveying, desires a good opening with some engineering firm. Address E. M. S., Box 42, this office.

DRAUGHTSMAN, MECHANICAL, OF MODerate ability, wishes a position with desirable party. One year at Pratt Institute. Reference given if required. Address A. D. WALLING, 618 Macon Street, Brooklyn. 26

WANTED.—POSITION AS SUPERINTENDent of water-works. Address J. G. L., Box 110, this office. 26

Building Intelligence.

NEW YORK.

Birmingham st, s e cor Henry st. br bldg; cost, $23,000; o, H Fischel; a, Buchman & Deisler.

492–94 Broome st, br, stone and iron bldg; cost, $85,000; o, Henry Corn and ano; a, A Zucker.

357–59 Greenwich st, br shop; cost, $14,000; o, E M Harrison; a, Leicht & Havell; m, W C Hanna; c, P Roberts.

51 Pitt st, br flat; cost, $20,000; o, F Weintraub; a, F Ebeling.

87 Sheriff st, br and stone flat; cost, $20,000; o, Fay & Stacom; a, C Rentz.

37th st, n s 60 w 6th av, br bldg; cost, $13,000; o, W S Ridabout; a, G H Greibel.

N s 63d st, 200 e Amsterdam av, 2 stone flats; cost, $22,000 each; o, W Rankin; a, J W Cole.

S s 76th st, 125 w Columbus av, 5 stone dwells; cost, $25,000 each; o, P Farley; a, Thom & Wilson.

BUILDING INTELLIGENCE.

NEW YORK.—Continued.

S s 72d st, 548 e Av A, br stable, and flats; cost, $46,000 all; o, A Klempt; a, E Wenz.

N s 117th st, 200 w 8th av, 2 stone flats; cost, $18,000 each; o, E Cunningham; a, H Davidson.

E s West End av, bet 97th and 98th sts, 11 br and stone dwells; cost, $114,000 all; o, E Kilpatrick; a, Boring & Tilton.

S s 132d st, 125 e 5th av, 3 br and terra cotta flats; cost, $86,000 all; o, Lizzie T Wilkes; a, C Baxter.

Boulevard and Bedford Park, br dwell; cost, $7,000; o, C H Colman; a, E K Bowne.

S w cor 141st st and Alexander av, 4 br flats; cost, $73,000 all; o, C McLean and E Lang; a, A Spence.

N s 70th st, 22 e Columbus av, 5 br dwells; cost, $125,000 all; o, G W Ruddell; a, G A Schillinger.

N s 80th st, 387 w 9th av, 3 br dwells; cost, $45,000 all; o, Gilpin & Taylor; a, G A Bagge.

N s 90th st, 21 w West End av, 7 br dwells; cost, $84,000 all; o, Byrne & Sheridan; a, T J Sheridan.

W Central Park, 55 n 83d st, flat; cost, $100,000; o, E Purcell; a, Danmar & Fischer.

S s 104th st, 149 w 8th av, br flat; cost, $18,000; o, E Johnston; a, A B Ogden & Son.

S s Private st, 100 e Westchester av, 3 fr dwells; cost, $9,000; o, S D Bonfils; a, C S Clack.

ALTERATIONS.—NEW YORK.

124 W 53d st, vault under walk, interior alterations and walls altered; cost, $7,500; o, Edison E I Co; a, Buchman & Deisler; m, List & Lennon.

151 Clinton st, 4-story and basement extension, light shaft; cost, $10,000; o, L Sobel; a, H Horenburger.

River av, Riverdale, n s, near Riverdale av, interior alterations, walls altered; cost, $9,000; o, G P Morisini; a, D & J Jardine.

BROOKLYN.

S s 11th st, 230.5 w 8th av, 3 br flats; cost, $6,000 each; o and b, Thomas Smith; a, R Dixon.

N s Noll st, 200 w Hamburg av, 2 fr, br filled, tens; cost, $4,000 each; o, a and b, Leonard Erk.

W s Felix st, 100 n Fulton st, br flat; cost, $14,000; o, Charles A Cheseborough; a and b, W J Conway.

N s Herkimer st, 231 e Nostrand av, 3 br and brown stone dwells; cost, $5,000 each; o, C A & E S Betts; a, F B Langton.

N e cor Auburn pl and Canton st, br dwell; cost, $7,000; o, L Arensburg; a, T F Houghton.

N s Auburn pl, 30 e Canton st, br dwell; cost, $7,000; o and a, same as above.

4th av, 75 n 52d st, fire engine house; cost, $10,000; o, City of Brooklyn; a, not given.

S s W 9th st, 100 w Smith st, 2 br dwells; cost, $9,000 all; o, M E Conlan; a, F J Conlan.

N s Garnet st, 100 w Smith st, 2 br dwells; cost, $9,000 all; o and a, same as above.

N s Pacific st, 70 e Classon av, br dwell; cost, $7,000; o, C G Reynolds; a, Amzi Hill & Son.

S w cor Bedford av and Bergen st, br stable, cost, $17,000; o, E O Pierce; a, Robt Dixon.

W s Skillman st, 160 n De Kalb av, br dwell; cost, $9,000; o, J R Woods; a, E P Selover.

S s 4th st, 200 e 6th av, 6 br dwells; cost, $48,000 all; o, Moses & Fanton; a, G M Miller.

S s Madison st, 90 w Sumner av, 2 br dwells; cost, $20 000 all; o, R Geary; a, Wm Godfrey.

S s Linden st, 100 w Central av, 2 fr dwells; cost, $9,000 all; o, F C Wood; a, H Vollweiler.

S s Jefferson av, 80 e Tompkins av, 5 br dwells; cost, $50,000 all; o, J F Saddington; a, F D Vrooman.

E s Lincoln av, 150 n Adams st, 10 fr dwells; cost, $15,000 all; o, T A Wellwood; a, W H Volkening.

S s Flushing av, 220 e Nostrand av, 3 fr dwells; cost, $12,000 all; o, A Wissel; a, D Acker & Son.

BUILDING INTELLIGENCE.

BOSTON, MASS.—Taylor st nr Water st, 6 br and fr addn and bldgs, mechanical and storage; cost, $15,000; o, A T Stearns Lumber Co.

43 and 43a Charles st, 2 br tens; cost, $11,000; o, Nora Donahoe; a, J F Kelley; b, K Driscoll.

94–96 Crawford st, 2 fr dwells; cost, $13,000; o, a and b, A D Gould.

33–37 Richmond st, br cold storage bldg; cost, $100,000; o, Quincy Market Cold Storage Co; a, W G Preston; b, Wm Carpenter.

9–11 Richmond st, br cold storage bldg; cost, $45,000; o, a and b, same as above.

Westminster st, fr dwell; cost, $7,000; o, Edw Seaver; a, W P Wentworth; b, Jas Jackson.

Wrentham st, fr dwell; cost, $18,000; o, J I Stewart.

CAMBRIDGE, O.—Plans are drawn for a $20,000 opera house at Canal Dover, O. Mr A Hardesty, of this city, is interested.

CLEVELAND, O.—The Sheriff Street Market and Storage Company has been issued a permit to erect a $150,000 building at the junction of Sheriff, Huron and Bolivar sts. The new structure will be made of brick, steel and stone; Lehman & Schmitt will be the architects.

DENVER, COL.—3d av, bet S 15th st and Broadway, br dwell; cost, $10,500; o and a, Tiniere & Johnson.

3d av, bet S 15th st and Broadway, br dwell; cost, $12,000; o and a, same as above.

Logan av, bet 14th and Colfax sts, br dwell; cost, $28,000; o, I E Blake; a, L M Wood.

1st av and Ellsworth st, terrace, cost, $12,000; o, T H Jones.

GRAND RAPIDS, MICH.—The Universalist Society will build a church to cost $50,000.

MILWAUKEE, WIS.—5th near Clybourne, stable; cost, $18,000; o, American Express Co.

Market Square, hotel alt; cost, $7,000; o, Pabst Brewing Company; a, A Hoffmann.

MINNEAPOLIS, MINN.—After months' discussion the Commissioners have decided to build the Court House and City Hall. Granite will be used; $2,500,000 will be expended.

ORANGE, MASS.—Br shoe shop, 40 by 108; o, J B Reynolds; a, J A Jackson, of Brockton.

PORTLAND, PA.—A summer hotel is to be erected at this place.

SALT LAKE CITY, UTAH.—First South st, 6-story br store; cost, $80,000; o, H Dinwoody; a, R Bowman.

SPRINGFIELD, MASS. — Greenwood st, br block of 4 tens; o, Henry Alden, of Thompsonville, Conn; b, P L Morse.

WEST BAY CITY, MICH.—Kolb Bros. will erect a brick brewery, to cost $12,000, to be commenced at once.

Max Heavenrich and Ernest Feige have secured a site upon which they will build one of the largest furniture manufactories in the State.

WILKESBARRE, PA.—Alterations of First National Bank Building; cost, $20,000; o, First National Bank; a, Kipp & Podmore; b, E T Long.

YOUNGSTOWN, O. — Contractor A G Young has secured the contract for building an addition to the City Hospital. Contract price, $5,000.

Architect A F Thompson has prepared plans for a new shoe factory to be built here, to cost $10,000. Contract not let.

W Federal st, br and s power house and car station; cost, $45,000; o, Y St A A C; a and c, L M Moffett; br and s work, C Manser.

BUILDINGS.—There is nothing over $7,000 in value to report at the following places: Dayton, O.; Wheeling, W. Va.; Galveston, Tex.; Geneva, N. Y.; Waco, Tex.; Pottstown, Pa.; Charleston, S. C.; Ogdensburg, N. Y.; Allegheny, Pa.; Zanesville, O.; Cambridge, O.; Montclair, N. J.; Knoxville, Tenn.; Fitchburg, Mass.; Poughkeepsie, N. Y.; Canton, O.

THE ENGINEERING & BUILDING RECORD

AND

THE SANITARY ENGINEER.

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THE ENGINEERING AND BUILDING RECORD,
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POLITICS IN THE CHICAGO DRAINAGE COMMISSION.

ABOUT a month ago THE ENGINEERING RECORD published an editorial upon "Politics in Municipal Engineering," prompted by the course pursued by the Board of Trustees of the Sanitary District of Chicago, who are charged with the construction of the proposed drainage canal from the Chicago River to the Desplaines River for disposing of the sewage of the city. There appears now to be need for again alluding to the same subject.

The Chief Engineer of the Board, Mr. Lyman E. Cooley, it seems, has been trying to conduct his department on a purely business basis, selecting men for their merits and not for their politics, or their "pull" with members of the Board. Out of 125 men, only perhaps a dozen (and those in minor positions) owe their appointments to their influence with any of the trustees. This, of late years, has been something quite unusual in Chicago administration, and has apparently excited the hostility of some of the trustees, who wish to conduct the office according to the usual political methods. In June last the Chief Engineer estimated that he could make, in a hundred days, certain surveys for determining which one of four proposed routes should be adopted for the canal. Several sources of delay have occurred, and obstacles have been met with which required the scope of the investigation to be extended, causing, also, somewhat larger expenditures than was expected. As can readily be appreciated by anyone having but a superficial knowledge of such matters, in an important work of this kind the preliminary surveys and researches should not be unduly hurried or the money stinted, as it is all important that they should be thorough, in order that the best location may be obtained and the work most economically executed. Indeed, a liberal policy in this respect is the truest economy. But this delay and increased expenditure have been made the pretext for a renewed attack on the Chief Engineer, stigmatizing the unavoidable failure to complete the surveys at the specified time as an "unfulfilled promise," and he has also been condemned for continuing to make certain investigations actually ordered by the Board, though these could be quickly and promptly stopped if the Board would take the responsibility of rescinding the resolutions ordering them

The Engineering Committee of the Board have recently been holding an investigation, in which they have subjected their Chief Engineer to a long and rigid cross-examination, with the evident purpose of developing something to his discredit, which they could use against him. The animus of this investigation is shown by their demanding that he should answer "Yes" or "No" to all their queries without adding any explanation whatever, the reason given by one of its members being that "the Board did not propose to spend the public money and to waste time in listening to speeches by Mr. Cooley, and that gentleman must, therefore, confine himself to answering such questions as we may see fit to ask."

If the Board of Trustees desire to make a success of their work, and prosecute it with economy, they have got to lay aside "politics" and personal interests. And while they should in no degree give up their personal responsibility or neglect their watchfulness over the work and the expenditures, yet they should lend the engineer their full support and assistance as long as he manifests his competency, honesty and administrative ability, which, up to this time, he has conspicuously done. No engineer of reputation can afford to be held responsible for the success of an engineering work unless he can have the selection of his subordinates and full control over them, and that is the principle for which Mr. Cooley is contending, and he is entitled to the support of all right-minded people.

STREET CLEANING AND DISPOSAL OF REFUSE.

ELSEWHERE in this issue we publish, under the above head, a tabulated statement pertaining to the methods followed in different cities of the United States in cleaning streets and in disposing of the accumulated refuse, and giving figures of cost.

The matter, as explained, originally grew out of a suggestion made a short time ago by Mr. Sylvester H. Martin, Chief of the Bureau of Street Cleaning at Philadelphia, accompanied by a set of returns for that city published at the time. Subsequently returns from several other cities, among them New York, Boston, and Brooklyn, were printed, and it was found expedient to extend the range of inquiry to all the larger cities and towns with the view of determining as accurately as possible the several practices adopted. The main results, with some detail information as to character of the pavements, widths and mileages of streets, etc., are given in the large table. Incomplete though they necessarily are, for reasons pointed out in the article, they are not without importance and value, and furnish a general illustration at least of a subject in which all municipal authorities have a growing interest. The larger and the several smaller tables show, almost at a glance, what line is followed in any of the places from which returns were received, and will, therefore, prove instructive, even on only superficial examination.

NAVIGABLE STREAMS AND SYSTEMS OF IRRIGATION.

AN article appears in *The Gazette*, of Fort Worth, Tex., from a correspondent in Kansas City, stating, upon the authority of a Prof. Richard Meagher, that the diversion of water by the irrigation systems of the far West is having a serious effect upon the navigation of the larger rivers, and predicting that within ten years the Missouri River will be so reduced in volume that even the smallest craft will be unable to ply its waters.

Professor Meagher asserts, what is now generally admitted, that denudation of forests, in the Rocky Mountain region, produces no effect on the amount of annual rainfall. Its only effect is to cause the rainwater to run off much more rapidly into the streams, thus producing heavier freshets, and correspondingly lower stages of the rivers than ever before. But Professor Meagher also claims that these freshets are failing to appear, the storage reservoirs for irrigation purposes retaining so much of the heavier rainfalls as to prevent the freshets from being even as great as they were formerly.

No doubt, extensive irrigation and the building of large storage reservoirs will produce some effect of this kind—but it seems quite unlikely that the comparatively small area yet irrigated, or the moderate size of the storage reservoirs yet built on the Atlantic Slope can have produced any such effect as Professor Meagher states, or that their effect will be as serious in the future as he suggests. Still, the subject may be worthy of more careful investigation.

WAGES RATES IN THE BUILDING TRADES.

The secretaries of the building exchanges in 38 cities in the country have sent to the Wisconsin Bureau of Labor Statistics the schedule of wages in the building trades for each city. Where there is no exchange the information has been supplied by masons and builders. The schedules have been tabulated and interesting facts thus brought to light.

The six cities in which the highest wages are paid are New York, Brooklyn, Chicago, St. Louis, Galveston, and San Francisco. The trades selected for the table were masonry, carpentry, painting, plumbing, roofing, and the common labor required in the erection of a building. No one city pays the highest wages in all the trades, or in more than one trade. Thus, St. Louis pays the highest wages for masonry. New York for carpentry, San Francisco for painting, Chicago for plumbing, Santa Fe for roofing and Galveston for common labor. Santa Fe pays more than any other city for roofing, but it ranks below Brooklyn in all the other trades.

The lowest wages are paid in the Southern cities, Atlanta, New Orleans, Lexington, Va., Vicksburg, and Norfolk, Va. Some of the smaller cities of the North pay but little more than those of the South. Wages in the North seem to depend more on the size of a city than on its location. The explanation is that in the larger cities the trades are better organized. For the same reason two adjoining cities seldom pay exactly the same wages. New York pays more than Brooklyn for painting, carpentry, and plumbing. Brooklyn pays more than New York for masonry, roofing, and for common labor. There is the same difference in the wages paid in the near by cities of Minneapolis and St. Paul, and Cincinnati and Cleveland. Philadelphia and Boston rank below the five leading cities. Atlanta pays the lowest wages for roofing, masonry, and common labor, but comparatively good wages for painting and plumbing.

The difference in the wages rates paid in each trade is as great as their geographical distribution. Atlanta will pay 21 cents an hour for masonry, but St. Louis is willing to give 49 cents for the same work. New York and Baltimore pay 40 cents an hour, and Brooklyn, Galveston, Washington, San Francisco and Chicago from 41 to 45 cents an hour. For carpentry New York pays 39 cents an hour, and Lexington, Va., 18 cents. In eight cities from Minneapolis to Providence, the prevailing rate is 25 cents an hour. New Orleans and Vicksburg are willing to pay 25 and 26 cents, but most of the smaller Western cities will give less than 25 cents for carpentry. For plumbing Chicago pays 40 cents an hour, and Vicksburg 22½ cents. New York and San Francisco pay 39 cents. The other 33 cities follow in no particular order, some of those in the West paying less than Southern cities. The rates for painting show the greatest difference, San Francisco paying 53 cents an hour, and New Orleans 22½ cents. New York pays 52 cents, and Kansas City 51 cents. Indianapolis, Baltimore and Providence are willing to pay 42 cents, and Santa Fé 40 cents an hour. Roofing is paid for at the lowest rate of all the trades, 19 cents in Atlanta. New York pays 34, Brooklyn 37, and Santa Fé 38 cents an hour. For common labor Atlanta pays 7½ cents. New York, according to the table, pays 16 cents an hour less than do Philadelphia, Boston and Brooklyn. Galveston parts with 20 cents an hour, or $2.00 a day, the highest rate of all. The rate in San Francisco is not shown, but from another source it is known that $2 is also paid for common labor there.

Experiments have recently been made at the Cincinnati, O., water-works with the Anderson scrap-iron process of water purification, described some time ago in our columns. The results are reported to have been successful, though it is stated that, through the inadequacy of the small machine used, the full benefit of the process could hardly be determined.

AMERICAN SOCIETY OF CIVIL ENGINEERS NOMINATIONS.

We understand that a committee of five members of the American Society of Civil Engineers have prepared a ticket in which appear the names of those nominated by the Nominating Committee, except those who declined to serve. The Committee's action is in the line of the suggestion in our issue of last week, and in accordance with Section 6, of Article 7, of the Constitution.

Mr. Bogart the present Secretary, we also learn, declines to consent to the use of his name for office of Secretary.

NOTES.

The Executive Committee of the Mississippi River Improvement Association met at Memphis, Tenn., on November 17. A resolution was adopted indorsing the bill introduced into the last Congress appropriating $9,000,000 for the purpose of levee construction in the Mississippi Valley, from Cairo to the head of the passes. A committee was appointed to visit Washington during the coming session of Congress for the purpose of inducing that body to take up the bill at an early date. The members of the association are unanimous in the opinion that the present levee system is the only safeguard against overflow.

The December meeting and monthly dinner of the Architectural League of New York, will be held at Morello's, 4 West 29th Street, New York, on Monday evening, December 1, next, at 6:30 o'clock. It is hoped that the better facilities afforded at the new meeting place will induce a large attendance. A. D. F. Hamlin will read a paper on ' Basilicas and Baths—a Study of the Origins of Byzantine Architecture," which will be illustrated with lantern views.

Philadelphia newspapers complain that many members of the City Council are either directly or indirectly interested in the local electric light companies, and that the latter, therefore, among other things, do not find it difficult to secure all desired privileges for the asking. The peculiar working of the city's political machinery, moreover, is said to effectually prevent all otherwise possible competition on the part of newer companies.

According to Chicago reports, the old project of establishing a direct water route between Chicago and the Atlantic has, in a measure, been revived through the recent researches of Mr. E. L. Corthell, C. E., of Chicago. Mr. Corthell is said to be collecting data and statistics as to the feasibility of canal and ship railway routes that have already been partly surveyed, and shortly expects to incorporate the results of his researches in a report to a party of capitalists which he is said to represent.

Prof. Edward L. Nicholls, of Cornell University, delivered an address on "The Light of the Future" last week before the Electric Club of New York. Professor Nicholls believed that the electric light could not possibly be the light of the future, inasmuch as our descendants will not be satisfied with a light which involves the throwing away of from 90 to 95 per cent. of the potential energy involved in its production. Moreover, the incandescent and arc lights seemed to him to have reached the maximum of their possible development.

Engineers Fteley, Birdsall and McLean, in a joint report to the New York Aqueduct Commission, pronounce the old Croton dam perfectly safe. In view of the magnitude of the interests at stake, however, Mr. Fteley suggests that it would be well to build a dam below to provide against any possibility of accident.

A course of free lectures on roads and road-making will be given at the Case School of Applied Science, at Cleveland, O., beginning on the first Monday in January, 1891, and continuing four weeks.

The carelessness or incompetency of the Brooklyn, N. Y., Building Department, to which we had occasion to refer several times within the past year, has again been illustrated by the breaking down of part of a stand at the Brooklyn Eastern Park, on Thanksgiving Day, during the annual Yale-Princeton foot-ball match. Though the legal responsibility for the accident rests with the managers of the park, the Building Department cannot escape censure, since it issued a permit for the erection of the structure and apparently approved of it without adequate inspection. The speculators who put up the flimsy structure will doubtless have to pay well for their recklessness. But the public have a right to expect an intelligent supervision over the erection of such stands.

MEETINGS OF ENGINEERING SOCIETIES.

The American Society of Civil Engineers holds its regular meetings on the first and third Wednesday in each month, at the House of the Society, 127 East Twenty-third Street, New York.

The Boston Society of Civil Engineers holds its regular meetings at the American House, Boston, at 7.30 P. M., on the third Wednesday in each month.

The Western Society of Engineers holds its regular meetings at No. 78 La Salle Street, Chicago. at 7.30 P. M., on the first Wednesday in each month.

The Engineers' Club of St. Louis holds regular meetings in the club's room, Laclede Building, corner Fourth and Olive Streets, St. Louis, on the first and third Wednesdays in each month.

The Engineers' Club of Philadelphia holds regular meetings at the House of the Club, 1122 Girard Street, Philadelphia.

The Engineers' Society of Western Pennsylvania holds regular meetings on the third Tuesday in each month, at 7.30 P. M., at its rooms in the Penn Building, Pittsburg, Pa.

The Engineers' Club of Cincinnati holds its regular meetings at 8 P. M. on the third Thursday of each month at the Club rooms, No. 24 West Fourth Street, Cincinnati.

The Civil Engineers' Club of Cleveland holds regular meetings on the second Tuesday of each month, at 8 P. M., in the Case Library Building, Cleveland. Semi-monthly meetings are held on the fourth Tuesday of the month.

The Engineers' Club of Kansas City meets in Room 200, Baird Building, Kansas City, Mo., on the second Monday in each month.

The Engineering Association of the Southwest holds regular meetings on the second Thursday evening of each month at 8 o'clock, at the Association headquarters, Nos. 63 and 64 Baxter Court, Nashville, Tenn.

The Civil Engineers' Society of St. Paul meets at St. Paul, Minn., on the first Monday in each month.

The Montana Society of Civil Engineers meets at Helena Mont., at 7.30 P. M., on the third Saturday in each month.

The Civil Engineers' Association of Kansas holds regular meetings on the first Wednesday in each month at Wichita, Kan.

The New England Water Works Association holds quarterly meetings in Boston at Young's Hotel.

The Canadian Society of Civil Engineers holds its regular meetings on each alternate Thursday, commencing with the 9th of October, at the House of the Society, 112 Mansfield Street, Montreal.

The Engineering Department of the Brooklyn Institute, Brooklyn, holds regular meetings, at 8 P. M., on the third Tuesday of each month. Until the Institute building is repaired, the meetings will be held in the rooms of the Young Men's Christian Association Building, 502 Fulton Street.

Chicago is contemplating the building of a tunnel to connect the north and south sides of the city. The tunnel, as now held in view, is to be about one mile long. There is to be a 12 by 14 foot passageway for foot passengers, and a 36 by 18 foot roadway. The cost is estimated at $1,500,000.

PERSONAL.

William Bruce Gray and Aristide Roderigue, architects, of Washington, D. C., have formed a partnership and opened an office in the Willard Iron Building, 1,333 and 1,335 F Street, in that city.

OBITUARY.

Ex-State Senator Edwin H. Hobbs, Civil Engineer of the Amoskeag Corporation, died on November 27, at Manchester, N. H., aged 55 years.

Samuel Barber, the contractor, who, years ago, laid most of the wooden pavement at Elizabeth, N. J., has died at Chicago, at the age of 58. After leaving Elizabeth Mr. Barber went to Washington, where he engaged largely in public works.

Nathaniel C. Scoville, of New York, died suddenly on November 21, in Buffalo. He was at the head of a large car wheel manufacturing company there, and had been in business since 1885 in Buffalo, where he had lived until a few years ago. He was born in Salisbury, Conn., in 1832.

Thomas J. Whitman, died last week at his home in St. Louis, of typhoid pneumonia. He was 57 years of age, and was a mechanical engineer. He was a brother of Walt Whitman, the poet. He was born in Brooklyn, N. Y. His last big work was the building of water-works at Memphis.

J. P. Andrews, contractor, died suddenly on November 27, at his home in Cairo, N. Y., of apoplexy. Mr. Andrews was known in all parts of New York State, having been actively engaged in building railroads and constructing large edifices. One of his most extensive pieces of work was the construction of the Grand Central Station and the Fourth Avenue Tunnel in New York City.

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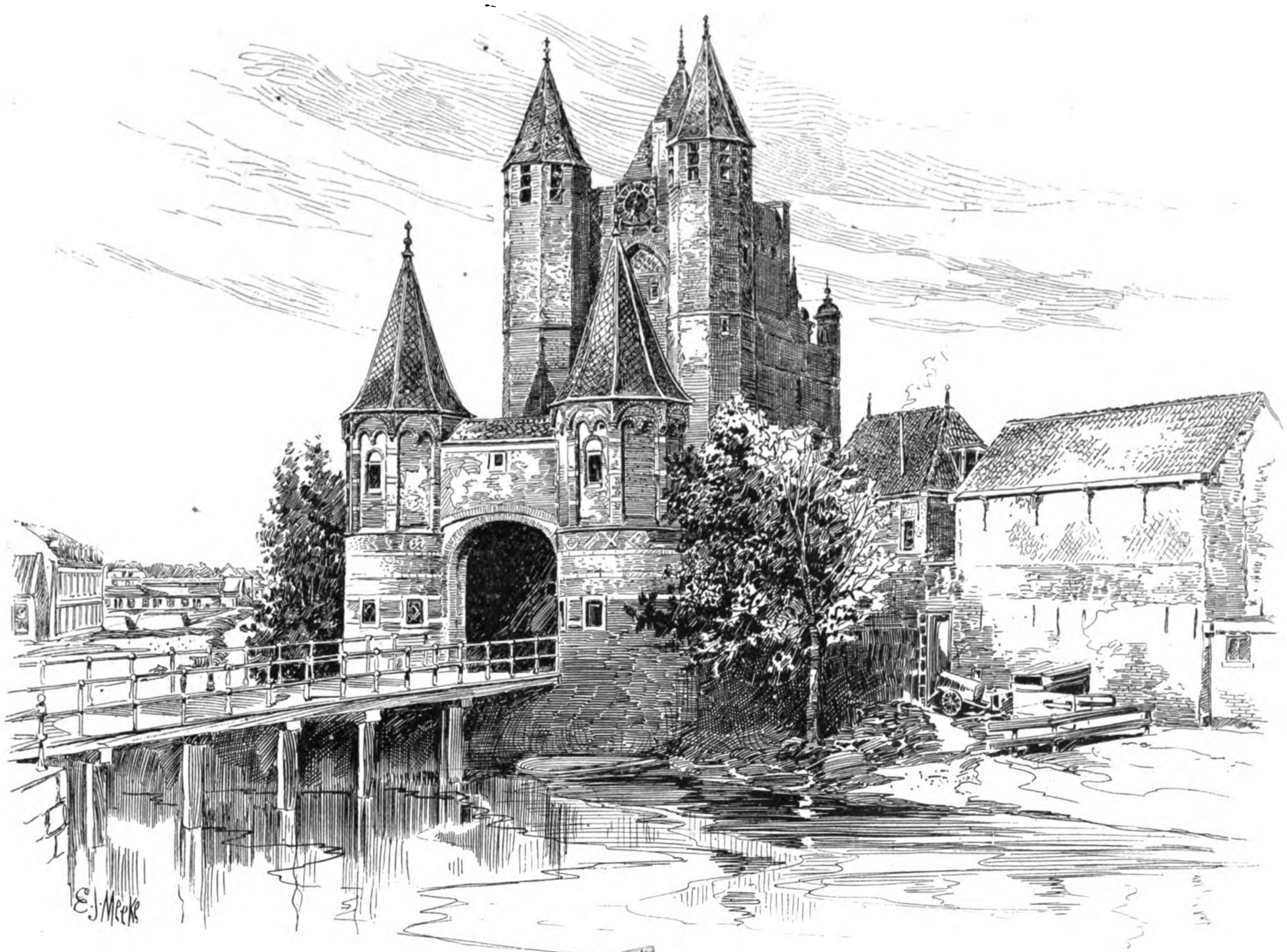

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ENGINEERING SOCIETIES.

At a meeting of the Engineers' Club, of St. Louis, held on November 19, Prof. J. B. Johnson read a paper in which he took the position from the standpoint of an engineer that aerial navigation for commercial purposes is now, and always will be, impracticable, and that the air ship will never be anything else than an ornamental machine and a curiosity. His general position was that there was a natural limitation to aerial navigation that could never be overcome, and to reach this conclusion simply required the study and application of well-known fundamental principles familiar to all engineers, without going to the trouble of making experiments. Professor Johnson referred to the experiments made by Raynard, who, in 1885 and 1886, constructed a machine that made five trips and came back to the starting point each time, but who gave up the enterprise after reaching the conclusion that the necessary power could not be obtained. He then presented a formula illustrating the resistance, atmospheric and otherwise, that such a vessel would have to contend with, and demonstrated that it could not be overcome by any methods that could possibly be adopted.

Messrs. Meier, Holman and Potter were appointed a committee to select candidates for offices to be elected at a subsequent meeting. The officers to be elected are president, secretary, treasurer, and vice-president.

ANNUAL REPORTS.

Toronto Water-Works. Annual Report of the Superintendent for 1889.

The water supply of the city is obtained from Lake Ontario at a point 2,357 feet from Hiawatha Island (forming the harbor of Toronto), where it has a depth of 30 feet. A 6-foot wooden pipe connects the inlet crib in the lake with the shore crib; a 4-foot wooden pipe connects the latter crib with a third one at Hanlan's Point on the north side of the island, and a 3-foot cast-iron main is laid from there across the harbor to the pumping station. For the purpose of increasing the water supply of the city an additional pipe (48 inches in diameter, of steel) was contracted for, at date of report, to be laid across the harbor, and a 60-inch steel pipe from Hanlan's Point to the crib on south side of the island. The project of extending the intake, by a 72-inch steel pipe, 350 feet further into the lake to a depth of 60 feet was also under consideration.

The high-level pumping station had formerly a capacity of only 1½ million gallons in 24 hours, but two 3-million-gallon pumping engines of the George F. Blake Manufacturing Company have just been added. The main pumping station has now a daily capacity of 22 million gallons. Mr. William Hamilton, the Superintendent, recommends that the supply should be further improved by replacing a 4-million-gallon pumping engine with one of 8 or 10 million gallons capacity.

The revenue of the water department has increased so much, compared with expenditures, during recent years (yielding each year a handsome surplus), that it has been determined that the consumers ought now to have the benefit of it. An order was therefore issued, and took effect last spring, deducting 60 per cent. from the gross amount of bills for prompt payment. Meter charges also have a discount of 50 per cent. for prompt payment, making the net meter price 12½ cents per 1,000 gallons.

Annual Report of Superintendent of the Montreal Water-Works for 1889.

The Superintendent, B. D. McConnell, urges replacing an old breast wheel which has been in use over 30 years, and is getting into pretty bad order, by a modern turbine wheel; and also urges the insufficiency of the present steam pump at the time of year that the water-power is available. He further calls attention to the fact that one section of a large aqueduct for additional supply was built more than 12 years ago, and that no more work has been done upon it since. Delay increases the cost for land, etc., and if work be recommenced at once the aqueduct will not be completed any sooner than it will be needed. The cost of pumping (pumping house expenses) for the past year was: For low service—By water-power, $1 63 per million gallons raised 169 feet, or 96 cents per million gallons raised 1 foot; by steam power, $13.18 per million gallons raised 169 feet, or 7.8 cents per million gallons raised 1 foot. For high service—By steam-power, $25.78 per million gallons raised 213 feet, or 12.1 cents per million gallons raised 1 foot.

ANCIENT OIL WELLS IN PENNSYLVANIA.

Prof. J. S. Newberry, writing in *Harper's Magazine*, says that petroleum was sought and used in North America perhaps as early as anywhere else in the world, since it was collected in many places and in large quantities by that mysterious people or peoples whom we know as "the Mound Builders."

When in 1859 Professor Newberry went to Titusville, like thousands of others called there by the Drake oil well, he noticed that the bottom lands on Oil Creek below the town, and where covered with a magnificent forest of hemlock trees, were pitted in a peculiar way; that is, the surface was occupied by a series of contiguous depressions 10 or 15 feet in diameter and from 1 to 3 feet in depth. These were circular and symmetrical, in that respect differing from the pits formed by uprooted trees. Inquiring of Brewer & Watson, who had an oil well there, what was the cause of this series of pits, he received no satisfactory answer from them, but a bystander answered his question by taking him to his well, just begun in the vicinity. As it chanced, this well was sunk in one of the pits before referred to. It was carried to the depth of about 25 feet in the earth when rock was reached and the drilling begun. Throughout this depth it followed the course of an old well, which had been cribbed up with timber, and in it was a ladder such as were commonly used in the copper mines of Lake Superior by perhaps the same people who worked the oil wells. This ladder was a portion of a small tree, of which the trunk was thickly set with branches. These were cut off four or five inches from the trunk, and thus formed steps by which the well owner could go down and gather the oil as it accumulated on the surface of the water, just as was done by the old oil producers on the banks of the Caspian and the Irawaddy. Some of the trees which grew over the pits which marked the sites of oil wells were three and even four feet in diameter, thus proving that the wells had been abandoned at least 400 or 500 years ago.

At Enniskillen, Canada, and at Mecca and Grafton, O., Professor Newberry found similar ancient oil wells. At Enniskillen the oil was obtained by sinking pits through 40 or 50 feet of impervious clay. Beneath this the oil accumulated on the surface of the limestone, and sometimes thousands of barrels flowed out when one of these reservoirs was tapped. In sinking one pit, which was 7x14 feet in area, on the banks of Black Creek, the operators found that one corner of their shaft cut into an older shaft, which had been filled up with rubbish, twigs, leaves, etc. At the depth of 27 feet from the surface a pair of deer's antlers were taken from this old pit. Here, as on Oil Creek, the surface was occupied with trees three feet in diameter, and some of them were growing immediately over the old oil well.

NOVEL ENGINEERING WORK.

A novel engineering work has just been completed at the Duddon estuary, on the Cumberland coast, England, and is referred to in London *Engineering*.

For many years past a valuable hematite mine has been worked on the northern shores of this estuary, but at length the ore had been won, close to the margin of the sea, under which the bed of ore extended. To get at some of the ore underneath the sea-bed, a barrier has been constructed, which excludes the sea from an area of 26 acres. This barrier is just two-thirds of a mile in length, and for about one-half this length is fully 50 feet in height from the bottom of the foundations to the top of the parapet. At high water of high spring tides there is a depth of rather more than 20 feet against the seaward face of the work, but being exposed during southwesterly gales to the full force of the waves sweeping up the Irish channel, banked by the Atlantic rollers, the sea at such times breaks with great violence against the new barrier, as was, of course, expected, and has been provided for in the structure just completed. The engineer of the work is Sir John Coode and the contractors are the well-known firm of Messrs. Lucas & Aird. There is every reason to believe that the anticipation of the directors and shareholders of being able to continue the working of the iron ore over a further period of 25 years may be realized, thus giving employment during that time to about 1,500 men.

The Dubuque, Iowa, Street Railway is being fitted up for electric storage battery traction, and will probably be the first line on which the system will be used exclusively.

GREENE AVENUE RELIEF SEWER, BROOKLYN, N. Y.

This sewer, which is one of the largest in the country, is now in process of construction. The Boundary sewer, with a circular section and diameter of 22 feet, and the Tiber Creek sewer, 30 feet in diameter by 11 feet in height, both of Washington, D. C.; the Mill Creek sewer of St. Louis, 20 by 16 feet, and the Mill Creek, 20 feet by 20 feet, but with a larger area than given by a circular section, the Cohocksink, 18 feet 6 inches by 12 feet 8 inches, and the Hart Creek sewers, 16 feet diameter, all of Philadelphia, are believed to be the only larger ones. The St. Louis and Philadelphia sewers and the Tiber Creek sewer of Washington, are all located on the lines of old water courses, which accounts for their large size. The Stony Brook of Boston is also larger, but this is really an elongated culvert, built to obtain an inclosed water-way of capacity sufficient to avoid the disastrous floods which had been experienced before its construction.

The Greene Avenue sewer commences at Marcy Avenue, and runs, *via* Greene Avenue, Fourth Avenue and Butler Street, to the Gowanus Canal. It is intended to take the storm-water from a territory of about 1,500 acres, lying between Marcy Avenue and Flatbush Avenue, and south of Greene Avenue and Hanson Place, and thus relieve the existing sewers which now drain this district into the East River, and which are of insufficient capacity to carry the water of heavy storms from their entire drainage area. It is possible that the sewer may be extended on Greene Avenue for one or two blocks above Marcy Avenue. At Marcy Avenue the sewer, of circular form, has a diameter of 10 feet, which is increased to 12 feet, 14 feet, and 15 feet, as the drainage area increases, continuing 15 feet in size from Raymond Street till its near approach to the street surface, towards the lower end, compels a change of form. For this lower section it is being built with vertical side walls and curved invert, with a flat covering composed of iron beams supporting brick flooring arches. Near the outfall the sewer has a width of 21 feet between side walls, and a central depth of 6 feet.

The sewer will be 12,300 feet in length and have a bottom slope of 1 in 1,000. It is calculated to provide for a rainfall of about one inch per hour, reaching the sewer, when running at its maximum capacity, without any head over the soffit of the arch. At its upper end the sewer is but little below the local sewer, whose overflow it receives, and at its terminus the invert is at the level of mean high tide. Between Marcy Avenue and Dean Street (on Fourth Avenue), a distance of 9,400 feet, the sewer has a depth below street surface, at grade line, varying from 31 to 81 feet, and for this length it is being built by tunneling. From Dean Street to the outlet it will be built in open cut.

The tunnel section of the work is being driven, upon the pilot tunnel system, by Hart, Anderson & Barr, contractors, who also built the Knickerbocker Avenue extension sewer (12 feet in diameter) in Brooklyn in 1885–6, by the same method. The pilot tunnel system was devised, and first made use of, by Mr. Anderson at the Hudson River tunnel in 1880–81, when he was its superintendent.

In this sewer the pilot, composed of wrought-iron plates, with angle iron flanges on all four sides for bolting them together, is about 6 feet in diameter for the 15-foot section of sewer. It is kept some distance in advance of the main tunnel, and is located a little above its axis for convenience in excavating and placing the plates above it. In driving the pilot, the upper plates, which are narrower than the others, are first inserted, bolted up and temporarily supported till the circle is completed. A temporary wooden bulkhead retains the earth in front of its lower half while the upper half is being extended. The tunnel is at the same time being enlarged to its full dimensions, in sections of 10 feet, similar plates being used for retaining the earth above the springing line, and the plates supported by radial shores bearing upon the pilot tunnel. As the soil encountered so far is either a fair quality of not very fine sand, or of gravel interspersed with bowlders, it has not been necessary to extend the iron lining below the springing line. The sides or quarters of the invert are kept in place by plank, also supported by radial struts bearing on the pilot. The bottom of the invert needs no support. The rear end of the pilot, which is constantly removed as the forward end advances, is supported on the finished brickwork of the sewer; the pilot is kept about 30 to 35 feet in length. For supporting the 10 feet of tunnel excavation to full size in advance of the brickwork, the pilot acts in a great measure as a girder, its own main points of support being the brickwork in the rear and the undisturbed ground in front.

The centering for the brick lining, also supported upon the pilot, is composed of ribs made of two pieces of angle iron riveted together, and covered with the usual lagging. The brickwork (the outside plates remain in the work) is intended to be 16 inches thick for the 12 feet to 15 feet sections, but owing to a little irregularity in fixing the plates its thickness is in some places increased to 20 inches and even 24 inches.

But little water has as yet been encountered, and it is readily pumped by hand, from the excavation in front of the brickwork, to a trough which delivers it into a dump at the shaft where it is handled by a pulsometer. A 12-inch drain pipe beneath the sewer was provided for in the plans, but has not been found necessary. Considerable of the earth excavated is being left in the bottom of the sewer till its completion, and upon this is laid the track for the dump cars which convey out the material excavated, and bring in the brick, cement and other supplies. The mortar is mixed below.

There will be eight shafts sunk in all, and at each of them will be built a manhole through which the overflow of the existing sewers, during storms, will be delivered to the relief sewer, According to the plans the connections will be curved both laterally and vertically, the sills at their junction with old sewers, placed at the proper heights to allow all ordinary sewage to flow in the old channels without being diverted, and one wall of the connections constructed so as to cut off all flow in the old sewers which exceeds this amount. Thus far only three shafts have been sunk—viz.: at Dean Street and Fourth Avenue with a depth of 31 feet; at Hanson Place and Flatbush Avenue, 44 feet in depth; and near Fulton Street, 67 feet in depth. At all of these points the work of driving the tunnel is in progress. Work has also been commenced at the lower end of the sewer. A foundation of two courses of 4 inch plank, in the soft ground there encountered, is first laid. On this the side walls and invert are built of rubble, with an 8-inch brick lining. The sewer at its outlet will first empty into a settling basin, 60 feet by 84 feet in size, with its bottom 8 feet below high tide. Here sand, gravel, etc., will be intercepted and screens for catching floating matter put in if found necessary. The basin outlets are to be trapped from the canal.

The tunnel work is in charge of Assistant Engineer L. Russell Clapp, the portion in open cut in charge of Assistant Engineer David F. Brower, for which Swain & Keeney are the contractors, and the whole work is under the supervision of the Department of City Works, of which Robert Van Buren is Chief Engineer.

BRICKS FROM WASTE OF PLATE GLASS MANUFACTORIES.

As is well known, plate glass is ground by means of wooden plates covered with iron, between which quartz sand, abundantly moistened with water, is brought.

By the manipulation of grinding, which consists of a constant moving to and fro of the grinding plate over the plate to be ground, the quartz sand becomes mixed with particles of iron and sand, and after it has lost its sharpness is piled up near the manufactory as worthless material.

According to *The Brickmaker*, this waste material may be utilized in the manufacture of bricks. The sand, as stated, contains about 15 per cent. of glass particles and 2 per cent. of iron particles. It is very hygroscopic, and before it can be used for the manufacture of bricks has to be dried, and is then pressed into the mold under a pressure of 660 pounds per 0.155 square inch. The pieces thus obtained are subjected to a temperature of 2732° Fahr. At this high temperature the glass enters into a combination with the sand, a new product with new properties being thereby obtained. The bricks thus produced have a specific gravity of only 1.5; they are perfectly white and are not attacked by acids, and for this reason would be especially desirable for use in factories of chemical products, particularly in factories of sulphuric acid. hey also resist frost. Regarding the strength of the material, experiments have shown them to possess a compressive strength of from 840 to 975 pounds per 0.155 square inch By mixing the sand, enameled bricks showing beautiful colors are obtained, which may be used for decorating fronts and interiors.

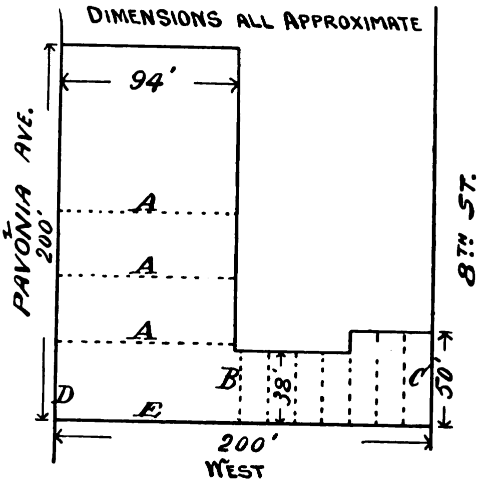
ACCIDENT TO THE NEW WELLS, FARGO & CO. STABLES AT JERSEY CITY.

A FATAL accident occurred on the morning of the 22d inst. at the new stable building of Wells, Fargo & Co., at Jersey City, N. J., now in process of construction, by which ten persons were injured, two of them fatally, while the recovery of a third is doubtful.

The building has a frontage of about 200 feet on Pavonia Avenue, with a depth of 94 feet, and has an ell from 38 to 50 feet in width, extending back to Eighth Street, the ell being a little over 200 feet deep. It is three stories in height. The walls of lower story are 20 inches and of the two upper stories 16 inches thick.

The floors are carried by iron girders, supported on the walls and on intermediate iron posts. These iron girders and the wooden floor beams were all in place for the second and third stories, but no flooring was laid.

At the time of the accident the roof trusses from B to C, in the ell, were in place; and, as stated by Mr. Post, of the firm of Post & McCord, contractors for the iron and roof work, three of the long span roof trusses, A A, were set up and connected both with each other and with the gable E by the full complement of trussed purlins; and part of the jack rafters were up. The trussed purlins bearing on the brick gable E were all anchored to the brickwork and the wall completed with a stone coping. A fourth truss was on the lower floor about ready to be hoisted, but no strain had yet been put upon the falls of the lifting derrick.



The accident seems to have been caused primarily by a heavy gust of wind from the westward, which threw down a section of the wall E for about 90 feet in length from the corner in the upper story and 40 or 50 for the second story, the lower story being uninjured, The brickwork fell partly within and partly without the building, the weight of brickwork and trusses carrying away both floors. As the iron girders of the second floor were anchored to wall girders built in over the arched doorways, the fall of the floor tore out one bay of the front at D. The mason work is of good quality; the bricks are very good, and the mortar appears to be fairly good, lacking, perhaps, a little in adhesion to the brick, but as the fallen wall was recently built, and the distance to the ground considerable, very good adhesion was not to be expected after the concussion produced by the fall. The portion of west wall still standing is in good alignment.

The wall itself, however, is pretty light for one of such length (fully 200 feet) and height, without cross walls. The New York City building laws would have required at least 4 inches more thickness for upper and lower stories, and 8 inches more for the middle story. When the heavy gust of wind came, it struck with its full force against a wall 200 feet long, over 90 feet of which were entirely unbraced above the third floor (a height of over 20 feet, besides the gable), the three roof trusses in place offering little resistance; and the work being still green it proved too much for it. There seems to be no other reasonable explanation for the disaster.

REFERRING to the pumping machinery at the Cornell University water works, mentioned in our issue of November 15, as being essentially of the Worthington type, the Gordon Steam Pump Co., of Hamilton, Ohio, writes that they furnished to the Universiy in August, 1883, one hydraulic engine with 17-inch power cylinders, 7½-inch outside, packed plunger pumps, 10-inch stroke. In August, 1886, a duplicate of this was furnished.

THE WATER SUPPLY OF PARIS.

IN the course of an article dealing with the sanitary condition of Paris, as affected by the present systems of water supply and sewerage, the *Engineer* recently made the following remarks:

"There is no Government department which has been more active in France during the past few years than that of public works; and the engineering enterprises undertaken under its auspices have undoubtedly done much to develop the internal resources of the country. But little has been done in the important matter of sanitation; and at the present moment Paris, with its magnificent highways and bridges, is provided with a system of sewerage of the most primitive order. Ineffective sewerage and a bad water supply are, in truth, the principal factors in determining the very much higher death-rate of Paris than of London; and to realize how bad these are, it is only needful to regard this discrepancy in the mortalities of the two cities, in relation to the fact that the other conditions of Paris are far more favorable to a low death-rate than are those of London, The question of the Parisian sewerage will have to be dealt with before very long; but works are at present in train for providing a more satisfactory water supply. A good deal of progress has already been made towards this end, of which the latest step was the recent construction of the reservoir at Montmartre.*

"Even during the past summer, however, the inconveniences of the present system of water supply have been severely felt. The service of pure spring water carried by aqueducts into the city is not sufficient to meet all the necessities of Paris; and when it is found insufficient—a thing which generally occurs during the hot and dry months of the year—it is necessary to substitute Seine water for some weeks together. This step has been taken this year, and the discontent which it evoked perhaps had something to do with inducing the Chamber to approve the long-debated scheme for bringing an adequate supply of "source" water into Paris. This is to be done by means of an aqueduct, which will transport the waters of the two small streams, the Avre and the Vigne, from their source in the department of Eure-et-Loir into Paris. The plans for this work have now been all prepared, and the necessary legal steps for the acquirement of land have been taken. The aqueduct will run through the two departments of Eure-et-Loir and Seine-et-Oise, and will discharge into an enormous reservoir to be built at Montretout. The most interesting part of the work, from an engineering point of view, is the tunnel which is to convey the water under the heights of Marly and the Park of St. Cloud. This tunnel will commence upon the borders of the Park of Versailles, and will run as far as Villeneuve-l'Elarg—a distance of about 4¾ miles. Its depth below the ground will, in some parts of the route, exceed 215 feet. Work has already been commenced on this portion of the undertaking. Fifteen shafts have been sunk at distances of about 550 yards. This preliminary work has not been carried on without difficulty. If is found that the sandy soil of which the hills on the west of Paris are composed is completely permeated with water at a little distance from the surface. Operations are therefore carried on by sinking a metallic lining, consisting of two concentric cylinders, secured together by iron braces, and strengthened by masonry. At the bottom the two cylinders join; and they terminate in a steel attachment with a cutting surface, which sinks into the wet sand under the weight of the cylinders. Inside this tube, which is 10 feet in depth, workmen can safely carry on the work of removing the soil; and with its progress the tube is lengthened out by the addition of new ones. Other noteworthy features of the works in connection with the scheme are the construction of an iron aqueduct across the Seine bridge, the erection of new machinery at Clichy, the laying of an extensive series of pipes through Paris, and the building of the Montretout reservoir. This reservoir will contain three compartments on the same level, each of them holding 4½ million gallons of water; and the entire capacity of the reservoir will be sufficient to supply Paris for three days. It will be covered with brickwork arches turted over. On the whole, it may be hoped that the Parisians are at last in a fair way to escape from the compulsory limitation of water consumption to which they have so long been condemned."

COMMANDER MELVILLE, Engineer in Chief of the Navy, makes out a strong case in his annual report in arguing for a reorganization of the Engineer Corps upon a basis more appropriate to the modern condition of naval science. He says that the number of engineer officers is now 194, of whom four have not had the proper engineer education, and two at least did not wish to be appointed in the Engineer Corps. He holds that a much larger number of officers is needed in the Engineer Corps, and also a better couse of instruction for the young men who are each year appointed into it.

THE United States armor-clad cruiser "Maine" was successfully launched at the Brooklyn Navy Yard, at noon on Tuesday, November 18. This is the first launch that has taken place at the Brooklyn yard since that of the unfortunate "Trenton" in 1876, and the "Maine" is the first of the latest type of iron-clad to be launched in a United States Navy Yard.

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*See THE ENGINEERING RECORD, August 9, 1890.

BUILDING CONSTRUCTION DETAILS.

No. XXXV.

(Continued from page 394.)

THE CHICAGO AUDITORIUM.—PART III., HINGED CEILINGS.*

FIGURE 24 is a plan, to reduced scale, of the ceiling. which is raised and lowered in sections.

Figure 23 is a vertical section and elevation at Z Z, Fig. 24, and shows the arrangement of hinged ceiling T (Fig. 1, page 296, Vol. XXI.), The double girder E¹ is suspended from roof truss J by rods A, and to it are attached the hinges C C, etc., at intervals of about 15 feet, corresponding to the separate sections of the ceiling, which are revolved by hoisting chains at D D, etc. B and B are 10-inch lattice girders.

Figure 25 is a vertical section at elevation at Z Z, Fig. 26, and shows the arrangement of hinged ceiling Q, Fig. 1 (page 296. Vol. XXI.).

Figure 26 is an elevation from X X, Fig. 25, of part of the ceiling, which is symmetrical about the center line C C, and has a total length of 87 feet 2 inches.

Figure 27 shows the detail at hinge A, and Fig. 28 shows the pattern of single and double hinges.

The ceiling is partly counterbalanced by weights W, and is hoisted and lowered by crabs D, each having a capacity three times as great as their estimated duty. B B, etc., are 1"x1" tee bars, spaced 12 inches apart.

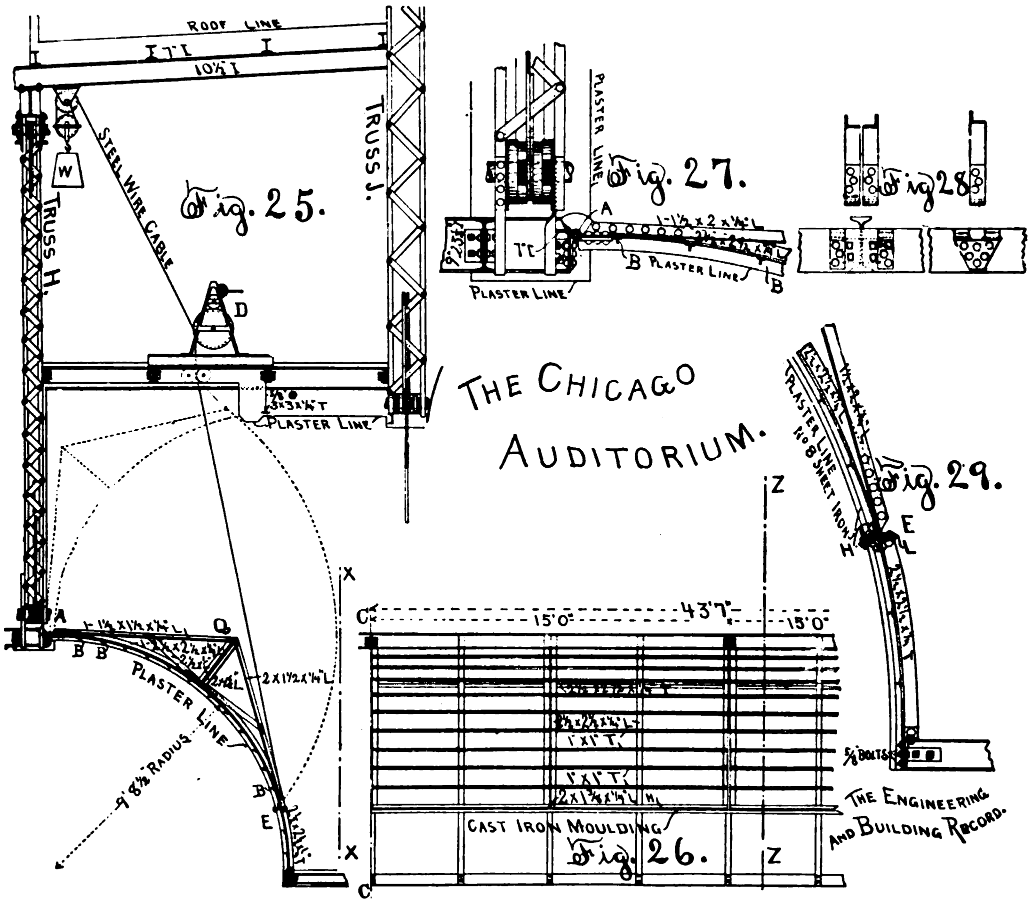

Fig. 25. Fig. 27. Fig. 28. Fig. 29. Fig. 26.

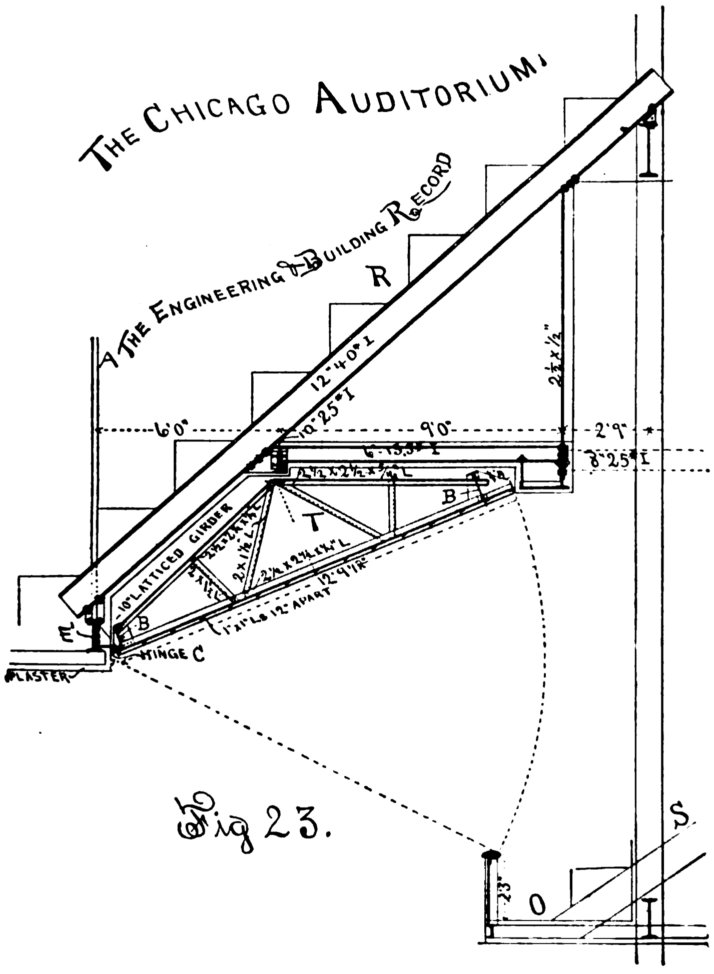

Fig 23.

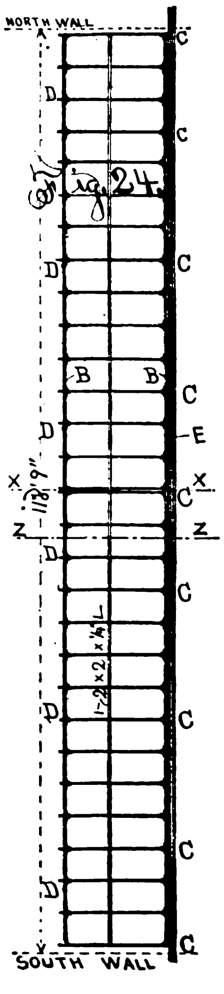

Fig. 24.

When closed the lower edge of this ceiling frame rests at E on the top of the rail in front of balcony R, Fig. 1.

Figure 29 shows the detail of the seat at E. H is a continuous longitudinal angle revolving against the cast-iron seat plate L.

(To be continued.)

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* Part I., General Description and Elliptical Ceiling was published April 12; Part II., Main Roof Trusses, was published November 22.

GOOD COUNTRY ROADS.

THE New Jersey law, which was passed two years ago, permitting the various counties of that State to issue bonds for the improvement of country roads, has led to movements in that direction in other States. There is no county in New Jersey, says the New York *Times*, in which the law has been given a fairer trial than in Union County. Bonds have been issued in that county to the amount of $300,000, and the money obtained by this issue will be sufficient to put in fine condition some thirty miles of country roads, extending in one direction from Elizabeth to Plainfield, and in another direction from Rahway to Summit.

The original estimate of expense for these improvements was $10,000 per mile, and to the credit of those who have had the improvements in charge, this sum has proved sufficient for them. The roads are now nearly finished, and for the first time in the history of Union County they are in condition for all sorts of travel in every season of the year. It is alleged that in bad weather one horse can now draw a load which required the strength of four horses before the improvements were made.

Chauncey B. Ripley, who was one of the projectors of the road law, said that it is the opinion of property owners in Union County that the issue of bonds for this improvement will really never be felt by the taxpayers. The taxes levied to pay the interest on these bonds are now lighter than were the expenses to keep the roads in repair under the old system. Since the law went into operation, moreover, real estate values in Union County have advanced nearly $1,500,000, exclusive of property advances in Elizabeth of nearly $700,000 more. While this increase is not claimed as all due to the improved roads, it is felt that this improvement may reasonably be credited with having already appreciated county values to the full extent of the cost of the roads, while general taxes are no higher than before the roads were laid.

Mr. Ripley quotes Warren Ackerman, who is probably the largest real estate owner in Union County, to the effect that the improvements cannot cost the present taxpayers a dollar, because by the time the bonds shall mature the increase of population and the appreciation of values will have been sufficient to pay for their redemption. As Mr. Ackerman expresses it, the bonds will be redeemed by taxes on valuations that do not now exist, and on persons who are not now residents of the county. Sheriff Glasby, who is also very much interested in the work, has expressed to Mr. Ripley opinions identical with those of Mr. Ackerman. He says that two years ago people were leaving Elizabeth because of the bad roads, but that the population is now increasing, and that the city is becoming attractive to people who like to drive and who are now enabled by the condition of the roads to enjoy that pastime.

The prominence given to Mr. Ripley in connection with this law and its execution has brought letters to him from various parts of the country which show an increased interest in this subject, and which promise to popularize the movement. Within a few weeks Mr. Ripley has received a letter from a gentleman for many years a member of the Pennsylvania Legislature. He wants a copy of the New Jersey laws and all printed matter relating thereto. He says that it is his purpose to devote his chief energies during the coming session to procure the passage of a similar act in his own State. This gentleman is also the owner of a newspaper, whose columns he intends to devote to the championship of this movement.

In Massachusetts a chair has been recently endowed at the Boston School of Technology to be known as the Chair of Public Roads. Mr. Ripley says that he has reason to believe that not only in Pennsylvania. Massachusetts, and New York—a society having recently been formed in this State to promote the improvement of public roads—has interest been awakened in this subject, but that there is hardly an Eastern or Middle State that has not taken on new zeal in the matter of the improvement of roads.

In Tennessee the Vanderbilt University instructs free of charge one person from each county to supervise roads. During the coming session of the Legislatures bills for this purpose will be introduced in Ohio, Virginia, Maryland and Rhode Island, in addition to the States mentioned. New Hampshire has recognized the importance of good roads in the White Mountain district by making State appropriations for the construction and repair of the principal county and town roads. Mr. Ripley was glad to notice during a visit to Maine last Summer, that increased attention is given to the condition of the roads in Bangor, and that at Bar Harbor the town authorities have become convinced that if they are to maintain that place as a favored summer resort they must provide good roads for the summer visitors.

THE POTTSTOWN, PA., NEW WATER-WORKS.

The new water-works at Pottstown, now in course of construction by the Pottstown Water Company, to give the town a larger and better water supply, will cost about $120,000. The water basin is a parallelogram 320 by 200 feet, is divided into two compartments, with an average depth of 13 feet; walls 9 feet thick at the bottom and 3 feet at the top, with 6-inch coping. The basin will have a capacity of 5,000,000 gallons. Water will be taken from the Schuylkill by a 30-inch pipe opening into an archway 3 feet wide by 4 feet and 3 feet high, leading to a pumping well 12 feet in diameter. The pipe is laid to the botton of the river, and extends at a grade into the well, so that water can be obtained at the lowest stage of the river. The water is forced up from a 24-inch main into the reservoir, from which a 20-inch main leads to the town for distribution. The available head of water will be 163 feet.

STREET CLEANING AND DISPOSAL OF REFUSE.

With the object of ascertaining the methods adopted for cleaning streets and disposing of street sweepings and other refuse (ashes, garbage, etc.), and the cost of the same, The Engineering Record recently sent out a number of circulars to the cities and larger towns of the United States asking for information upon this subject. The form of circular issued was one suggested by Mr. Sylvester H. Martin, Chief of Bureau of Street Cleaning, Philadelphia, given in the number for August 9, 1890.

The data furnished in the replies do not enable us to give the cost of street cleaning with as much accuracy as we hoped to be able to do. In many of them the cost is not given, or cannot be separated from the repairs. Many places have few or no paved streets, the frequency of cleaning is indefinite, or it is done quite irregularly, in some cases by the abutters, the city or town only carting away the sweepings. It is frequently uncertain how much, if any, of the amount charged to cleaning may have been expended on unpaved roads. In some of the returns, under the head of "width of main streets," has been given the width of paving only, and in others that of the entire street.

Table I. gives a summary of the data received relative to the cost of street cleaning in 32 places, from which the returns are more complete.

The replies to the other queries of the circular are summarized as follows:

DISPOSAL OF STREET DIRT.

Used for filling low places and private lots, or for grading streets and park grounds	54	cities	and towns
Part used for filling and balance taken out to sea.	3	"	"
Delivered at waste dump or garbage ground.	9	"	"
Hauled out of the city or town	6	"	"
Thrown into the river	2	"	"
Used as fertilizer	1	"	"
Sold for fertilizer	3	"	"
	78		

CLEANING CATCH BASINS.

Cleaning weekly	3	cities	and towns.
" bi-weekly	1	"	"
" monthly	6	"	"
" bi-monthly	2	"	"
" quarterly	5	"	"
" 3 times a year	1	"	"
" semi-annually	7	"	"
" annually	4	"	"
" 1 to 2 times per week (Lowell)	1	"	"
" 8 to 10 times per year	1	"	"
" 6 to 12 times yer year	1	"	"
" weekly in winter and monthly in summer (Los Angeles); summer is dry season	1	"	"
	33		

The above are given in many cases as averages, and it is stated in several of them that the basins are cleaned oftener if necesarry. From the remaining places a few make no return or say that they have no sewerage system, and others report, "cleaned after every storm," "as often as necessary," "when choked up," or "at no regular time."

For the cost of cleaning, 32 report having no data; only 26 give any statement of cost. For these the annual cost of cleaning each basin ranges from 30 cents to $11.71, the average of all being $4. For two-thirds of the number the prices range between $1.46 and $6, with an average of $3.62. It is possible that three or four of the larger amounts may include cleaning of sewers, though it is not so stated.

REMOVAL OF ASHES.

Daily removals	8	cities, etc.
Three times per week	2	"
Two times per week	9	"
Weekly	16	"
Bi-weekly	2	"
Monthly	1	"

Some of the above report that on business streets, in the center of the city, the removal is effected oftener. Washington reports removal from 2 to 6 times per week; Chicago reports removal daily, 2 and 3 times per week; Boston reports removal from dwellings weekly, stores semi-weekly, hotels and markets daily.

This makes 41 reports in all. In the remainder no return is given, or it is stated that the removal is left entirely to the householders; in some cases, however, it is under the supervision of the police or health officers, who interfere if it is neglected too long.

DISPOSITION OF ASHES.

Used for filling low places and private lots, or for grading streets and park grounds	53	cities, etc.
Part used for filling and balance taken out to sea	3	"
Delivered at waste dump or garbage ground	11	"
Hauled out of the city or town	7	"
Thrown into the river	4	"
	78	

REMOVAL OF GARBAGE.

The frequency of garbage removal is given as follows:

Daily removal	13	cities, etc
Three times per week	7	"
Semi-weekly	12	"
Weekly	9	"
Bi-weekly	1	"
Daily, in summer	2	"
Semi-weekly, in winter, and 3 times a week in summer	7	"
Daily, 2 and 3 times a week (Chicago)	1	"
	52	

Of the above, three report that garbage is removed daily from markets, stores and hotels and restaurants. In five of the returns no statement is given, and in the remainder it is said to be left to the householder, controlled by the police or health authorities.

DISPOSAL OF GARBAGE

Used for fertilizing fields or manufactured into fertilizer at a factory	5	cities, etc.
Sold to farmers, or used for feeding hogs	16	"
Burned or cremated in a refuse destructor	5	"
Delivered at city dump or garbage ground	9	"
Hauled outside the city	8	"
Rotted outside the city	1	"
Treated with lime	1	"
Buried	4	"
Dumped into the river	7	"
Carried out to sea	2	"
Disposed of by contractor	3	"
Used for grading lots, etc.	10	"
	71	

One of the above reports the garbage as partly burned on the city dump, along with ashes and street dirt.

REMOVAL OF DEAD ANIMALS FROM THE STREETS.

Removed by contract at expense of city or town	29	cities, etc.
Removed at expense of city by Street Commissioner or other city official, or by order of the Board of Health	36	"
Removed at expense of city, and cost recovered from owner of animal, if found	4	"
Contract made for removal without cost to the city for value of the animals	7	"
City receives a small price from contractor for the privilege of collecting dead animals	2	"
No provision made, but left to owners or other private parties to remove them	8	"
	86	

In St. Louis the city receives $50.15 per month for the privilege of collecting.

DISPOSITION OF DEAD ANIMALS.

Buried	33	cities, etc.
Delivery to rendering, glue, or desiccating works, or manufactories of fertilizers	21	"
Buried or cremated	2	"
Used as fertilizer	3	"
Thrown into Missouri River	1	"
* Deposited in garbage grounds or dump	3	"
Hauled out of the city	5	"
Left to decay in the fields	2	"
	70	

Machine sweepers are reported as being used for more or less of the street sweeping in 35 places.

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* In one case partly burned.

Table I.—Cost of Street Cleaning.

Name of City.	Population.	Character of Pavements.				No. Width of Main Streets.	Frequency of Cleaning.	Annual Cost of Cleaning
		(h) Block, Asphalt, etc.	Cobble.	Macadam	Gravel or unpaved.			
		Miles.	Miles.	Miles.	Miles.	Feet.		
New York	....	325.2	5.1	25.5	41	60 and 100	One-third daily; one-third tri-weekly; one-third bi-weekly	$1,255,835.00
Philadelphia	1,050,000	261.1	392.2	96.0	...	50	Once a week	425,042.00
Brooklyn	852,000	86.5	280.4	...	....	60 and 70	Part daily, balance tri-weekly	340,000.00
Boston	450,000	53.0	8.0	172.0	159	40	Principal streets daily; others two and three times a week	150,000.00
Omaha, Neb	134,752	(a) 52	....	....	315	100	Weekly, but not very regular	20,000.00
Kingston, N. Y.	22,000	1	¼	3¾	38	50	Weekly	2,000.00
Duluth, Minn	35,000	3.7	....	44	46	66	Paved, daily; others, occasionally	5,000.00
Jersey City, N. J.	163,000	27.5	10	1½	102	60	Some weekly, others once in two or four weeks	26,000.00
Erie, Pa	40,000	10	....	....	90	60 to 100	Quarterly	2,000.00
E. Saginaw, Mich	60,000	25	1	1	113	66	Semi-weekly, sometimes oftener	(b) 6,000.00
Springfield, Mass.	43,700	1	....	15	100	50	Block daily; other streets depending on location	7,100.00
Schenectady, N. Y.	22,000	3.5	12	½	50	70	Main streets weekly, side streets bi-weekly	2,000.00
Decatur, Ill	18,000	8	....	2	50	60	Paved streets weekly	3,000.00
Hoboken, N. J.	....	21	....	....	14	50 to 100	Weekly	4,000.00
Chelsea, Mass	28,000	1.5	....	5	34	50	Block semi-weekly, macadam monthly	2,000.00
Cohoes, N. Y	24,000	3.1	....	...	25.1	60	Paved streets weekly	(c) 9,000.00
New Haven, Conn	85,000	4.8	0.1	27.8	107.3	50 to 65	Block once to twice a week, others occasionally	12,000.00
Dubuque, Iowa	35,000	0.9	....	34.6	80	64	Monthly, except in winter	6,100.00
Fresno, Cal	11,000	1	....	....	35	80	Daily	1,200.00
New London, Conn	13,800	4.8	0.2	3	8.5	33 to 80	Monthly	2,000.00
Haverhill, Mass	26,500	1.5	0.2	2.1	25	50 to 60	Block and cobble semi-weekly Macadam quarterly	1,000.00 300.00
Washington, D. C.	250,000	156.5	....	....	....	80 to 160	One to six times per week	83,852.99
Chicago, Ill	1,200,000	372.1	....	206	1,419.5	66	Monthly to daily	213,247.77
New Orleans, La.	250,000	38	33	....	455	50 to 60	"Goes on daily"	75,000.00
Minneapolis, Minn	200,000	24.6	...	....	775	80	Paved streets daily, if necessary	(d) 3,334.87
Newport, Ky	28,000	13.5	....	9	1.5	40	Semi-annually	5,000.00
St. Louis, Mo	450,000	50	...	220	300	80	Tri-weekly	149,795.56
Mobile, Ala	45,000	6.5	1	20	70	50	Daily	24,000.00
Los Angeles, Cal	50,000	7.8	....	1 5	80	80	Paved, two to three times per week	(e)
Lowell, Mass	78,000	9.8	...	10	110	50 to 70	Main streets daily } Paved Other streets weekly } Unpaved	8,000.00 9,000.00
Albany, N. Y.	98,000	18.3	35.8	1.7	..	(f) 36 to 57	Once or twice a week	8,000.00
Lawrence, Mass	44,505	2.3	....	2.8	70	50	Paved streets weekly	(g) 13,000.00

(a) Three miles of this amount are alleys.
(b) Cost for cleaning pavements only.
(c) Includes keeping bridges in repair.
(d) For sweeping.
(e) Paved streets per mile:
20 to 60 feet, $16.
60 to 80 feet, $18.
80 to 100 feet, $20.
(f) Between curbs.
(g) Estimated.
(h) In this column are included all the smoother surfaced pavements, including stone and asphalt block, sheet asphalt, brick and wood.

There seems to be decided room for public improvements in some of the places heard from, as, for example, in a city of Pennsylvania of over 25,000 inhabitants, which has no sewers and no regular cleaning of streets, and in a city of Kansas, of some 12,000 inhabitants, which has about 65 miles of streets, and only about ¼ of a mile of pavement (macadam). To places away from the natural gas region, the reply from Indianapolis, that they have *no ashes*, is a little startling.

IMPROVEMENT IN ELECTRIC PIPE WELDING.

In welding together pipes by the electrical method it has been the usual practice to employ internal mandrels to prevent collapse or change of circumferential outline. Prof. Elihu Thomson, however, has recently invented a simple process by means of which the use of internal fixtures is avoided. The invention is based upon the circumstance that if a hollow structure be heated at a certain portion of its length and subjected to an upsetting action it will bulge exteriorly instead of collapsing. The structure will, therefore, have a larger diameter at the swelled portion. In the present process, where it is applied to the welding of pipes, hammer blows are delivered at the weld or on the side of the pipe, and are so graduated as to simply contract this bulging of lateral spreading tendency. The hammering is delivered laterally so as to restore the metal back to its original position on the sides of the pipe. There is said to be no tendency to collapse on account of the bulge of the pipe acting as a sustaining support.

EUROPEAN INLAND NAVIGATION.

(Concluded from page 392.)

"The following table of canals and canalized rivers in the United States has been compiled with care, and it is believed to be substantially correct, the information contained in it being the result of an extended correspondence with the managers and engineers of the various waterways.

"As far as practicable the canals and rivers have been arranged in geographical order. Canals that are mere artificial channels without locks, have not been included, nor any canals that are not regularly or occasionally used for purposes of navigation:

"It should be borne in mind that a large number of canals that once existed have been abandoned, such as the James River and Kanawha Canal, the Beaver and Erie Canal, and many of the branches of the Erie Canal of New York. The future of several canals included in the table is uncertain, but only those have been omitted that have actually passed out of use as canals.

"In noting the differences between our country and France we are at once struck with the fact that while our canal mileage is steadily lessening, that of France is not only increasing year by year, but immense sums of money are being expended to widen and deepen old canals. An expenditure on canals alone of $73,000,000 since 1871, the greater part of which was borrowed at a time when France was staggering under the heavy burdens imposed by the war of 1870, may well cause us to ask ourselves if our policy of letting canals go to ruin and then abandoning them is not a grave mistake in political economy. It should also be noted that all the waterways of France are absolutely free, except a few that are burdened with ancient leases, and that from time to time the Government is condemning and buying in these leases, so that before many years the whole 5,050 miles of canals and canalized rivers will be free of dues. The justification for such liberality may be found in the estimate put forth by French political economists that the canals, even when free, pay 5 per cent. per annum in economizing the national wealth.

"In comparing our canals with French ones we find that even the Erie Canal has less capacity than the standard which has been adopted in France for all main lines, of which size of canal France already has a length of 952 miles. The true measure of the usefulness of a canal is the size of boat that can traverse it, and we see that while the French canals can pass a 300-ton boat the Erie can only pass a 240-ton boat. This disparity, however, will not long remain, as the State of New York is rapidly doubling the length of the locks on the Erie Canal, so that two boats connected, end to end, can be locked through at one time, thus increasing the tonnage capacity to 500 tons, or 200 tons in excess of the French standard. The additions to the locks are being made two feet wider, with a view to an ultimate change to locks having a width of 20 feet.

"If we look at the tabulated statement of the State canals of Ohio, we see that the capacity of the Ohio locks is only 90 tons. It is therefore not surprising that these canals are not flourishing, and that every year strong efforts are made to have them abolished as a dead weight on the Commonwealth."

Alabama is conducting a lively campaign in the interest of good roads. The newspapers of the State have taken the matter up and are keeping its importance prominently before the public.

CANALS FORMING PART OF A MARITIME OR RIVER NAVIGATION.

	Length.	Depth.	Locks.			Owner or Lessee.
			No.	Available length.	Width.	
	Miles.	Feet.		Feet.	Feet.	
Essex, Mass	1	12	4	90	20	Private corporation.
Enfield Falls, Conn	5	4.5	4	71	18	Private corporation.
Delaware and Raritan	44	9	14	210	24	Pennsylvania Railroad.
Feeder	22	6	4	100	24	" "
Chesapeake and Delaware	14	9	3	211	24	Private corporation.
Albemarle and Chesapeake	8.4	8.	1	206	40	" "
Upper Appomattox	5.5	2.6	5	60	9	" "
Augusta, Ga	7	11	1	90	15	" "
Lake Borgne	6.8	6	1	265	70	" "
Barataria	33.5	5	1	125	26	" "
Plaquemine	4	6	1	117	25	" "
Muscle Shoals	16	5	11	260	60	United States.
Louisville and Portland	2.4	Var.	2	335	80	" "
St. Mary's Falls	1	16	1	465	80	" "
Des Moines	7.6	5	3	325	80	" "
Cascades*	0.6	8	1	449	90	" "
Willamette River	0.6	Var.	4	170	40	Private corporation.
Total	179.4					

*Unfinished.

CANALIZED RIVERS.

	Length canalized.	Depth in low water.	Locks.			Owner or Lessee.
			No.	Available length.	Width.	
	Miles.	Feet.		Feet.	Feet.	
Songo (Maine)	7	3	1	80	24	Private corporation.
Black (New York)	43	4	2	142	30	State of New York.
Schuylkill*	90	6.5	36	99	18	Reading Railroad.
Monongahela†	102.2	6	9	160	50	Private corporation and United States.
Ohio‡	6	6	1	600	110	United States.
Beaver (Pennsylvania)	3	2	2	104	25	Private corporation.
Muskingum	84	5.5	10	160	36	United States.
Little Kanawha	49	4	5	127	26	Private corporation and United States.
Great Kanawha§	58	7	5 2	270 311	50 55	United States.
Big Sandy‖	13.5	6	1	160	52	" "
Kentucky	98	6	5	149	38	" "
Green and Barren	175	3	5	145.5	36	" "
Cumberland‖	14.4	4	1	270	52	" "
Coosa (Alabama)	5.3	3	3	175	40	" "
Black Warrior‖	0.4	6	1	287	52	" "
Wabash‖	12	3.5	1	214	52	" "
Illinois	146	7	3	310	75	United States and State of Illinois.
Fox:						
Above Montello	29.5	3	4	150	35	United States.
Montello to mouth	130.9	6	23	160	35	" "
Chippewa (Wisconsin)	3	4.5	1	270	40	Private corporation.
Total	1,070.2					

Length of ordinary canals, 2,099.1 miles; maritime or river canals, 179.4 miles; canalized rivers, 1,070.2, miles—Total, 3,348.7 miles.

*Fifty miles of lateral canal; 8 locks have two lifts each.
†Larger locks at lower end.
‡ Movable dam.
§ Two fixed dams; 5 movable.
‖ Unfinished.

CANALS.

	Length.	Depth.	Locks.				Owner or Lessee.
			No.	Available Length.	Width.	Capacity.	
	Miles.	Feet.		Feet.	Feet.	Tons.	
Erie*	351.8	7	34 38	208 98	18	500 240	State of New York.
Oswego†	38	7	9 9	208 98	18	500 240	" "
Oneida River†	20	4.5	2	102	30	....	" "
Cayuga and Seneca†	22.8	7	11	98	18	240	" "
Black River†	35	4	109	78.5	15	76	" "
Feeder†	12	4	1	78.5	15	76	" "
Delta feeder†	1.4	4	1	78.5	15	76	" "
Baldwinsville†	5.8	4	2	78.5	15	76	" "
Champlain†	66	5	23	98	18	120	" "
Glens Falls feeder†	12	4	14	88	15	....	" "
Delaware and Hudson	108	6	108	92	15	135	Private corporation.
Morris	102	5	34	90	11	80	Lehigh Railroad.
Lehigh‡	48	6	55	87.5	22	110	Lehigh Navigation Company.
Delaware Division	60	6	25	87.5	11 22	....	" "
Pennsylvania	144	6.3	31 4	176 81	17	320 160	Pennsylvania Railroad.
West Branch Division	35	5	12	81	17	113	" "
Juniata Division	14	5	4	81	17	113	" "
Susquehanna and Tidewater	45	6	30	170.7	17	270	Reading Railroad.
Chesapeake and Ohio	184.5	6	73	90	15	140	Private corporation.
Dismal Swamp	29.1	5	5	98	17.6	....	" "
Feeder	3.5	2	1	90	10.5	....	" "
Savannah and Ogeechee	16	3	1 4	143 79	30 18	....	" "
Ohio	308	4	144	78	15	90	State of Ohio
Hocking branch	41	4	19	78	15	90	" "
Walhonding branch	25	4	11	78	15	90	" "
Miami and Erie	246	4	93	78	15	90	" "
Sidney feeder	14	4	....	....	....	90	" "
Wabash and Erie	11	4	4	78	15	90	" "
St. Mary's	3	4	1	78	15	90	" "
Illinois and Michigan	97.2	6	15	100	18	200	State of Illinois.
Total	2,099.1						

* Free—all locks duplicated.
† Free.
‡ Twelve miles slackwater.

CONSTRUCTION DETAILS OF THE ROCHESTER, N. Y., WATER-WORKS.

PART I. — SANITARY PROTECTION OF HEMLOCK LAKE.

THE water for a domestic supply for the city of Rochester, N. Y., is obtained from Hemlock Lake, a natural reservoir, about thirty miles from and 388 feet above the city.

The lake is about seven miles long and five-eighths of a mile wide. It occupies the northern extremity of a deep, narrow valley, which is fifteen miles long. In the southern part of the valley is situated the village of Springwater, having a population of about 600. The shores of the lake are bluff and steep, rising to a height of from 300 to 500 feet, and mostly covered with a growth of timber. The basin of the lake is deeply excavated in the formation known as the Marcellus Shale, lying above the limestone rock of that region.

In the Springwater valley, south of the lake and on the summits of the bluffs forming the boundary of the basin, are a considerable number of farms devoted to the usual purposes of agriculture. About the time at which operations were commenced to utilize Hemlock Lake as a source of water supply for the city, attention was attracted to the lake as a desirable point for summer residences, and there have been built on its shores over 100 cottages and several hotels or summer boarding-houses, with a summer population, including transient visitors, of from 500 to 700 persons.

The necessity for the efficient sanitary protection of this water-shed was self evident. Obviously the ideal method would be the purchase of the lake and its whole water-shed, and the removal therefrom of every habitation or shelter for man or domestic animal, including all farm and village constructions and improvements, and to restore the whole area to a state of natural wildness and savagery. But this plan was abandoned on account of the great expense involved, and because the lake must be preserved for public navigation, and because of disputed titles to the riparian rights.

The Legislature of the State was, therefore, induced to pass a general act entitled, "An act to confer upon the State Board of Health power to protect from contamination, by suitable regulations, the water supplies of the State and their sources." Under this act the State Board of Health was requested to, and did prepare and establish, rules and regulations for the sanitary protection of the waters of Hemlock Lake. These regulations provide, in substance, that privies, pig-pens and barnyards shall not be located over or adjacent to any stream, spring, or dry water-course, where the contents thereof can reach the same; that any privy situated within 50 feet of any spring stream, or dry water-course, or ravine, shall be constructed without a vault, and shall have under the seats water-tight receptacles for night soil, which shall be frequently removed, emptied, cleaned and returned, and the contents buried in the earth in such a manner that they cannot, by any possibility, reach any water-course or permanent level of subsoil water. No manufacturing waste is allowed to be discharged or drained into any spring, stream or dry water-course on said water-shed. The same restriction applies to the depositing of dead animals, birds, fish, decayed fruit, leaves, sawdust, roots, branches or trunks of trees in any spring, dry water-course, or into the lake itself. The washing of sheep or other animals in the lake or any of its tributaries is also prohibited.

The provisions relating to houses, cottages, tenements, tents and picnic grounds within 200 feet of the shores of the lake may be summarized as follows: Each is to be furnished with at least one privy set upon the surface of the ground, without a vault, and so constructed that metallic pails, 15 inches high by 14 inches in diameter, can be placed under the seats and easily removed with their contents. The occupants are required daily to add dry loam in small quantities, as a deodorizer and absorbent. It is made the duty of the occupant also, to provide a receptacle for dry garbage and to carefully place the same therein. All slop or wash water must be scattered upon the surface of the soil at a distance from the lake, or any ravine or water-course, and the points at which said slops are deposited to be frequently changed. Animal manures from stables are required to be carefully deposited in tight-covered receptacles and the contents thereof to be frequently removed.

The city of Rochester is required to furnish a sufficient number of metallic pails for the use of each necessary privy within 200 feet of the lake, and is required to remove, empty, cleanse and disinfect the same as often as is necessary. When a full pail is removed an empty one is to be supplied in its place. The pails during removal are to be provided with air-tight covers, so that no odor shall escape. The contents of the pails, together with the dry garbage, is required to be removed by the city to a point below the foot of the lake and there buried. As soon as possible after these rules were ordained and sanctioned by the County Judge, the city commenced operations thereunder, and has continued the same since that date. In practice, the night soil and garbage is collected and removed to the foot of the lake by means of a broad, flat-bottomed steamboat, the collections being usually made in the early morning. From the steamboat landing the night soil and garbage is transported on a tramway to the dumping ground, which is a plat of land owned by the city in a retired location 1,800 feet below the foot of the lake.

The treatment of the night soil and the garbage, on its arrival, is as follows: Narrow trenches are excavated, care being taken that the permanent level of subsoil water shall not be reached, and the contents of the pails are deposited therein in thin layers. It is then immediately covered with dry loam to a depth of about 6 inches. This process is repeated day by day until the trench is nearly filled, when the balance is rounded up with earth. A measurement of the location of these trenches is made and recorded, the surface cultivated and cropped, and after a suitable period the same land may be again used for a like purpose. A trench 500 feet in length has proved entirely sufficient for a single year's operation up to the present time, and as these trenches need not be more than 3 feet apart, it will be seen that but a small area need be provided for the purpose.

The cans, as fast as they are emptied, are taken to the sanitary building, which is provided with an elevated tank filled with a solution of copperas, as also all other necessary appliances for washing, cleansing, deodorizing and drying the cans. The cans are of heavy galvanized iron, and are

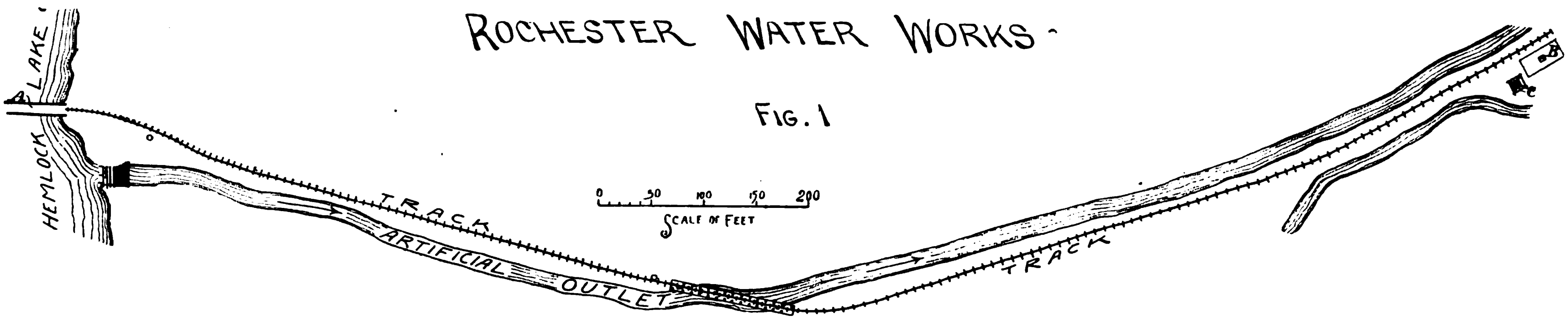


FIG. 1

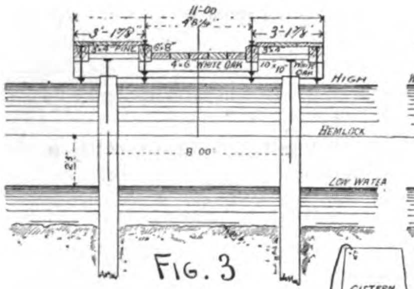


FIG. 3

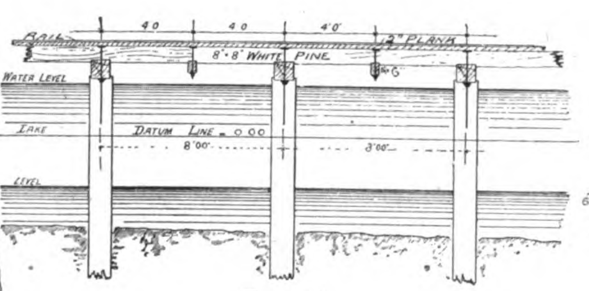


FIG. 4

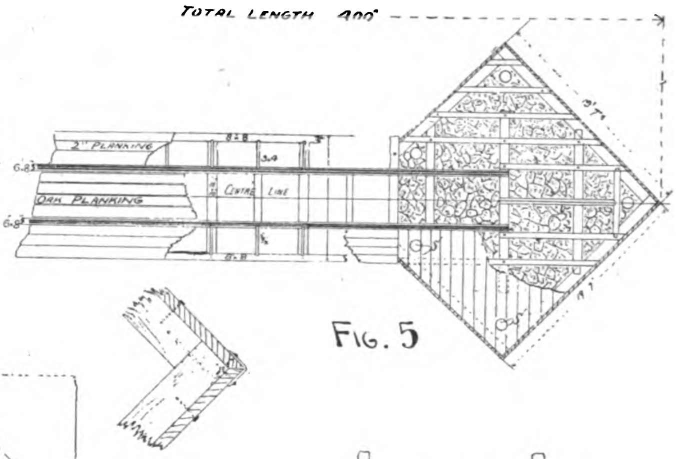


FIG. 5

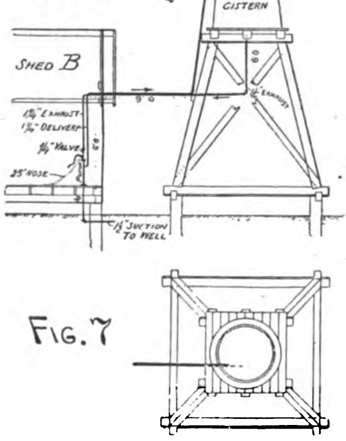


FIG. 7

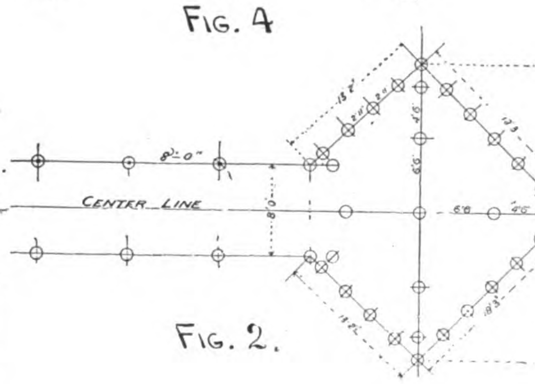


FIG. 2.

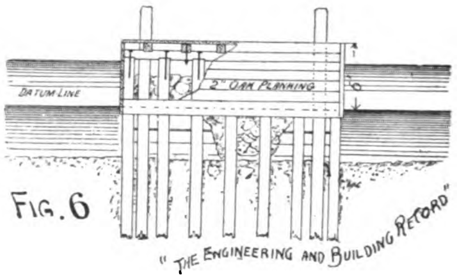


FIG. 6

"THE ENGINEERING AND BUILDING RECORD"

thoroughly coated, inside and outside, with black asphalt varnish. In the cleansing of the cans, if found necessary, other and more active deodorizing and disinfecting agents are employed. The process has been so conducted for several years that all local prejudice has subsided, and all fears as to possible offensive odors in the neighborhood allayed. In the sanitary building and about the grounds no offensive odors are discernible, although during the past year the contents of nearly 6,000 cans were thus removed and treated.

The results that have been accomplished thus far may be briefly stated : A great proportion of the residents about the lake have kept their grounds in a neat condition and maintained the sanitary purity of the water. Underbrush, logs limbs of trees and decaying vegetable growths are no longer thrown into the lake, nor allowed to litter the shores, but are carefully collected and burned. Privies, pig-pens, etc., away from the lake, but on the water-shed, have been removed from streams, ravines and dry water-courses and placed under such sanitary regulations and espionage as to render them unobjectionable. The local Boards of Health have become interested in these questions and their co operation secured. Animals which die upon the water-shed, and decayed putrescible matter of all kinds are no longer discharged into the nearest ravine, but are buried in the ground a distance therefrom. And finally, all night soil and dry garbage produced about the lake is collected and buried a long distance below the lake.

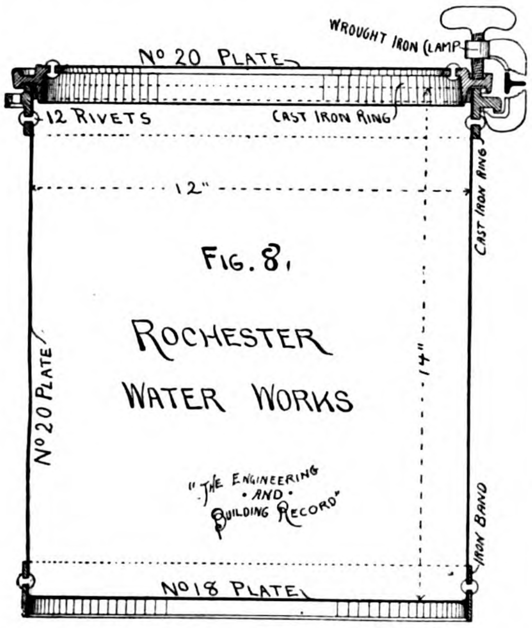


Figure 1 is a diagram showing the location of the steamboat landing A, washing shed B, and tank C. Figure 2 is a diagram of piling for the dock A and its pier head, the latter being shown in plan in Fig. 5, and in elevation in Fig. 6. Figure 3 is a cross-section, and Fig. 4 a side elevation of dock A, Fig. 1. Figure 7 shows the arrangement of the cistern, washing shed, pump connection, etc. Figure 8 shows the details of the iron service buckets.

The above description is chiefly condensed from a paper presented to the American Water-Works Association, by J. Nelson Tubbs, late Chief Engineer of the Rochester Water-Works, and the illustrations are prepared from drawings made in this office from the originals belonging to the Water-Works Department. In subsequent issues we shall describe the general features of the water-works system and illustrate special construction and standard maintenance details.

(To be continued.)

According to the Boston *Post*, James L. Anthony, C. Amory Stevens, Thomas McConn and their associates have filed with the Secretary of the Commonwealth of Massachusetts a petition to the Legislature, asking for incorporation as the Old Colony Ship Canal Company, for the purpose of constructing a ship canal from Buzzard's Bay to Barnstable Bay. Alfred D. Fox and his associates also petition for incorporation for the purpose of constructing a ship canal between the two bays above named.

St. Paul, Minn., has for some time actively prosecuted the work of putting electric wires underground. The results, up to the present time, have been satisfactory.

ELECTRIC POWER IN MAINE.

The great Penobscot River, the largest in Maine, drains 7,400 square miles, a region as large as the State of Massachusetts. From Oldtown to Bangor, a distance of 12 miles, the river falls more than 90 feet, giving several of the finest water powers in the world. These, says the Bangor (Me.) *Industrial Journal*, have mainly been used for the manufacture of lumber, but one of the finest is now to be used for a different purpose. At Veazie, four miles above Bangor, an electric plant has been building during the past year, that, when entirely completed, will be one of the largest in the world.

The building will be 240 by 52 feet, with a wheel house running the entire length, 23 feet wide, a boiler house 50 by 35 feet, and a tower 48 feet in height from foundation of the front of the building. The main building will be 32 feet high. The upper story will be leased to parties wanting room and power. Fifteen water wheels of 150 horse-power each will be placed in this plant and so arranged that they can be run separately or in groups. The power is transmitted to a main shaft, and connected with this will be two alternating machines for incandescent lights sufficient for 3,000 lights, four arc dynamos, and three power generators. About 100 feet in length of the building is completed, seven wheel pits are complete and six wheels are set. These are now in operation and light and power are being supplied to parties desiring either or both.

The plant will supply lights for the cities of Bangor and Brewer, power for the electric railway for Bangor and Brewer, and will also pump water for Brewer and Veazie. The ownership of the plant is divided as follows ; Three-fifteenths are owned by the Penobscot Water and Power Company, four-fifteenths by the Bangor-Street Railway, and eight-fifteenths by the Bangor Electric Light and Power Company. Power for motors will be let by the Electric Light and Power Company. The electric system used is the Thomson-Houston. For pumping water for supplying Brewer and Veazie, Henry R. Worthington, of New York, furnishes the pump, with a capacity of 2,000,000 gallons per day. The whole plant is thoroughly and substantially built of brick.

INSPECTION OF ELECTRIC WIRES AT BOSTON.

The Boston, Mass., Common Council has passed the following ordinance bearing on the supervision of electric wires throughout the city :

Section 1. A department of the city, to be known as the "Department for the inspection of Wires," and to be under the charge of the inspector of wires, is hereby created. Said inspector shall be appointed by the Mayor, subject to confirmation by the Board of Aldermen, for the term of one year, beginning with the first day of May in the year of his appointment, and until his successor is appointed and confirmed, and shall be paid an annual salary at the rate of $3,500 a year.

Sec. 2. Said inspector shall supervise every wire or cable over streets or buildings, and every wire within a building, when such wire is designed to carry an electric light or power current ; shall notify the person or corporation owning or operating any such wire or cable, whenever its attachments, insulation, supports or appliances are unsuitable or unsafe, or any tags or marks thereof, hereinafter described, are insufficient or illegible ; and shall remove every wire abandoned for use and every wire, except the wire of a street railway company used for the transmission of its motive power, or for the protection or support of such wires, which, after the expiration of six months from the date of his appointment, shall be unprovided with a tag or mark distinctly designating the owner or user of such wire or cable ; shall see that all statutes, ordinances and regulations relating to said duties, and to the location and removal of wires and cables in, over or under streets or buildings are strictly complied with and enforced.

Sec. 3. Said inspector shall, as soon as convenient after his appointment, make, and thereafter keep in his office, a map showing the location of all wires over, in, or laid under the streets and other public places, and over buildings of the said city, and a record of the names of the owner or owners of each and all said wires.

Sec. 4. Said inspector shall, when so required by the Mayor or Aldermen, examine every application for the erection of any wire, or poles or posts for the support thereof, in or over any street or public place, or for conduits under any street or public place for such wire, and shall report to them any facts which, in his opinion, bear upon the question of granting or refusing to grant such application.

Sec. 5. Said inspector shall have the charge and control of the erection and maintenance of all wires owned by the city, including the fire-alarm telegraph and police electric signal and telephone systems, and of the posts and other supports therefor now erected or owned, or hereafter erected by the city. He shall purchase and set up all the wires, posts, supports, and all the dynamos, machinery and other electrical appliances required by the city in all departments, and shall see that all the said wires, posts, machinery and appliances are maintained and kept at all times in good order and condition.

THE ADHESIVE POWER OF DRIFT BOLTS.

Some experiments on the adhesive power of drift bolts are described by John B. Tscharner in a pamphlet of selected papers of the Civil Engineers' Club of the University of Illinois.

The author states that probably the only information on the subject, thus far available, is the following in Baker's "Treatise on Masonry Construction": "In some experiments made at the Poughkeepsie Bridge, it was found that a 1-inch round rod driven into a $\frac{15}{16}$-inch hole in hemlock required, on an average, $2\frac{1}{2}$ tons per lineal foot (of depth) to withdraw it; and a 1-inch round rod driven into a $\frac{3}{4}$-inch hole in white or Norway pine required on an average 5 tons per lineal foot (of depth) to withdraw it." It was thought that a series of experiments made to determine more fully the following questions might, therefore, be of some interest:

1. The average holding power.
2. The relative holding power of pine and oak.
3. The best relation between the diameters of hole and bolt.
4. The holding power as the bolt is being withdrawn.
5. Relative holding power, bolt perpendicular and parallel to the grain.

The tests were made on a 100,000-pound Riehle's testing machine in the testing laboratory of the University of Illinois. The rods or drift bolts used were of steel, 1 inch in diameter and about 30 inches long. Holes $\frac{15}{16}$, $\frac{14}{16}$, $\frac{13}{16}$ and $\frac{12}{16}$ inches in diameter were bored in the face of the timber. Care was taken to get the holes as nearly perpendicular to the face of the piece as possible. The rods were driven with a sledge. In case the rod was found to be not quite perpendicular to the face of the stick when it was placed in the machine, small pieces of sheet-iron were placed between the timber and the bed-plate to make the bearing uniform.

To determine the average holding power a series of 45 tests were made by driving a 1-inch round rod into a $\frac{15}{16}$-inch hole in yellow pine, the depths varying from 3 to 12 inches. All were driven perpendicular to the grain of the wood. The mean of the several tests showed that it required 500 pounds per lineal inch of depth to withdraw one of the bolts. This result corresponds fairly well with the first series of experiments made at the Poughkeepsie bridge quoted above.

It was found, further, that the holding power of white oak is a little over three times as great as that of yellow pine.

In determining the best relation between diameters of hole and bolt, three series of tests were made in $\frac{15}{16}$, $\frac{14}{16}$, $\frac{13}{16}$ and $\frac{12}{16}$-inch holes, each series being in a single piece of wood. From the results obtained it was found that if we designate the strength in the $\frac{13}{16}$-inch hole as 100 per cent., that for the $\frac{14}{16}$-inch hole would be 79.7, 79.5 and 71.1 per cent. for the three series of tests, and that for the $\frac{15}{16}$-inch hole 47.4, 47.3 and 52.4 per cent., while the $\frac{12}{16}$-inch hole gives 52.5, 52.5 and 45.3 per cent. The holding power for the $\frac{13}{16}$-inch hole was greater than for any of the others, while common practice seems to favor a $\frac{15}{16}$-inch hole. It is possible that the fact that the bolt is harder to drive in a $\frac{13}{16}$-inch hole, and also more liable to split, may have something to do in determining the practice. However, in answer to the latter supposition, Mr. Tscharner says that in the 126 tests made, not a single crack in the timber was caused by the driving of the rod. The results clearly show that the elastic limit of the fiber of the timber is passed between the $\frac{13}{16}$ and the $\frac{12}{16}$-inch holes, as the holding power of the $\frac{12}{16}$-inch hole is almost the same as that of the $\frac{15}{16}$-inch hole. Hence, if we would utilize the maximum holding power of the timber, the author states that the proper ratio of diameter of the hole to that of the bolt would be 13 : 16.

In determining the holding power as the bolt is being withdrawn the method of procedure was as follows: The bolt was driven into the piece, placed in the machine, and power was applied until the rod slipped. This was recorded as "started," and the holding power at this point was read and recorded. The rod was then drawn out some fractional part of an inch, and the holding power again read and recorded. It was found that as motion begins, the holding power decreases very rapidly, and that when the rod has been withdrawn an inch the holding power is only about 20 per cent. of the initial resistance. After this the holding power decreases almost directly with the distance drawn out. The method of failure was almost in every case by a series of jerks and thuds, the holding power rising and falling in a series of waves.

As to the influence of the direction in which the bolt is driven—whether perpendicular or parallel t. the grain—it was found that the ratio between the holding power of a bolt driven parallel and that of one driven perpendicular is about as 1:2 This ratio was found to be nearly the same whether the timber was pine or oak.

BRICK-MAKING AT BAGDAD.

THE British Consul-General at Bagdad, in his latest report, has some interesting observations on brick-making in that town.

All Bagdad, with a population of about 116,000 souls, may be said to be built of kiln-dried bricks. Stone is little used there, as it is in Mosul, in house building, and, although the tenacious clay of Irâh gives good material, its use is confined chiefly to huts and agricultural squattings along the Tigris banks. There is thus an enormous demand for bricks. These are all hand-made and kiln-dried. There are about 25 large and small kilns at work, in the hands chiefly of Jews and Christians, but the turn-out is far behind the demand. Half-built houses sometimes remain so for long periods for want of bricks. The kilns are dotted over the desert outside the city. Often in spring, when the Tigris or Euphrates lays acres of ground under water, these stand like islands in the inundation, and brick-making is suspended. The bricks are carried from the kiln on small donkeys, each taking not more than 10 large or 25 small bricks. In the course of transit they get much broken, as the best, though good to look at and of a chrome yellow color, are very brittle. Another great promoter of the demand for bricks is the absorption of water every winter, bricks suffering equally with the mortar in which they are laid, owing to their porousness. Thus there is hardly a house, or wall, or brick pathway in Bagdad which does not constantly call for patching or rebuilding with new bricks. The old city walls, thrown down about 1870 by Midhat Pasha when Governor-General, remain still, in spite of years of burrowing and abstraction, a mine of broken bricks. Under a late *regime* it was said that the right of taking these away and selling them was conferred as a substitute for pay on the soldiery; but at present all classes seem to help themselves to them. These remarks serve to show what a good opening there is in Bagdad for brick-making after some simple but scientific method. Unskilled labor can be engaged to any extent just now at about 18 cents per diem for men and 10 cents for boys. Fuel is abundant.

Novelties.

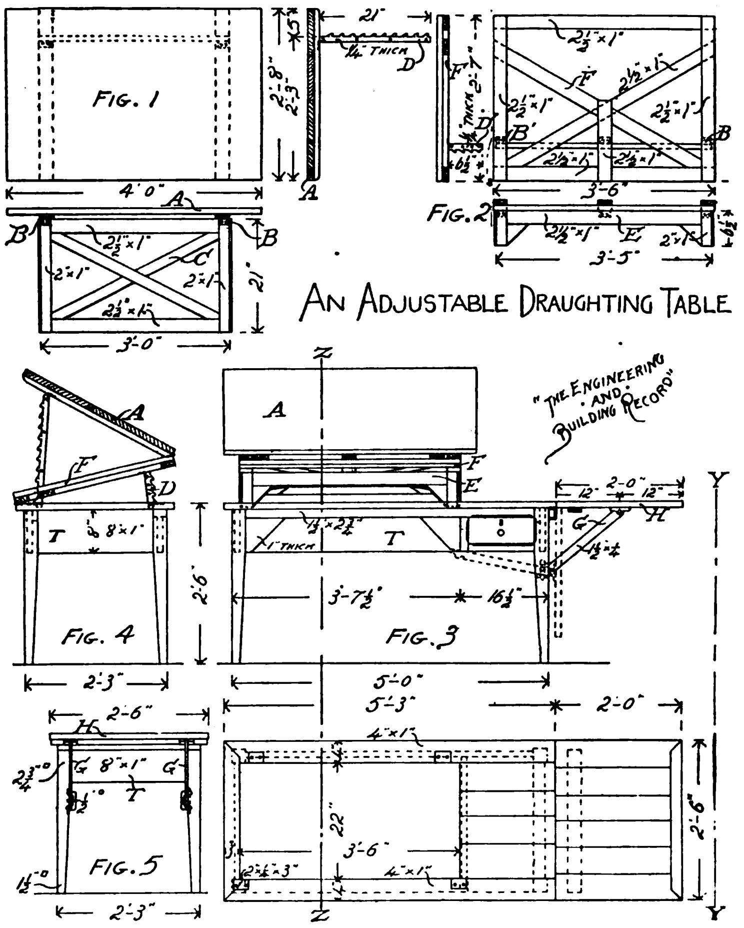
Devices are described under this head purely and strictly as news; because believed to be new and calculated to interest readers.

In no case is pay accepted, directly or indirectly, for publishing a novelty notice.

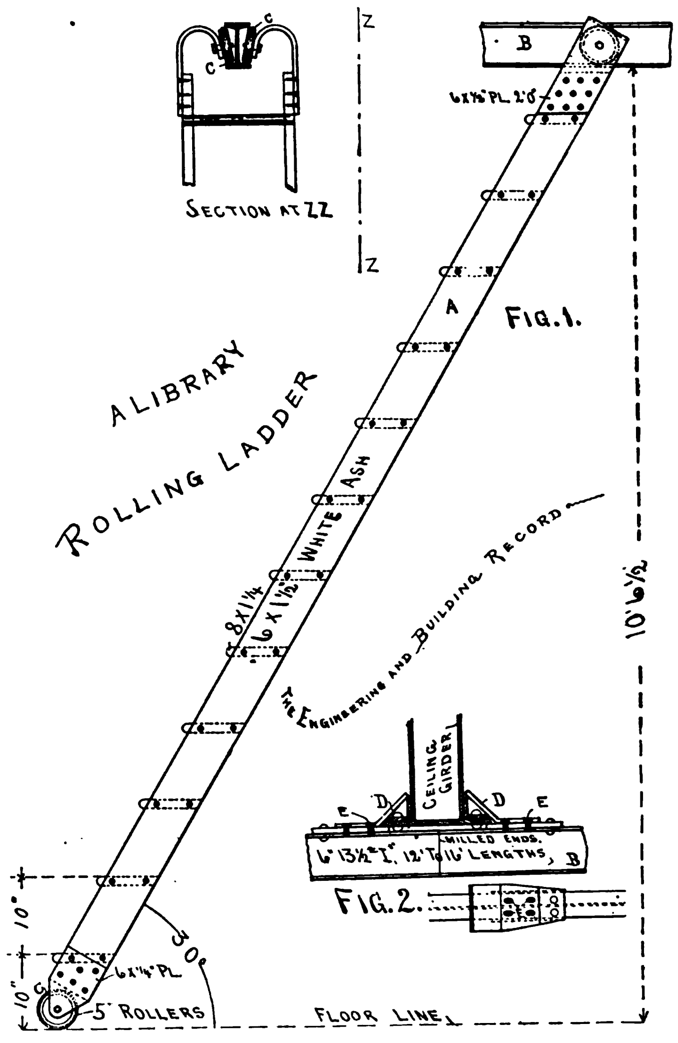
As the subjects are selected for their supposed novelty and interest merely, it will, of course, be understood that the selection does not imply indorsement.

AN ADJUSTABLE DRAUGHTING TABLE.

FIGURE 1 shows a drawing board A that may either be used on the independent table frame C, or attached to the frame E, Fig. 2, that is intended to be placed on the table T, Figs. 3, 4, 5. Fig. 3 shows a plan and elevation of frame E and board A on table T. Fig. 4 is a section at Z Z in Fig. 3, and Fig. 5 is an elevation from Y Y, Fig. 3. Board A has an independent adjustment by the hinges B B and bar D, and the top F of frame E has another adjustment, also independent, by its hinges B′ B′ and bar D′ H, Figs. 3 and 5, is a drop leaf supported by the braces G G. This table was designed by M. J. L. Towler, for use at the Detroit Bridge Works.



An Adjustable Draughting Table



A Library Rolling Ladder

A LIBRARY ROLLING LADDER.

FIGURE 1 is a side elevation of one of several rolling ladders recently designed and constructed by the Pittsburg Bridge Company for use in the Allegheny Court-House, where convenient access was desired to long rows of high shelves.

Light iron beams, B, parallel to the shelves, were attached to the floor girders of the story above, and on their lower flanges the top rollers of the ladders were carried, their axis being set parallel to the flange surfaces. The bottom rollers had no special track but ran freely on the bare floor. All the rollers had concave edges into which rubber rings C were sprung to make them run smoothly and quietly.

The track beams B meet each other in very close butt joints and are conveniently attached to the girders, without any drilling or fitting, by the use of the iron clamps D. These have slotted holes, E, permitting them to be set exactly and then bolted tight.

IT is reported that for the first time in many years a general flushing of the sewers in the Mission district, San Francisco, is in progress. The diphtheria raging in epidemic form in that section is attributed to the filthy condition of the sewers.

BOOK NOTICES.

SEWAGE DISPOSAL WORKS: A Guide for the Construction of Works for the Prevention of the Pollution by Sewage of Rivers and Estuaries. By W. Santo Crimp. Published by Charles Griffin & Co., London; 1890.

The author of this book was for a long time connected with the Wimbledon Sewage Works, and is now Assistant Engineer to the London County Council. He states that his main object has been to meet the want for an illustrated guide to the construction of sewage works, by bringing together the plans and details of some of the best examples of such works which have been carried out. Accordingly, after about 120 pages of introductory matter the bulk of the work is given up to descriptions and plans of sewage farms and works at twenty different places in England, and of the sewage precipitation works at Dortmund, Germany.

The English works include those of Bedford, Birmingham, Doncaster, Coventry, Ealing, Swanwick, Beddington, Chiswick, Bradford, Salford, Portsmouth, Wimbledon and others, illustrating ordinary sewage farming, intermittent filtration, and various chemical and precipitation processes, the whole being well illustrated and accompanied with useful information as to cost, results, character of effluents, etc.

The author is not an advocate of any particular process, but appears to be inclined to take the most favorable view possible in each particular case and to accept the statements of patentees without much criticism. This is especially the case in his remarks on the treatment of sewage by electrolysis, which he thinks is one of the most promising of all methods—but in regard to which he has only the statements of the patentee to give as evidence. The book is one which we commend to the attention of municipal engineers as a useful addition to their libraries.

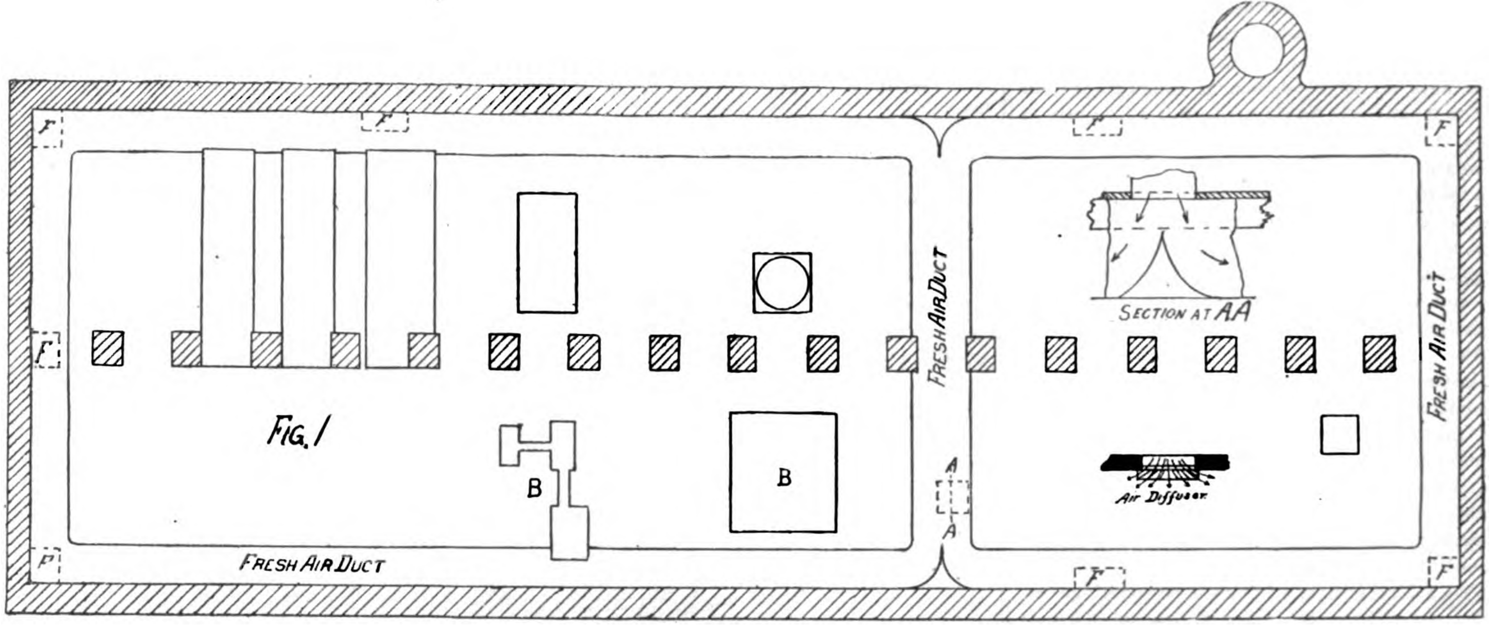
MUNICIPAL ENGINEERING. By W. D. Clark.

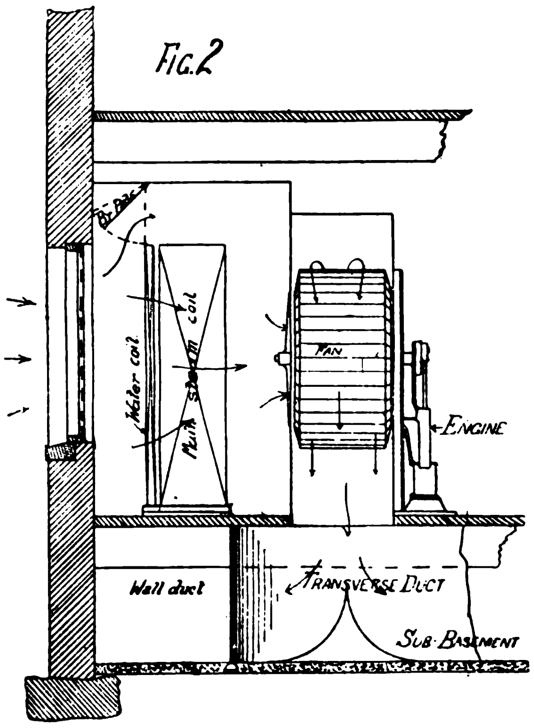
The above is a paper read before the Illinois Society of Engineers and Surveyors, in January, 1890. In it, the author, after touching upon the varied duties and responsibilities which devolve, or should devolve, upon the municipal engineer, whose services, as he states, are often much too little appreciated, especially in cities of moderate size, discusses some of the principal questions to which he has to give his attention, especially those of paving and sewerage. Mr. Clark's opinion, given in this paper, that a single ring of brick is ample for all sewers up to a diameter of five or six feet, and that in deep excavations it might be used for a very much larger diameter with perfect safety, is one that would not meet the general approval of skilled engineers.

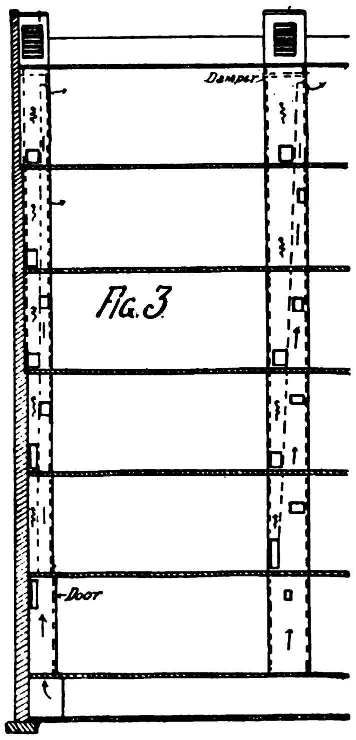
DOMESTIC PLUMBING HEATING LIGHTING & VENTILATION ENGINEERING

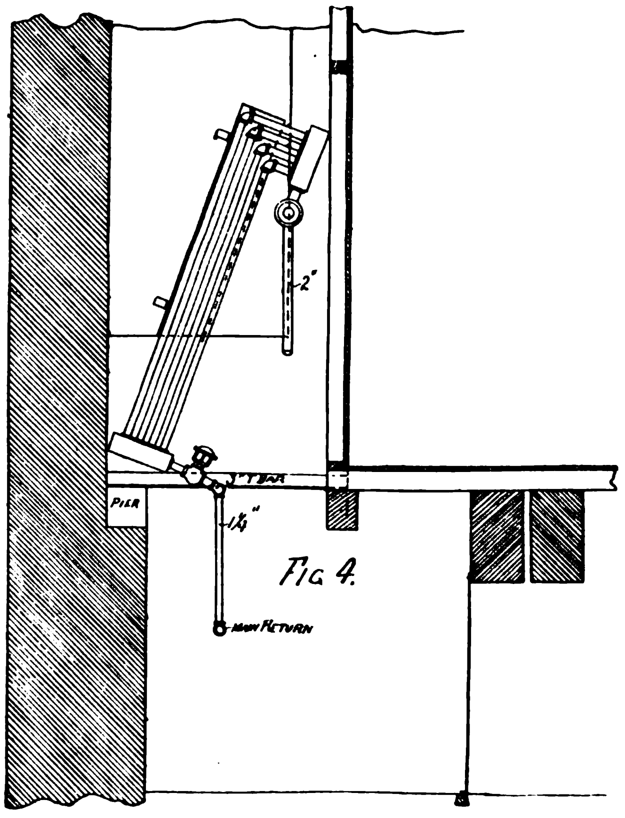
HEATING AND VENTILATING IN THE ENGINEERING BUILDING OF THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY.

THE system of heating and ventilating in the engineering building of the Massachusetts Institute of Technology, at Boston, was designed by Professor S. H. Woodbridge, and to him we are indebted for the following particulars and annexed illustrations relating to it.









STEAM HEATING AT THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY, BOSTON.

The building is without interior walls other than light partitions, and all available external wall space is demanded for piers and windows. Locations were allowed for eight vertical flues, varying from 9 to 12 square feet in cross-section, for the supply and discharge ventilation of the thirty and more rooms. The rooms were arranged by their intended users, with only partial reference to the fixed location of flues, and connecting air ducts were disapproved as unsightly. The great value of the basement floor space imposed a limit of 16x12 feet on the area to be surrendered to ventilating purposes. The use of the concrete floor of the sub-basement for apparatus, above and about which the basement floor is removed, precluded the use of this space as a distributing air chamber, and compelled the building of a continuous duct about the perimeter of the sub-basement, Fig. 1, with one cross duct beneath the fan at A A, and into which it discharges The main duct, except where engine beds B encroach upon it, is 15 square feet in cross-section. The cross duct has nearly twice that area. The control of the air quantities to be moved in one direction or another within these ducts is effected by movable deflectors, one under the fan, and one at each end of the cross duct.

The perimeter ducts have for three of their sides the foundation wall of the building, the sub-basement concrete floor, and the wooden floor of the basement. The fourth side is of galvanized iron, secured by nailing to wooden strips set in the concrete and nailed to the wooden floor and beams. A free use of elastic cement was made in all joints between metal and wood, and of paint in all locked or other joints of the sheet metal, and provision made for a possible settling away of the concrete from the wooden floor.

To clear the laboratory ceiling and the floor space of all possible obstructions and the unsightly appearance of piping, the steam mains and branches, traps, etc., are placed within the air conduits. All such steam pipes are carefully pitched and drained and covered.

In the plan of the sub-basement floor, Fig. 1, these pipes have not been shown, since the small scale of the drawing might have tended to create some confusion.

The eight vertical ducts F (see also Fig. 3, which is an elevation of the ducts), are of necessity made to serve the dual purpose of supply and discharge. To adapt them to such purpose, a diaphragm is fixed in such way as to provide two channels having areas proportioned to the quantities of fresh and spent air to be moved through them to and from the successive stories. These diaphragms are made of sheet iron, which is secured by methods effectually preventing the leakage of air from the plenum into the exhaust conduits. Wherever practicable, the diaphragm is so placed as to remove the supply conduit from the outer walls, and to bring the discharge conduit against them.

Because of the small space occupied by the entire system, velocities of the air moved must be high. To secure to each register of the lower stories its proportion of air, and to prevent its going by such register under the momentum of its movement, deflectors are used, the area of each and the angle at which it is set controlling the air volume issuing from each register. Similar deflectors, set in a reverse position, are used for the outlets from the upper stories. To thoroughly break up and diffuse the swift flow of cool air in solid current from the register, diffusers, such as are shown in Fig. 1, are used.

The building accommodates some 30 students, and the air supply is nearly 2,000,000 cubic feet per hour, the fan running at 250 revolutions.

The warming is effected by three systems. Because of the great amount of steam work done in the basement, air must be supplied in large quantities, and at a temperature ranging from 45 to 55 degrees, according to laboratory work and outside conditions of weather. The eight distributing flues cannot supply air to the several floors or rooms at different temperatures. They must supply it at the temperature required by that room above the basement most easily warmed to the point desired. Therefore it becomes necessary to provide means for supplying air through one system of conduits to the basement at, say 50 degrees, and to all rooms above the basement at 70 degrees, and to further warm the air by direct means, in such rooms as require supplementary heat.

The air is heated before it reaches the fan to 50 degrees, a "Standard" metallic thermometer mounted in the fan case indicating the temperature, which is controlled by regulating the steam pressure in the coil. In moving under pressure through the sub-basement conduits the air leaks into the basement, as was anticipated, through innumerable small vents, the current being nowhere sensible, and yet the aggregate volume amounting to some 750,000 cubic feet per hour. Reaching the base of the flues the air passes through steam coils so made and placed that the flue area is not obstructed (Fig. 4). The control of steam to these coils is by means of the Johnson electric regulating apparatus, the thermostat being hung before the supply register on the third floor. Whatever the temperature in the sub-basement conduits, the air supply to the rooms may be maintained at 70 degrees or 72 degrees, the range being confined within these limits by the automatic action of the regulator.

Within the rooms are placed wall steam pipes, the steam supply to which is regulated by the Johnson automatic apparatus, the thermostat being exposed within the rooms. For the quick warming of the building the sub-basement conduit temperature may be run up to 100 degrees, and the flue thermostat may be swung away from the register front. Air at such times may be circulated through the building instead of being taken from the outside.

The construction and arrangement of the auxiliary heater at the base of the flues is a matter of interest, because well suited to a successful working of the automatic method of steam supply. The steam enters at the top and through a valve so throttled that when the main conduit air is at its coldest the steam flow will be nearly continuous. The coil drains through a check valve. Without such arrangement, Professor Woodbridge explains, the temperature within the flue would fluctuate through a considerable range, for on the wide opening of the supply and return valves steam would enter freely at both ends and suddenly heat up the coil and the flue. It is desirable that the steam flow should be as nearly continuous as possible, and sufficient in quantity to warm the air passing through the coil. If the supply valve is throttled the drip valve must be closed until the pressure within the coil is sufficient to force the accumulated water outward against the steam pressure. A throttled drip valve would allow steam to back into the coil and cause pounding. But the check valve holds back the steam and allows the condensation to collect until its weight and the steam pressure combined force the valve open and the water out. The filling of the pipes with condensed water serves also the useful purpose of automatically regulating the length of their heated parts, and aids in maintaining the even temperature sought in the flues.

The heating is for the most part done by the exhaust steam of engines and pumps used in the building, and to avoid the possibility of returning oily water to the boiler the condensation is passed into the sewer. For the purpose of cooling this water, and of utilizing its heat, it is passed through 800 feet of continuous 1¼-inch pipe, made into a trombone coil 38 pipes high, 7 feet long, and 3 pipes deep, placed before the inlet window. In mild weather the condensation is so small that it goes to the sewer cold. When the outside temperature is low the temperature of the chilled water is higher, the increase in the rate of condensation slightly exceeding that of the chilling. The maximum rate of flow is about one cubic foot per minute.

The fan and combined heater, Fig. 2, with directly attached engine, is of the Sturtevant pattern and make, with a large by-pass over the heater. The fan is 6 feet in diameter, and at 250 revolutions per minute supplies 33,000 cubic feet of air.

The water of condensation is taken care of by a syphon trap made of a 4-inch pipe, 18 feet long, driven vertically into the ground, bushed at the top and tapped at the side. Through the bushing runs a 2½-inch pipe to within one foot of the bottom of the large pipe. This pipe is bushed at the top, tapped at the side and open at the bottom. The tap receives the water from the returns. The bushing receives a 1-inch pipe which drains the supply main at a higher pressure than the return, and runs inside the 2½-inch to within one foot of the bottom of the large pipe. Within the trap there may, therefore, be two pressures and two heights of water columns on the steam side, one vent discharging the water of both. The only resistance or friction is that due to the flow of water through the large pipes.

All steam for the building is brought from the Rogers building through an underground 6-inch pipe, about 1,000 feet long. The water condensed in the heating apparatus is metered, and the record preserved for the purpose of record and investigation.

The cost of the complete installment was nearly as follows:

Fan, engine, main coil (1,000 square feet), coolers, etc... ..	$1,445
4,580 square feet of direct steam surface, flue coils, mains, fittings, and placing...	4,490
Construction of ducts and sheet iron work................ ..	900
Johnson's electric service.	1,355
Pump, Locke's regulators, sunken syphon trap, covering mains, etc.....	1,775
Total....	$9,965

The direct heating surface is as great as though the heating of the building depended solely upon it, as insufficient boiler power threatened to make the use of the ventilating system impracticable in severe weather. Furthermore, if air is passed into the rooms at the temperature at which it is desired to keep such rooms, to maintain that temperature the direct surface must be as large as would be required for heating by direct radiation.

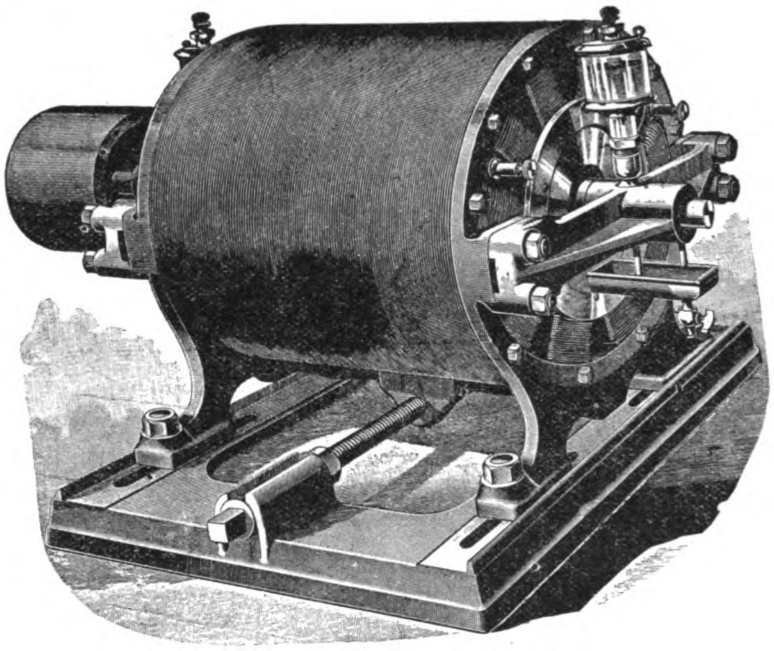


FIG. 32.—THE WESTINGHOUSE MOTOR.

The system is practically a dual one, the capacity of either part being enough for the heating of the building. The ventilating system includes the main heater, cooler, fan, engine, duct, supplementary heater in flues, etc. Its cost may be put at $3,500, and the balance may be charged to the heating plant. The total heating surface is about 1 square foot to 110 cubic foot of space.

Handicapped by the conditions imposed, the work is of interest not so much as an illustration of a perfect system, as of what may be accomplished under difficulties.

The following summary will prove of interest:

Area of inlet windows	33	square feet.
Area through steam coil..	20	"
Area of fan mouth	13.3	"
Area of fan discharge...	12.2	"
Area of floor occupied by fan room and heating chamber..	120	"
Area of heating coil....	1,200	"
Area of flues for supply and discharge of air	96	"
Number of flues for supply and discharge of air.	8	"
Air volume supplied, cubic feet per hour	1,950,000	

ELECTRIC MOTORS.

(Continued from page 397.)

THE WESTINGHOUSE MOTOR.

THE Westinghouse motor, shown in Fig. 32, is an alternating current motor, and is made by the Westinghouse Electric Company, of Pittsburg, Pa.

This motor, like the alternating current dynamo, dispenses with a commutator and, moreover, has no electrical connections of any kind with the armature, relying solely on induction for the rotative effort. The motor consists of a series of field magnets, wound with two sets of coils, the ends of which are connected to binding posts conveniently located for attachment to the supply circuit. These binding posts form the only connection with the current, the latter being taken from the regular lighting circuits, with the addition of a single return wire. This return wire makes it possible to send two alternating currents through the field of the motor at the same time, the pulsations of the currents being similar but not simultaneous. The resultant of these two currents is that a rapidly rotating polarity is given to the field, corresponding in period to that of the currents producing it.

The armature is similar in construction and appearance to the ordinary Siemens drum armature, without the commutator. The winding is, however, claimed to be simpler, and consists of a few turns of comparatively small wire, the ends of which, instead of being carried out to a collecting ring, or any other form of sliding contact, are soldered together, forming a closed circuit having no connection with the main current. The alternating currents in the field induce secondary currents in the armature, and by the attraction between these and the revolving polarity of the field, rotation is produced, the rate of rotation corresponding very nearly with that of the field. The field of revolving polarity must not be confounded with any actual revolutions of the field magnets. The field magnet considered as a structural part of the motor is fixed, but the magnetic axes of its polarity rapidly shift their position.

When no work is being done by the motor, very little current passes either through the armature or field; but as load is put on and the work increases, the armature tends to lag slightly, causing the passage of more current in proportion to the work done. The reaction between the armature and the field is similar to that between the primary and secondary coils of a Westinghouse converter, and the increase of load on the motor causes increased supply of current in a manner similar to that when lamps are added to the secondary circuit of a converter.

By an ingenious adaptation of the converter principle, the motor may be regulated in speed and the direction of motion reversed without the use of switches and resistance coils. The method of operation is exactly similar to the link-reversing gear of a locomotive. The extreme position of the reversing lever in one direction corresponds to full speed ahead. From this it can be graduated through every intermediate speed to the reversing point, and from that on to full speed backwards.

Lightness and compactness are claimed for the motor. It can be served either through a converter or directly from the primary circuits.

(TO BE CONTINUED.)

ONE of the latest practical applications of aluminium is found in electric street car trolleys. The great lightness of such aluminium trolleys constitutes an important advantage in overcoming the mechanical difficulties of current collecting.

THE METHOD OF PROPORTIONING RADIATING SURFACES.

BY R. C. CARPENTER, ITHACA, N. Y.

THE method of proportioning radiating surfaces in common use is a rule-of-thumb, founded perhaps on experience, but, at the very best, an unscientific operation, which often proves very unsatisfactory.

It is usually the custom to make the radiating surface some portion of the cubic contents of the room, say 1 to 40 for hot-water heating, and 1 to 60 for steam heating, with various modifications, reductions or additions as the case may require, and as the judgment or experience of the designer indicates. If the changes from this proportion are managed with good judgment the radiating surfaces will be well distributed, otherwise some rooms are likely to be cold and others too hot. What may seem strange, the first writer on the subject of steam heating seems to have been the principal one to investigate this subject from a scientific standpoint, and his rules, although somewhat complex in their application, can be, I believe, adapted to our practice of to-day. The writer I refer to is Thomas Tredgold, and his work was written more than sixty years ago. The works of Hood, following twenty years later, make use of his experiments and rules and put them in better form for practical use. I think the methods of reasoning and the researches of Tredgold are worth the attention of all those engaged in designing heating apparatus, and as the book may not be accessible to many, I will briefly refer to them, as well as to Hood, and also give some reductions from his results, so as to make them applicable to modern practice.

In the first place, he refers to a well known fact, that a higher temperature is required in a room heated by conduction, or by conveying in bodies of heated air, than in the case of a room warmed by radiant heat chiefly, for the reason that in the first case the air of the room is abnormally dry, and evaporation takes place from the body, which produces the sensation of chilliness; in the latter case no such an effect is experienced.

Radiant heat, however, acts to warm a person very unequally, so that one might literally burn on one side and freeze on the other; yet despite the inequality caused by such heating, it is, in connection with a limited amount of heating by conduction, the most satisfactory method. For conveying heat he argues that steam is the best medium, and, he thinks, superior to hot water, though judging from the erroneous causes that are given for hot-water circulation, he seems to have known little or nothing of hot-water heating. Believing it to be very injurious to health to heat air with any surface hotter than 210 degrees, he rejects, as unsatisfactory, other methods, and considers simply steam heating. It will surprise many modern heating engineers to see how perfect was the apparatus in nearly every detail even in his time.

As for his scientific calculations, he takes as his unit the heat necessary to raise the temperature of one cubic foot of water one degree per minute. We ordinarily take as a unit the heat necessary to raise one pound of water one degree per hour, which we denote as a British Thermal Unit, or in symbols B. T. U.

The unit used by Tredgold is 3674.4 times as great. He finds from calculation that the same heat that would heat one cubic foot of water one degree would heat one cubic foot of air 2,850 degrees, or this heat would warm 2,850 cubic feet of air one degree.[*] That is, according to Tredgold, a cubic foot of air would require .00035 as much heat as a cubic foot of water; and he further states that a cubic foot of iron would require .95 as much as the same bulk of water.[†]

Tredgold next undertook to ascertain how much heat was given off from different kinds of surfaces, and I consider his experiments of this kind the best that have been made. In making these experiments he allowed for the specific heat of the metals employed, but did not allow for the thickness, and in this respect the later experiments of Peclét would indicate that he had made no appreciable error. The method employed was to fill pipes of different material with water at 180 degrees and note the time it took to cool to 150 degrees, and he made corrections for heat transmissions in accordance with the method of Dulong and Petit; his methods are to be considered accurate, although errors of measurement may have been made.

The results obtained were as follows, the last column being deduced by the writer:

	Proportional conduction and radiation of heat.	Tredgold's unit as explained, per minute.	B. T. U. per sq. foot per hour, deduced from Tredgold's values.
Tinned iron.	100	.00041	1.46
Glass	155	.000644	2.37
Glass, later trial	.. .	... ...	1.99
New sheet iron with smooth black-scale	156	.000656	2.47
Sheet iron, rusty and brown surface.	180	.000738	2 70

The last was assumed to be like cast-iron. Tredgold, at a later date, measured the cooling of water contained in a cast-iron pipe. This can be reduced to the following:

	Proportional conduction.	B. T. U. per sq. ft. per hour
Cast-iron pipe, ordinary rusty surface	128	1.88
Same pipe covered with black varnish	132	1 93
Same pipe covered with white paint	125	1.83
Glass, later trial	....	1.72

It is interesting to compare this test with one made by Mr. George H. Barrus with a cast-iron and a wrought iron radiator in a similar manner. The cast-iron radiator gave 1.72 B. T. U. per hour per foot of surface, while the wrought-iron radiator, under the same conditions, gave off 2.04 B. T. U.

Tredgold next found that the product of the number .000738, which he took as the heat units given off from a cubic foot of water per minute, through cast-iron pipe, multiplied by 2850, the number of cubic feet of air heated by the cooling of 1 cubic foot of water one degree, to be 2.1. This, multiplied by the difference of temperature between the pipe and the air, would be the cubic feet of air heated by one square foot of pipe per minute. The number taken from Barrus determination should be 1.6 instead of 2.1 or about 25 per cent. less) Tregold's rule to find the radiating surface is: Multiply the cubic feet of air to be heated per minute by the difference between the temperature the room is to be kept at, and that of the external air, in degrees, and divide the product by 2.1 times the difference between the temperature of the pipe and that of the room. Example: How much steam-pipe surface is needed to heat a room 70°, when outside air is 0°, and 500 cubic feet of air are needed per minute? We have $500 \times 70 = 35000$ divided by $(2.1 \times (212 - 70) = 298.2,)$ which gives as a result, 116.8 square feet.

The methods used to find the number of cubic feet of air needed per minute, which is indeed the most difficult part of the required computation, were as follows: From the experiment which has already been described, he found that a square foot of glass would cool 1½ cubic feet of air 1° per minute for every degree of difference of temperature. He also made some experiments relating to the cooling effect of ordinary doors or windows, from which he concluded that each door or window, in addition to the glass let in 11 cubic feet of air per minute which had to be warmed to the temperature of the room. For ventilation he adopted the low co-efficient of 4 cubic feet per minute for each person in the room. Hence, he had the following rule for air to be warmed per minute:

RULE.—The amount of air to be warmed per minute should be equivalent to 4 times the number of people the room is to contain, added to 11 times the sum of the windows and doors, added to 1½ times the number of square feet of glass.

By combining the two rules we readily find the radiating surface required in any room to be equal to the difference of temperature between the outside air and that in the room multiplied by the sum of 4 times the people, plus 11 times the windows and doors, plus 1½ the area of the glass, divided by twice (the difference between the temperature of the steam pipe and that of the room). This, expressed algebraically, is as follows: Let S equal the radiating surface required; let P equal the number of people expected to be in the room; W, the number of windows and doors together; G, the area of glass surface; t, the required temperature of the room; t', the outside temperature; T, the temperature of the pipes.

$$\text{Then } S = \frac{(t - t')\,(4\,P + 11\,W + 1.5\,G)}{2.1\,(T - t)}$$

Example: In a room 20x14 feet and 11 feet high, having three windows each, with 20 square feet of glass, and one door, required the radiating surface to keep it at 70 degrees when the outside air is zero. Allowing 300 cubic feet to each person, such a room would accommodate 10 persons, although for private houses the allowance must ordinarily be double this. For hot water heating take T equal 170 degrees. Then

$$S = \frac{(70)\,(40 + 44 + 90)}{2.1\,(100)} = 58 \text{ nearly.}$$

Since there are 3,080 cubic feet of air in the room, this will give one foot of radiating surface to each 53 cubic feet in the room.

A corner room, or exposed room, of that size, would generally have five windows, in which case, the other dimensions remaining the same,

$$S = \frac{70\,(40 + 55 + 150)}{210} = 82 \text{ sq. feet, or 1 to 38 cubic ft.}$$

These dimensions are evidently small compared with our modern practice. If we introduce in place of 2.1 the co-efficient 1.6 obtained by Mr. Barrus from an actual test of a cast-iron radiator, we have:

$$S = \frac{(t - t')\,(4\,P + 11\,W + 1.5\,G),}{1.6\,(T - t)}$$

which is equal, for the first case cited, to 77 square feet, or about 1 to 45 cubic feet, and in the second case, with five windows, 100 square feet is required, which is equal to about 1 to 30 cubic feet of space. In this latter case the rule agrees very well with modern practice.

The work of Charles Hood on hot water heating was written about 20 years later, and by following the same course of reasoning as Tredgold, but using somewhat different co efficients, he arrived at the following formula: Letting l = required length of 4-inch pipe, the other letters remaining as before explained, he gives:

$$l = \frac{125}{222}\,\frac{(t - t')\,(5\,P + 1.25\,G)}{(T - t)}$$

Since .849 foot of 4-inch pipe makes one square foot of surface, the number of square feet of heating surface becomes by reduction

$$S = \frac{(t - t')}{1.507}\,\frac{(5\,P + 1.25\,G)}{T - t} = .6644\,\frac{(t - t')\,(5\,P + 1.25\,G)}{T - t}$$

Applying this to the first example, we have

$$S = .6644\left(\frac{70'}{100}\right)(50 + 75) = 59 \text{ sq. feet,}$$

an amount almost identical with that given by Tredgold's rule. In the example regarding the corner room, we have:

$$S = .6644\left(\frac{70}{100}\right)(50 + 125) = 82 \text{ square feet,}$$

an amount 5 per cent. in excess of that given by Tredgold's rule.

Various other rules have been proposed from time to time. Nason, in his catalogue, states Hood's rule as follows:

$$\frac{S = 147\,(t - t')\left[1.289\left(G + \frac{O}{20}\right) + 5\,P\right],}{250 \quad T - t}$$

in which O = the area of outside wall; P = the number of people; G = the area of glass; T = the temperature of the heating medium; t = the temperature of the room; t' = the temperature of the outside air. This formula differs from the one previously given by the introduction of one-twentieth of the exposed wall surface, for which there is no good reason. If introduced it should not exceed 1 per cent. instead of 5, and, except in peculiar conditions of buildings, it will rarely be as much. Consequently there seems to be no advantage in introducing it, as it makes the problem unnecessarily complex.

(TO BE CONCLUDED.)

THE Secretary of War has appointed a commission, authorized by Congress, to examine the Sacramento and Feather Rivers, California, to ascertain what is needed for their improvement, and report fully to the War Department for the information of Congress. The Commission consists of Col. G. H. Mendell, President of the Board; Major Alexander McKenzie and Captain Dan C. Kingman, United States Army Corps of Engineers.

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[*] Modern determinations would make this somewhat more, since the modern determination of specific heat of air is less than Tredgold used. The heat required to heat one cubic foot of water one degree would heat $\frac{62.5 \times 12.5}{.238} = 3324$ cubic feet of air one degree.

[†] A pound of air is heated 1° by .238 B. T. U; a cubic foot of air is heated 1° by .0192 B. T. U.; or 1 B. T. U. will heat 52.8 cubic feet of air 1° in temperature by modern determinations.

Notes and Queries

on Domestic Engineering.

Communications relating to the practical details of plumbing, heating, lighting and ventilation will be welcomed in this column. The writer's true name and address must always be given, but an assumed name may be used for publication if preferred.

RETURN PIPES IN A GRAVITY RETURN STEAM HEATING SYSTEM.

"SUBSCRIBER," of Weymouth Center, Mass., writes: "I should like to inquire through the columns of your paper in regard to piping for the return of a steam heating apparatus.

"The question is this: Would it be better to have the return pipes from the radiator drop perpendicular to a point below the water line in the boiler, and then run back to the boiler, keeping below that point, or would it be better to have the return pipe drop perpendicular, say one foot below the lowest point in the flow pipe, and then return to the boiler with a good grade down? Would there be any practical difference?"

[It is in all cases better, with the gravity return apparatus, to drop the return pipes perpendicularly below the water line at once, and then follow a perfectly aligned down grade to the boiler. The amount of pitch in the grade is not at all essential. When once you are below the water line the angle of the pitch has nothing to do with the flow of the water towards the boiler. The pitch should be great enough, however, to overcome any inequalities in the straightness of the pipe. Return pipes below the water line that are dead level will answer if no air becomes trapped within them. The slight pitch required above is, therefore, only necessary to insure the separation of the air to prevent "air-binding" in the return pipe. An air trap in the return pipe will offer a resistance sufficiently great to prevent a proper return of the condensed water

A horizontal return pipe must be either *sufficiently* above the water line to insure its never remaining filled with water, or it must be *below* it. The horizontal return pipe that is just at the water line or a little above it, so that fluctuations of pressure in the steam allow the water within the pipe to rise and fall a little, so that at one time it is dry and in a few moments after full of water, is always sure to be noisy. When it is necessary to run part of the return pipes above the water line, as in the wing of a building where there is no cellar, it should be run as high as possible and then dropped suddenly in a perpendicular manner within the deep cellar. In half excavated cellars it is a common thing to follow the ground line for convenience in supporting the return pipe. Should the grade of this half excavated cellar be a little above the water line of the boiler noise is sure to follow for the reasons given before. Should you begin to drop your return pipe from the lowest point of the flow pipe, as you suggest, you will be very apt to find noise where your return pipe crosses the level of the water line of the boiler. We presume that the above presents all the ordinary aspects of the question.]

Questions and Answers.

All questions relating to building construction, paving, sewerage, water supply, or kindred subjects, will be welcomed in this column provided they relate to matters of general interest and are not such as should properly be referred to a consulting engineer. Answers will be carefully prepared and a proof of both question and answer mailed to the inquirer as early as proper consideration will permit. They will be published for the benefit of other readers as soon as convenient. The full name and address should be given, not necessarily for publication, but as a guarantee of good faith, and to facilitate further correspondence in case the question is not sufficiently explicit.

Inquiries of the Editor, in order to secure prompt attention, should *not be written on the same piece of paper as a communication* to the *Publishing Department*. Letters renewing subscriptions are sent to a clerk in the publishing office, and matter for the Editor, if in the same enclosure, is likely to be overlooked unless it is on a separate piece of paper, so that it may be promptly sent to the Editor.

CORROSION OF IRON FLOOR BEAMS FROM CINDER FILLING.

"ARCHITECTS," New York, write: "In the article on 'Cast *vs.* Wrought Iron for Gas Mains,' published in THE ENGINEERING RECORD of September 6, quoted from a paper by Mr. Eugene Printy, cases are noted of serious corrosion of iron pipes, especially of wrought iron, produced by laying them in cinders obtained from locomotive ash pits.

"It is customary to use coarse cinders for filling in over the brick arches between wrought-iron beams for carrying granelithic side walks, and also for filling in over the arches between the floor beams in warehouses. In the case of sidewalks we fill the cinders in loosely, and in the case of interior floor beams we mix the cinders with cement mortar sufficient to make a coherent mass.

"Considering the statements made in Mr. Printy's paper, we would be glad to learn if you think the contact of the cinders with the iron floor beams would be sufficient to seriously injure the beams and eventually render them unsafe; and if you would advise substituting other filling for the cinders."

[There is certainly much danger in placing any iron, especially wrought iron, in contact with cinders if there be any moisture present. The injurious action of the cinders upon iron seems to arise from the formation of sulphuric acid from the sulphur contained in the former. As the percentage of sulphur varies greatly in different kinds of coal the action of some cinders would doubtless be slight.

Mr. Charles B. Brush says (*Transactions American Society of Civil Engineers*, Vol. 19, page 118): "I have had considerable experience with small wrought-iron pipe buried in the ground, and it has been unsatisfactory. There is great lack of uniformity in its durability. Ashes, especially, will soon destroy wrought-iron pipe, often during the first year"

A singular instance is given (in the *Journal of the Association of Engineering Societies*, Vol. 4, p. 274), of the corrosion of a 6-inch cast-iron water main at Fall River, by Mr. Philip D. Borden, Jr. The pipes, which were from two or three different makers, and had been in about nine years, were so corroded as to lose, in places, one-half to three-quarters of their substance, the thickness being reduced even to one eighth of an inch. These pipes were laid in a filling of cinders, iron slag from puddling furnaces, and other refuse from iron works, and the salt tidal water from the adjoining bay penetrated to and immersed the pipes twice in 24 hours. It would seem as if here were all the elements to account for the corrosion without looking farther for it. A chemical study of the case was, however, made by Prof. William Ripley Nichols, and he had been unable, up to the time the paper was published, to repeat the corrosive effects by experiment, or to produce acid reaction in the salt water kept in contact with finely powdered cinder. Moreover, other neighboring pipes laid in the same material were unaffected. The cause of the corrosion did not seem to have been definitely settled.

While, therefore, there might be no serious corrosion of iron beams from contact with cinders in cases such as that referred to in the above query, especially if there was any certainty of their remaining dry, yet, considering the damage to life and property which would arise from the failure of a heavily loaded warehouse floor, it would be safer to use some other material for filling, or to thoroughly plaster the beams with a coat of cement mortar so as to prevent any contact with the cinders.

We should be glad to hear from any of our readers who may have had experience on the subject of the query, as it is a matter of considerable importance.]

ACCORDING to a Hazleton, Pa., account, the Jeddo Tunnel Company will, about February 1, begin to drive a tunnel 4½ miles in length (starting at the foot of the Jeddo slope and extending to Butler Valley), for the purpose of draining the Jeddo, Harleigh and Ebervale Mines into the Susquehanna River at Berwick. In June, 1885, 30 acres over the Harleigh Mine caved in, causing a big creek to flow into the mines, but after a month's hard work the water was pumped out and work again resumed, only to be stopped a year later by the heaviest rain storm of the season, that flooded that mine and Ebervale. After months of vain endeavor to pump both mines dry they were abandoned, and the miners sought employment elsewhere. The tunnel will drain both mines.

AT the Chamber of Commerce in Albany, on Thursday, December 11, the special commission appointed in accordance with the provisions of the River and Harbor Bill will give a hearing on the subject of improving the channel of the upper Hudson so as to permit the passage of large vessels to Albany and Troy. Two propositions will be before the Commission. One is to make a ship channel to Albany only, and the other to extend it to the State dam.

THE large water-works tunnel under the lake at Cleveland, O., was completed on the 17th inst. The tunnel is 7 009 feet long, and eight feet high, with three courses of brick. It required 8,000,000 bricks to complete the lining. The wall is 12½ inches thick.

Building Intelligence.

NEW YORK.

E s 1st av, 26 N 44th st, br slaughter house; cost, $25,000; o, M F Fleischhauer; a, A B Ogden & Son.

N w cor Park av and 39th st, br dwells; cost, $110,000 all; o, Jennings & McCullough; a, Renwick, Aspinwall & Russell.

N e cor Bleecker and Carmine sts, br store; cost, $75,000; o, C. M. Cammeyer; a, C Reitz.

N s 133d st, 275 E 7th av, br flat; cost, $23,000; o, W G Gilmore; a, J C Burne.

S s 127th st, 225 W 2d av, 3 br flats; cost, $67,500 all; o, T J Robinson; a, same as above.

E s Mott st, 120 W 5th av, 7 br dwells; cost, $56,000 all; o, M E Conlon; a, F J Conlon.

N s 76th st, 200 W 9th av, 5 br dwells; cost, $100,000 all; o, Breem & Nason; a, Ogden & Son.

N s 59th st, near 5th av, br hotel; cost, $600,000; o, W W Astor; a, W H Hume.

N s 105th st, 100 E 2d av, 4 br flats; cost, $72,000 all; o, M Coogan; a, Cleverdon & Putzel.

N s 161st st, 200 E Morris av, 3 fr dwells cost, $10,500 all; o, C M Fowler; a, C C Churchill.

8–12 Dey st, br office bldg; cost, $150,000; o, Manhattan Union Tel. Co; a, H J Hardenburg.

73 Warren st, br store; cost, $40,000; o, A Coon; a, G A Schellinger.

N s 134th st, 150 e 7th av, 2 br flats; cost, $30,000 all; o, L Kahn; a, B Fisher.

410 to 414 E 25th st, br stable; cost, $10,000; o, C H Schultz; a, L Howard.

68 Bayard st, br shop; cost, $26,000; o, P Herter; a, Herter Bros.

ALTERATIONS—NEW YORK.

130–132 W 42d st, br store; cost, $20,000; o, Lewis & Conger; a, F and W E Bloodgood.

48 E 14th st, br hotel; cost, $8,000; o, F Bronson; a, R H Robertson.

KANSAS CITY, MO.—H J Simons, architect, will prepare plans for a $50,000 block of flats, four stories high, for P S Gidley.

BOSTON, MASS.—Barstow st, 2 fr dwells; cost, $7,500; o, H Rogers; a, L D Warren; b, D Baldwin.

Bradbury st, 2 fr dwells; cost, $7,500; o and b, D Baldwin; a, L D Warren.

Dakota st, 2 fr dwells; cost, $8,500; o, C N Capen; a, B Brown, Jr; b, J O Mason.

95 Washington st, fr dwell; cost, $9,000; o, H W Jordan; a, Eugene L Clark; b, not let.

Columbus av and Berkeley st, br mercantile bldg; cost, $350,000; o, D S Ford; a, Hartwell and Richardson; b, Norcross Bros.

24–26 Dover st, br addn and alteration; cost, $5,500; o, James O'Brien; a, H J Preston; b, J E Potter.

Arundel Park (Dor) fr dwell; cost, $7,000. o, C F ittredge; a, E J Lewis, Jr; b, W J Smith.

Minot st (Dor), 2 fr dwells; cost, $7,500; o, Thos Stark; a, Hill & Smith; b, G W Jackson.

B st, cor Tudor st, fr dwell; cost, $9,500, o, M A Holland; a, W P Wentworth; b, not let.

41 Paul Gove st, fr dwell; cost, $9,000; o, J W Crozier; a, W T Sears; b, E W Geldon.

21 Beaumont st, 6 Randolph st, 4 and 9 Westmoreland st, 4 fr dwells; cost, $20,000; o, H S Carruth, a and b, B Hamilton.

Washington cor Cobb sts, br addn and altn; cost, $6,000; o, John M Clark; a, A H Vinal; b, Neal & Preble.

Fulda st, br mfg; cost, $18,000; o, Dennison Mfg Co.

Adams st and Rosemont ter, 3 fr dwells; cost, $15,000; o, H O Goodwin, J T Disney, E G Woelfer; a and b, H B Rankin.

Ruggles st, fr mechanical; cost, $8,000; o, "House of Angel Guardian;" a, Jas Mulcahy; b, W S Mitchell.

Washington st, cor Sumner st, br alteration; cost, $80,000; o, Bres and Fellows Harvard College; a, Rand & Taylor; b, not let.

(Continued on page xi.)

CONTRACTING NEWS DEPARTMENT.

A WEEKLY RECORD

OF SPECIAL INTEREST TO CONTRACTORS, BUILDERS AND MANUFACTURERS OF ENGINEERING AND BUILDING SUPPLIES.

THE ENGINEERING AND BUILDING RECORD,
277 Pearl Street, New York.
November 29, 1890.

ARCHITECTURAL COMPETITION.

Grand Rapids, Mich.—The local Board of Police and Fire Commissioners has invited architects doing business here, to submit designs, to suit a plan which they have already adopted, for a building to contain a police station and all the necessary offices of the Boards. They ask for two designs, one to cost $30,000 and the other to cost $40,000, each building to be two stories high, with good basement and high attic. Designs are to be sumbitted before December 13.

CONTRACTING INTELLIGENCE

Our readers will oblige us by notes, clippings, or any information which will put us in the way of obtaining early and reliable news for our "Contracting Intelligence." *Information of importance sent to us exclusively, and not elsewhere published will be liberally paid for.*

For works for which proposals are requested see also the "Proposal Columns," pages i-ii-xi

WATER.

For Additional Water Items see Proposal Columns.

Seattle, Wash.—Reports say that the Trustees have purchased the Springhill Water-Works plant, and will make extensive improvements at once.

Wheatland, Iowa.—The project to improve water supply at this place is now a certainty.

Austin, Tex.—The Uvalde Water Supply and Power Co. has been incorporated. Capital stock, $25,000.

Topeka, Kan.—The following bids for a water-works system for the G. A. R. Reunion grounds at Ellsworth, Kan., were received by H. M. Hadley, architect, Nov. 15: A. A. Arment & Co., Dodge City, Kan., without the well, $3,478.80; E. W. Abendorph, Kansas City, Mo., without the well, $4,000; Thomas and W. C. Brown, Ellsworth, Kan., including well, $4,445; Christian States, Topeka, Kan., including well, $4,350; A. L. Snyder & Co., Topeka, Kan., including well, $3,985; Lawrence Plumbing and Heating Co., Lawrence, Kan., including well, $3,724.

Kettle Falls, Wash.—A. D. Burns editor of the Kettle Falls *Pioneer*, writes: "Kettle Falls is an entirely new town and not incorporated, but is backed up by a syndicate of Rochester, N. Y., gentlemen. $15,000 will be spent at once for water-works, water mains, etc. A $15,000 hotel is being built, which will be furnished with water throughout, as well as modern conveniences. The supply will be from a fine spring."

Halifax, N. S.—The City Council has decided to engage an hydraulic engineer to make an examination of the water-works system, with a view of making such improvements as may be necessary. Address Alderman Lyons for particulars.

Madrid, Neb.—The Madrid Water and Improvement Company has been incorporated for the sinking of artesian wells and making such other internal improvements as may be desired. The capital stock is $5,000, and the incorporators are D. D. Dayton, N. T. Potter and others.

Milledgeville, Ga.—City Clerk G. W. Coraker writes: "The question of increase of taxation for water-works will be submitted to the voters of our city on December 9. Should the vote be for the increase, the contract, as I understand it, is awarded already to Wm. Wheler, of Concord, and Chas. F. Porks, of Waltham, in the Commonwealth of Massachusetts, and John H Yeaton, of Palatka, Fla. From my understandings of the action of our City Council, it shuts out all other competitors, which, in my judgment, is wrong."

Columbus, Mo.—Bonds have been voted at this place for the purpose of introducing a system of water-works. Address the Town Clerk for particulars.

Orange City, Iowa.—The people of this place have voted in favor of water-works.

Chambersburg, Pa.—The following proposals for the construction of a 2,000,000 gallon reservoir, and to furnish, lay and connect about 9,000 feet of cast-iron pipe, were opened November 20, by D. B. Kirby, Town Clerk: A. H. Coon, Kingston, Pa., reservoir and pipe line complete, $20,800; James H. Harlow, Pittsburg, Pa., same as above, $21,230, with extra allowance for rock exceeding 20 cubic yards; Jehiel Vaughn, Middletown, N. Y., reservoir alone, $9,255, estimated from prices and quantities; laying pipe, 12-inch, 45 cents; 10-inch, 40 cents; 8-inch, 38 cents. James S. Reside, Chambersburg, Pa., pipe line complete, 12 A, $1.69; 12 B, $1.62; 10 A, $1.29; 10 B, $1.25; 8', $1.15. Seven bids for pipe were received, ranging from $27.15 to $29 05 per gross ton, the former figures being only for a portion of the pipe wanted. Special castings were offered by four firms from 2¼ to 2⅝ cents per pound. Contract awarded A. H. Coon, of Kingston, for the entire work complete, at $20,800.

Sioux City, Ia.—The City Council has accepted the proposition of Godfrey Brothers, of Fremont, Neb., to put in a system of drive wells and pumping apparatus to help out the water supply for the city until a big plant, drawing its supply from the Missouri, can be built. The contract price of the temporary plant is $35,000.

Pine Grove, Pa.—The Pine Grove Water Company has been organized to establish a plant at this place. Capital stock, $40,000. Address Jacob Ulmer for details.

Burlington, Wis.—This village decided, November 25, in favor of bonding itself for $8,000 to put in 2½ miles more of water mains and build an additional reservoir at the pumping station. The work will be let during the winter and commenced as soon as the weather permits in the spring.

Canton, S. D.—At a special election held here, November 25, it was decided to bond the place for water-works.

Water-Works.—See our Proposal Columns for information regarding water-works and water-works furnishings at the following places: Lowell, Mass.; Cincinnati, O.; Belvidere, Ill.; Harrison, O.; Ballinger, Tex.; St. Louis, Mo.

SEWERAGE.

For Additional Sewerage Items see Proposal Columns

Chico, Cal.—Town Clerk J. D. Sproul writes: "The Board of Trustees have had plans, specifications and detail drawings prepared by Messrs. Shepard & Teilman, of Fresno, Cal., and are now negotiating for the right of way, six miles, from the city limits to the dumping ground. The proposed system is practically the Memphis system, conveying the sewage through salt glazed vitrified sewer pipe, of 12, 14 and 16 inches in diameter. The estimates are in round numbers $60,000 for main, and such lateral sewers as it is proposed to put in under the plans. The bond election will be called within the next two months. A two-thirds vote is required under our State constitution to put a bonded indebtedness on a municipal corporation."

Fostoria, O.—The Sewer Commission has about completed its preliminary work, and at a recent meeting adopted plans and specifications prepared by G. D. Hersey. The system as proposed provides for both sewerage and drainage, and will be paid for by the taxpayers in general instead of on the assessment plan. The Council will be asked to provide funds to the amount of $90,000 to carry out the plans. It will be necessary to sell bonds to raise the money, and Council will, it is said, take prompt steps to meet the emergency. The plans provide for the main sewers to be of brick, 44 inches in diameter, with ten miles of laterals.

Brunswick, Ga.—Town Clerk E. A. Nelson writes: "The contract for the sewerage system of Brunswick has been closed with the 'National Sewerage and Sewage Utilization Company,' of New York, to be completed by June 1, 1891."

Puyallup, Wash.—It is probable that the projected sewerage system for this city will be established, at an estimated cost of $27,000. The City Engineer can furnish particulars.

West Oakland, Cal.—The agitation for a better sewerage system continues at this place.

Rockaway, N. Y.—The Board of Sewer Commissioners has determined upon gravitation as a system of sewerage for this village. The work will be pushed forward as speedily as possible during the winter.

Macon, Ga.—The bill providing for the sewerage of this city was presented to the City Council November 25, and referred to the Legislative Committee for action and report. Representative Boifeuillet can furnish particulars.

Sewers.—See our Proposal Columns for information regarding sewer construction at the following places: Toronto, Can.; Victoria, B C.; Mount Vernon, O.

BRIDGES AND IRON STRUCTURES.

For Additional Bridge Items see Proposals Columns.

Richmond, Va.—There is a movement on foot in this city to bridge Broad Street, the cost of which will be about $500,000.

Wallingford, Conn.—The Selectmen have awarded the contract for the new bridge in Zalesville to the Berlin Bridge Co., and to cost $2,479. The bridge is to be 111 feet in length. The cost of excavation and the mason work will foot up from $1,500 to $2,000 more.

Willimansett, Mass.—The following proposals were received by the County Commissioners of Hampden County, Mass., for building the masonry and foundations of a bridge over the Connecticut River at Willimansett, Mass., in accordance with plans and specifications prepared by their engineer, Edward S. Shaw, of Boston. Opened November 19.

Bidders.	Pier Masonry. 1,900 cu. yds.	Abutment Masonry. 1,250 cu. yds.	Wing-wall Masonry. 1,600 cu. yds.	Pier Foundations. 285 cu. yds.	Excavation. 3,000 cu. yds.	Riprap 750 cu. yds.	Total Amount of Bids.
Wright, Lyons & Co., Springfield, Mass.	$13.00	$10.00	$7.00	$27.00	$0.30	$1.50	$58.120
Flynt Building and Construction Co., Palmer, Mass.	13.50	9.50	7.25	28.00	.30	2.00	50.505
John F. Dolan & Co., Elizabeth, N. J.	17 00	11.00	8.50	14.00	.65	5.00	60,340
J. H. Leavitt, Boston, Mass	16.50	15 00	12 00	15.00	1 00	3 00	78,825
Moulton, O'Mahoney & Trumbull, Boston, Mass	19 97	13.70	9.90	25.00	.30	3 00	81 183
William H. Ward, Lowell, Mass	20.00	15.00	9 00	20.00	1.20	3.00	82,700
J. T. Tank, Providence, R. I	21.00	14.00	9.00	40.00	.50	3.00	86,950
George M. Atkins & Co., Palmer, Mass	24 00	18.00	13.00	25.00	1.00	3.00	101,275
G. L. Bosworth & Co., Holyoke, Mass	28 50	21.00	12.35	31.50	.75	7.00	116,637

The contract was awarded to Wright, Lyons & Co.

New York City.—The *Sun*, of November 28, prints the following: A new iron bridge across the river at Gardiner, to accommodate the Togus narrow gauge road, and a narrow gauge road from Augusta to the towns of China, Windsor, Summerville, Palermo, and Liberty, are the latest products on the Kennebec.

East Harrisburg, Pa.—It has been decided to establish either a bridge or tunnel at the railroad crossing at Market Street. Plans for a bridge are already completed, and it is probable that tunnel plans will also be wanted.

South Glasgow, Va.—Reports say that an iron bridge is to be constructed over the James River, at this place, by the South Glasgow Cement and Development Company, at an estimated cost of $400,000.

Marble Falls, Tex.—The following bids for the construction of an iron bridge over the Colorado River, at this place, were received by Louis G. Hester, Civil Engineer, November 18: Bids were made for both deck and through bridges, at 32 foot and 52-foot spans· Wrought Iron Bridge Co., Canton, O., $38,888, $40,750; George E. King, Dallas, Tex., $34,400; Groton Bridge and Manufacturing Co., Groton, N. Y., $34,973, $38,000; Youngstown Bridge Co., Youngstown, O., $33,000, $32,000, $36,640, $32,760; Chicago Bridge and Iron Co., Chicago, Ill., $30,740, $32,590, $31,600; Milwaukee Bridge and Iron Works, Milwaukee, Wis., $32,687, $34,036, $35,556, without piers; Wisconsin Bridge and Iron Works, $38,400, $34,300, $31,400; King Iron Bridge and Manufacturing Co., Cleveland, O., $34,000, $35,000; Variety Iron Works, $40,847, $40,347, $39,118, $38 839; Clinton Bridge Co., $34,665, $32,480; Lane Bridge and Iron Works, Chicago, Ill., $28,500, $36,200, $35,500; Pittsburg Bridge Co., Pittsburg, Pa., $41,275, $38,650; Berlin Iron Bridge Co., East Berlin, Conn., $38,000. Milwaukee, $32,687, accepted.

St. Paul, Minn.—A bridge will be built across Phalen Creek Valley, to cost $100,000.

Meriden, Conn.—It is proposed to erect two iron bridges in this city, at an estimated cost of $14,000. Mayor Page can furnish particulars.

Kansas City, Mo.—The Wyandotte County Bridge and Terminal Railway Company, of which Willard E. Winner is president, will build a new iron bridge over the Missouri River, eight miles above this city, to cost $1,000,000 or more. Frank D. Moore is the Chief Engineer.

Toronto, Can.—Plans are completed for the projected high level bridge over the Don, at King Street, and it is likely that proposals will be advertised for at once. The City Engineer can furnish particulars.

Cincinnati, O.—At a meeting of the County Commissioners and the City Board of Equalization, held November 24, it was resolved that the specifications for the erection of the bridge over the Miami Canal at St. Bernard, on Carthage Pike, be approved, provided the Cincinnati Inclined Plane Railway Company pay one-half the cost of both substructure and superstructure.

Atlanta, Ga.—Plans for the projected new bridge at Forsyth street have been submitted to the special committee, and Col. L. P. Grant and others have been appointed as a committee to confer with the officials of the Central and the Atlanta and West Point and the Western Atlantic railways regarding the share which their roads should pay towards the construction of the structure. The estimated cost is $25,000 or $30,000. Engineer Clayton can furnish particulars.

Milwaukee, Wis.—The project of bridging the Milwaukee River from Van Buren to Holton Streets is being revived, and a petition to the incoming legislature to legalize the steps necessary for its consummation has received the signatures of a number of citizens. The erection of the structure, it is said, will require the construction of viaducts on either side of the river, and it is estimated that the total cost of the enterprise would be $250,000.

Albany, Ga.—Reports say that an iron bridge is to span the Kinchafoonee Creek, about two miles north of this city, to be erected by the Central, of Georgia.

St. Louis, Mo.—It is proposed to replace the wooden bridge at Twelfth Street, this city, with an iron structure, at an estimated cost of $250,000. New bridges are also projected at the King's Highway, and at Ewing Street. Bridge Engineer Gayler can furnish particulars.

Jersey City, N. J.—The Board of Chosen Freeholders has decided, it is reported, to erect an iron bridge over the Mullica River, between Burlington and Atlantic Counties. The estimated cost is said to be $15,000.

Bridges.—See our Proposal Columns for information regarding bridge construction at the following places: Shebovgan, Wis.; Hamilton County, O.; Kansas City, Mo.

NEW DEPOTS.

Kansas City, Mo.—Plans have been made for a new union depot. Willard E. Winner is interested in the enterprise.

Paris, Ky.—Reports say that the Kentucky Midland Railway is to erect a new depot at this place.

Des Moines, Iowa.—Reports say that a new union depot is to be erected in this city, by the Des Moines Union Railway, Wabash, Maple Leaf, Des Moines, and Northwestern roads.

Pekin, Ill.—Extensive shops are to be erected at this place by the Santa Fe Road.

Huntington, W. Va.—Reports say that a new depot is to be erected at this place by the Ohio River Railroad Company.

STREET-WORK AND PAVING.

Kansas City, Mo.—It is proposed to build a boulevard nearly three miles long along the north bluff. The City Engineer is making a survey.

South Bend, Ind.—The officials have authorized the paving of numerous streets of this city.

Toronto, Ont.—Considerable street work is to be done in this city.

Dayton, O.—The City Commissioners have adopted resolutions authorizing the City Engineer to report plans and specifications, with an estimate of cost for paving several streets of the city.

Meriden, Conn.—The sum of $40,000 is to be expended on improving the streets of this city. Mayor Page can furnish particulars.

Macon, Ga.—The Georgia Quincy Granite Company has been awarded the contract to furnish this city with 10,000 Belgian blocks, at $495.

La Crosse, Wis.—The City Council has authorized the paving of numerous streets of this place.

GAS AND ELECTRIC LIGHTING.

Hannibal, Mo.—The citizens of this place will soon be called upon to vote upon the proposition to issue bonds to the amount of $20,000 for the purpose of putting in an incandescent light plant.

Columbus, Mo.—An electric lighting plant is to be established at this place.

Berwick, Pa.—An electric light plant is to be established at this place. The president of the Borough Council can furnish particulars.

Charleston, S. C.—Important improvements and extensions are to be made to the plant of the Charleston Electric Light Company.

Abilene, Tex.—A franchise has just been granted to the Abilene Electric Company, of which Max Elser is at the head. A plant for lighting is to be established at once.

Bristol, R. I.—Improvements are to be made to the plant of the local Electric Light Company.

Muscatine, Iowa.—Extensive improvements are projected by the Gas, Electric Light and Power Company, of this place.

Jersey City, N. J.—The following awards of public lighting were made by the Police Commissioners November 14: For lighting 935 lamps the United Gas Improvement Company will receive $20 per lamp per annum. The contract for 152 lamps in Greenville was awarded to the same company, in conjunction with the Consumers' Gas Company, price, $21 per lamp per annum. The bid of the New York and New Jersey Globe Gas Light Company, running from 1,000 to 1,500 oil lamps, was $1.68 per lamp. For the Bergen and Hudson City sections of the city the bid of the United Gas Improvement Company for the People's Gas Light Company, was $21 for each of 1,411 lamps per year. The contract for arc electric lighting was awarded to the Hudson Electric Light Company, at 23½ cents per light per night, nearly ten cents lower than the bid of the Jersey City Company.

Seattle, Wash.—A committee appointed by the Trustees to investigate the subject of the cost of electricity and gas for street lighting has recommended that bids be solicited for new contracts for all kinds of lights, for a term not exceeding one year. Also, that the city should own and control its own system of lights. The city clerk can furnish particulars.

Jonesboro, Ind.—A system of lighting is to be established at this place, by the Jonesboro Gas and Improvement Company. Estimated outlay, $300,000. Address Arthur L. Conger, for details.

Chicago, Ill.—The McFell Electric Company has been incorporated in this city, with a capital stock of $8,000. J. McFell is at its head.

Greenville, Ill.—The Greenville Electric Light and Power Company has been incorporated here. Capital stock, $10,000. For particulars address C. D. Halles, as above.

Shamokin, Pa.—A company has been organized at this place with the intention of establishing and maintaining an electric lighting plant.

Aledo, Ill.—The public officials of this place have decided to establish an electric light plant at once, The City Clerk can furnish particulars.

Amesbury, Mass.—A new incandescent machine, with a capacity of 500 lights, is to be added to the plant of the local Electric Light Company.

Woonsocket, Mass.—It is proposed to establish an electric light plant at this place.

Seattle, Wash.—The Standard Electric Company has been formed at this place with a capital stock of $25,000.

McKeesport, Pa.—Extensive improvements are to be made to the local electric light plant.

Milton, Pa.—The streets of this place will soon be lighted by electricity.

Chicago, Ill—The Morgan Park Electric Company has been incorporated to furnish electric light, power and heat. Capital stock, $25,000. G. S. Wheaton is one of the incorporators.

Davenport, Ia.—All the bids for public lighting in this city have been rejected and new ones will soon be wanted. Address Mayor Ficke, for particulars.

Electric Railways.—New electric railways are projected and improvements are to be made to those already established at the following places: Birmingham, Ala.; Lowell, Mass.; York, Ont.; Raleigh, Va; Lynchburg, Va.; Shenandoah, Pa.; Lancaster, Pa.; Lititz, Pa.; Lincoln, Neb.; Aurora, Ill.; Norwalk, Conn.

BIDS OPENED.

San Francisco, Cal.—Bids for the Preston Reform School have been opened as follows: Each bidder was required to make three separate bids, one for a stone front and sides, another for pressed brick and stone dressing, and another for common brick and stone dressing. The bidders and their bids were as follows: Richardson & Gale, $71,450, $63,950, and $62,200; B. Krenzberger, $73,692, $65,516 and $62,879; George D Nagle, $74,178, $67,770, and $66,010; J. H. Mackay, $74,890, $68,400, and $67,000; California Bridge Co., $88,172, $72,775, and $71,988.

GOVERNMENT WORK.

Scituate Harbor.—The following bids for dredging from Scituate Harbor, Mass., were received November 22: Boynton Bros., Boston, 34 cents per cubic yard; bowlders, $6; Bay State Dredging Co., Boston, 41c., $5, Metropolitan Dredging Co., Lynn, 40c., $6; New England Dredging Co., Boston, 34c., $5; Augustus R. Wright, Portland, 32½c., $5.

Plymouth Harbor.—The following bids for dredging from Plymouth Harbor, Mass., were received November 22: Metropolitan Dredging Co., Lynn, Mass., 33 cents per cubic yard; bowlders, $6; Augustus R. Wright, Portland, 29½c., $5; National Dredging Co., Wilmington, Del., 27c., $10.

Gloucester Harbor.—The following bids for dredging from Gloucester Harbor, Mass, were received November 22: National Dredging Co, Wilmington, Del., 23 cents per cubic yard; bowlders, $10: Augustus R. Wright, Portland, 28c., $8; Bay State Dredging Co., Boston, 22c., $8; New England Dredging Co., Boston, 27c., $5; Metropolitan Dredging Co., Lynn, Mass., 25c., $6.

Boston, Mass.—The following proposals for dredging the channels and harbors on the Massachusetts coast were opened November 21, by Col. S. M. Mansfield, Corps of Engineers, U. S. A.:

Weymouth River.—For dredging from Weymouth River 25,000 yards, more or less, of material, Augustus R. Wright, Portland, Me., 37½ cents per cubic yard; to remove bowlders over six tons in weight, $9 each. Boynton Brothers, Boston, 52 cents per cubic yard; to remove the big bowlders, $8. The Bay State Dredging Co., Boston, 55 cents per cubic yard, and $10 for removing bowlders. The Metropolitan Dredging Co., Lynn, Mass., 66 cents per cubic yard, big bowlders, $10.25.

Boston Harbor.—For dredging about 20,000 cubic yards of material from the channel leading to Nantasket Beach, Boston Harbor. Charles W. Lampee, Boston, 25 cents per cubic yard; to remove bowlders of over three tons, $10 each. Bovnton Brothers, Boston, to remove the material, 27 cents per cubic yard; bowlders, $6 each. A. R. Wright, Portland, 28½ cents for dredging, and $5 for removing bowlders. The Metropolitan Dredging Co., Lynn, 25¾ cents per cubic yard for dredging, and $10.25 for removing bowlders.

Salem Harbor.—For dredging of about 45,000 cubic feet of material in Salem Harbor: A. R. Wright, Portland, 22 cents per cubic yard; remove bowlders over three tons in weight, $5. The New England Dredging Company, Boston, remove material for 23 cents per cubic yard; remove the bowlders, $10 each. The Bay State Dredging Company, 25 cents for dredging, $10 for the removal of bowlders. The Metropolitan Dredging Company, 29¼ cents for dredging, $10.25 for removing bowlders. Messrs. Hamilton & Sawyer, Maine, 33 cents for dredging, $6 for removing bowlders.

Hingham Harbor.—For dredging of about 20,000 cubic yards from Hingham Harbor: A. R. Wright, Portland, 18 cents per cubic yard; to remove bowlders, $3 each. Boynton Bros., 25 cents for dredging, and $6 for removing bowlders. The Bay State Dredging Company, 52 cents for dredging, and $10 for removing bowlders.

Lynn Harbor.—For the removal of 40,000 cubic yards of material from Lynn Harbor: New England Dredging Company, Boston, 18 cents per cubic yard; to remove bowlders for $10. The Metropolitan Dredging Company, Lynn, 18¼ cents for removing the material, and $10.25 for removing bowlders. A. R. Wright, Portland, 18¾ cents; to remove bowlders, $5. The Bay State Dredging Company, 25 cents for dredging, and $10 for removing bowlders. The National Dredging Company, Wilmington, Del., made the same offer as the Bay State Dredging Company.

Winthrop Harbor.—For the removal of about 18,000 cubic feet of material from Winthrop Harbor: Boynton Bros, Boston, 24 cents per cubic yard; to remove bowlders, $6 each. The Metropolitan Dredging Co., Lynn, 28¼ cents per cubic yard; to remove bowlders, $10.25 each. Bay State Dredging Co., 28 cents per cubic yard; $10 for removing bowlders. A. R. Wright, Portland, 30 cents per cubic yard; will remove bowlders for $5 each. Hamilton & Sawyer, Maine, 30 cents per cubic yard; to remove bowlders, $6 each.

Newburyport Harbor.—For the delivery of rubble stone at the entrance of Newburyport Harbor: Joseph H. White, Boston, $1.47 per ton; Edward Canney, Pigeon Cove, Thomas A. Rowe, of Newton, each bid, $1.53 per ton; J. Cashman, of Newburyport, bid $1.69 per ton; G. W. Andrews, of Biddeford, Me., bid $1.82½ per ton, and the Rockport Granite Co. and Pigeon Hill Granite Co., of Rockport, each bid $1.95 per ton.

Harbor of Refuge.—Only one bid for the delivery of 225,000 tons, more or less, of rubble stone for the Harbor of Refuge, Sandy Bay, Cape Ann, was received, and that was from the Rockport Granite Co. and Pigeon Hill Granite Co., of Rockport, the bid being 73½ cents per ton. All proposals have been taken under advisement by Colonel Mansfield.

Washington, D. C.—The following bids for dredging in Potomac River, at Washington, D. C., were received by Peter C. Hains, 601 Eighteenth Street, N. W., November 25: Frank C. Somers, Camden, N. J., tidal reservoir, 200,000 cubic yards, 23 cents per cubic yard; John H. McNee, Washington, D. C., tidal reservoir, 15 cents and 16¼ cents per cubic yard; Washington Channel, 500,000 cubic yards, 15½ cents per cubic yard; Alabama Dredging and Jetty Co., Mobile, Ala., Channel, 14½ cents per cubic yard.

Milwaukee, Wis.—The following proposals for work on Wisconsin Harbors were opened on November 25, by Major Charles E. L. B. Davis, Corps of Engineers, U. S. A.

Manitowac Harbor.—Construction of pier superstructure. The figures are for the following items, in detail, in their order: 12x12 inch white pine timber, per m. feet, b. m.; 3x12 inch pine plank, per m.; stone, per cord; drift bolts, per pound; spikes, per pound, total, for 600 feet for cutting down and rebuilding superstructure, 20 feet wide and 6 feet high. Bidders: Truman Cooper, Manitowoc, Wis, $27, $19, $6; 3½ cents, 4 cents. Peter W. Galloway, Racine, Wis., $29.50, $22, $10.75, 4 cents, 5 cents.

Menominee River, Michigan and Wisconsin. Dredging 200,000 cubic yards: Truman & Cooper, Manitowoc, Wis., Section A, 10⅜c., Section B, 11⅜c.; S. O. Dixon, Racine, Wis., 20c., 23c.; Williams, Dougherty & Upham, Duluth, Minn., 23c., 23c.; Carkin, Stickney & Cram, Saginaw, Mich., 24c., 24c.; Green's Dredging Co., Chicago, Ill., 12¼c., 14½c.; White & Finch, Grand Haven, Mich., 12½c.; Christopher H. Starke, Milwaukee, Wis., 11½c., 11½c.; Knapp & Gillen, Racine, Wis., 14½c., 15c.; Green Bay Dredge and Pile Driver Co., Green Bay, Wis., 15¾c., 15¾c.

Mobile, Ala.—The following bids for dredging in Mobile Harbor, Miss., Biloxi Harbor, Miss., and Pascagoula River, Miss., were received by A. N. Damrell, Major of Engineers, U. S. A., November 20.

Mobile Harbor, Ala.—Anglo So. Construction Co., New York, N. Y., 16 cents per cubic yard for sand, 12 cents per cubic yard for clay; M. T. Fauria, Pensacola, Fla., 40 cents, $9\frac{4}{10}$ cents; Moore & Wright, Portland, Me., 18 cents, 11 cents; National Dredging Co., Wilmington, Del., 8⅜ cents for clay only; Alabama Dredging and Jetty Co., Mobile, Ala., 19 cents, 9 cents; George C. Fobes & Co., Baltimore, Md., 19 cents, 9 cents.

Pascagoula River, Miss—Alabama Dredging and Jetty Co., Mobile, Ala., 22 cents per cubic yard for compact clay and blue mud; George C. Fobes & Co., Baltimore, Md., 23 cents.

Biloxi Harbor, Miss.—George C. Fobes & Co., Baltimore, Md., 21 cents per cubic yard for blue mud mixed with sand; Alabama Dredging and Jetty Co., Mobile, Ala., 20 cents.

Boston Harbor, Mass.—The following bids for dredging in Boston Harbor, Mass., were received November 24: Bay State Dredging Co., Boston, 25 cents per cubic yard; bowlders, $8; Metropolitan Dredging Co., Lynn, 30c., $10; New England Dredging Co., Boston, 19¼c., $10; Augustus R. Wright, Portland, 21c., $8.

Brewster Spit.—The following bids for dredging from the west end of Brewster Spit, Boston Harbor, Mass., were received November 24: Bay State Dredging Co., Boston, 18 cents per cubic yard; bowlders, $5; Metropolitan Dredging Co., Lynn, Mass., 19c., $5; Boynton Brothers, Boston, 22c., $10; Augustus R. Wright, Portland, 14c., $4; New England Dredging Co., Boston, 21¾c., $5.

Manchester Harbor.—The following bids for dredging from Manchester Harbor, Mass., were received November 22: Robert Hamilton, Chebeague, Me., and Solomon Sawyer, Yarmouth, Me., 29 cents per cubic yard; bowlders, $6; Boynton Brothers, Boston, 33c., $6; Bay State Dredging Co., Boston, 32c., $8; Metropolitan Dredging Co., Lynn., Mass., 32c., $6; Augustus R. Wright, Portland, 23½c., $5.

INDUSTRIAL.

Pasadena, Cal.—The Palmdale Irrigation District (Los Angeles County) has issued bonds in the sum of $175,000 for the construction of two masonry dams and irrigation canals, to put 50,000 acres of land under cultivation The engineer is August Mayer, of Pasadena, Cal.

Pottstown, Pa.—A charter has been issued, incorporating the Pottstown Cold Storage and Warehouse Company, with a capital of $75,000.

Americus, Ga.—A stock company, with a capital of $20,000, is to establish a 70-ton ice factory at this place.

St. Louis, Mo.—The Missouri Dredging and Transportation Co. has filed articles of incorporation. The capital stock is $10,000. George F. Mincke, St. Louis, can furnish details.

Bound in

THE ENGINEERING & BUILDING RECORD

AND THE SANITARY ENGINEER

DEVOTED TO ENGINEERING · ARCHITECTURE CONSTRUCTION

A JOURNAL for the ENGINEER · ARCHITECT · CONTRACTOR · MECHANIC & MUNICIPAL OFFICER ·

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PROPOSALS.

U. S. ENGINEER OFFICE. WILMINGTON, N. C., November 6, 1890.—Sealed proposals for **DREDGING** in the harbor at BEAUFORT, N. C.; Waterway between Beaufort Harbor and New River, N. C., and New River, N. C., will be received at this office until 12 M., December 16, 1890. The attention of bidders is specially invited to Acts of Congress approved 26th of February, 1885, and 23d February, 1887, Vol. 23, page 332, and Vol. 24, page 414, Statutes-at-Large. All information furnished by W. H. BIXBY, Capt of Engineers. 1

PROPOSALS.

NOTICE TO CONTRACTORS.

Sewer Pipe.

TENDERS WILL BE RECEIVED BY REGISTERED post, addressed to the City Engineer, TORONTO, up till noon on TUESDAY, 2d December, for supply of pipe for year ending 31st December, 1891.

APPROXIMATE QUANTITY REQUIRED.

PIPE.

6-inch pipe	35,000 feet.
6-inch bends	200
9-inch pipe	5,000 feet.
9-inch bends	100
12-inch pipe	12,000 feet.
12x6-inch junctions	800
12x9-inch junctions	200
15-inch pipe	3,000 feet.
15x6-inch junctions	200
15x9-inch junctions	100
18-inch pipe	500 feet.
18x6-inch junctions	20
18x9-inch junctions	40
1 foot 2 inches x 1 foot 9 inches tile invert	2,000 feet.
2x3-foot tile invert	3,000 feet.
6-inch stoppers	800
9-inch stoppers	200

Specifications and forms of tender can be obtained on and after the 1st of December at the City Engineer's office.

A deposit in the form of a marked check, payable to the order of the City Treasurer, for the sum of 2½ per cent., on the value of the work tendered for, must accompany each and every tender, otherwise it will not be obtained. All tenders must bear the *bona fide* signatures of the contractor and his sureties (see specifications), or they will be ruled out as informal.

The committee do not bind themselves to accept the lowest or any tender.

JOHN SHAW,
Chairman, Committee on Works.
Committee Room, Toronto, Can.,
November 26, 1890. 1

To Builders of Pumping Engines.

SEALED PROPOSALS, INDORSED "PROPOSALS for Pumping Engine," will be received at the office of the Lowell Water-Works, City Hall, Lowell, Mass., until 2 P. M. on FRIDAY, January 16, 1891, for the construction, delivery and erection of a ten-million gallon steam **PUMPING ENGINE** for the City of Lowell, Mass., and at that time will be publicly opened and read.

Specifications will be mailed upon application to Water-Works Office, City Hall, Lowell Mass.

Other information may be obtained upon application to Lowell Water-Works Office, or from GEORGE M. BARRUS, M. E., 95 Milk Street, Boston, Mass.

JOHN STOTT,
MILES F. BRENNAN.
EDWARD W. THOMAS,
Committee on New Engine of
Lowell Water Board.

LOWELL, MASS., November 24, 1890.

UNITED STATES ENGINEER OFFICE, 34 West Congress Street, Detroit, Mich., November 28, 1890.—Sealed proposals, in triplicate, for furnishing all **MATERIALS AND LABOR** and building the masonry of a lock at ST. MARY'S FALLS CANAL, MICH., will be received at this office until 2 o'clock P. M., January 27, 1891, and then publicly opened. Preference will be given to materials of domestic production or manufacture, conditions of quality and price (import duties included), being equal. Attention is invited to Acts of Congress approved February 26, 1885, and February 23, 1887, Vol. 23, page 332, and Vol 24, page 414, Statutes at Large. The Government reserves the right to reject any or all proposals; also to award the contract upon other considerations than the price. For further information apply at this office, or to the U. S. Engineer Office, Sault Ste. Marie, Mich. O. M. POE, Colonel, Corps of Engineers, Bvt. Brig.-Gen., U. S. A. 5

PROPOSALS.

PROPOSALS FOR VERTICAL PUMPS.

SEALED PROPOSALS WILL BE RECEIVED at the office of the Board of City Affairs, CINCINNATI, O., until 12 o'clock noon of December 26, A. D. 1890.

For four **VERTICAL PUMPS**, of five million capacity each, in twenty-four hours. These pumps to take the place of similar size Wetherill pumps now in position, and to operate by the steam ends now in use. Each bidder is requested to examine and measure the well, and so design his work as to properly connect with the parts to be retained.

Each bidder will be allowed to furnish his own plan, drawings and specifications, with guarantee as to date of completion, and forfeiture for failure in time. Also, will be required to give proposition on plans and specifications furnished by the Board of City Affairs.

For particulars apply to Willis P. Tharp, Superintendent and Engineer of Cincinnati Water-Works.

The Board of City Affairs reserves the right to reject any or all bids.

By order of the Board of City Affairs.
THOS. G. SMITH,
President.
Attest: D. W. BROWN, Clerk B. C. A. 3

NOTICE TO CONTRACTORS.

TENDERS WILL BE RECEIVED UP TO 4 o'clock P. M. on the 17th of December next, at the office of the undersigned, for the Construction of **SEWERS** for the Corporation of the City of Victoria, B. C.

For particulars of plans and specifications apply at the City Hall, Victoria, on or after the 15th day of November next ensuing.

Five per centum of the approximate amount of the work tendered for will be required to be deposited with a tender to insure its consideration This may be done either in Cash or by Certified Cheque on some bank in British Columbia. All Cash or Certified Cheques to be returned to unsuccessful tenderers.

Estimated cost of sewers, $300,000.

The lowest of any tender not necessarily accepted.

By order
WELLINGTON J. DOWLER,
City Clerk's Office, C. M. C.
Victoria, B. C., Sep. 26, 1890. 26

ELECTRIC LIGHTING.—Proposals are wanted until December 19, 1890, for lighting, by electricity and gas, the public streets, etc., of FRANKFORT, INDIANA, for a period of five years. Address S. A. COOK, City Clerk.

PROPOSALS FOR DREDGING.—U. S. Engineer Office, Cleveland, Ohio, November 10, 1890.—Sealed proposals, in duplicate, will be received at this office until 12 o'clock M., on TUESDAY, the 2d day of December 1890, when they will be opened in the presence of bidders, for **EXCAVATING** 925,000 cubic yards, more or less, of material from Maumee River and from Maumee Bay along line of proposed straight channel for TOLEDO HARBOR, OHIO. Preference will be given to materials and plant of domestic production or manufacture, conditions of quality and price (import duties included) being equal. The attention of bidders is invited to Acts of Congress approved February 26, 1885, and February 23, 1887, Vol. 23, page 332, and Vol. 24, page 414, Statutes at Large. All information can be obtained at this office. The United States reserves the right to reject any or all proposals. L. COOPER OVERMAN, Major of Engineers. 26

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CEMENT.

CITY ENGINEER'S OFFICE,
CITY HALL.
Providence, R. I., March 12, 1886.

Abstract from letter of SAMUEL M. GRAY, *City Engineer*.

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PROPOSALS.

Continued from page I.

HARBOR WORK, Grand Rapids, Mich.—Proposals are wanted until December 1, for doing certain dredging and general harbor work Address Major William Ludlow, U. S. A., as above.

CRUISER, Norfolk, Va.—Proposals are wanted until December 2, for furnishing a quantity of materials for Cruiser No. 8. Address Edwin Stewart, Paymaster General, U. S. A., as above.

DREDGING, ETC., San Francisco, Cal.—Proposals are wanted until December 16, for furnishing stone and doing certain dredging at Oakland Harbor. Address Col. G H. Mendeel, U. S. A., as above.

PIER WORK, Cleveland, O.—Proposals are wanted until December 4, for doing certain pier work at numerous harbors on Lake Erie. Address Major L. Cooper Overman, U. S. A., as above.

PAVING, ETC., Des Moines, Iowa.—Proposals are wanted until December 3, for doing certain street work in this city. Address R L. Chase, of the Board of Public Works, as above.

CURBING, ETC., Providence, R. I.—Proposals are wanted until December 3, for doing certain street work in this city. Address John A. Coleman, Commissioner of Public Works, as above.

NAVY DEPARTMENT, Washington, D. C.—Proposals are wanted until December 20, for the construction of one harbor defense ram, one torpedo boat, and one Swift torpedo cruiser for the U. S. Navy. Address B. F. Tracy, Secretary of the Navy, as above.

HARBORS, Wilmington, N. C.—Proposals are wanted until December 15, for doing certain harbor work at this place. Address Captain W. H. Bixby, U. S. A., as above.

WATER-WORKS, Belvidere, Ill.—Proposals are wanted until December 16, for the construction of a complete system of water-works. Address George H. Hurlbut, City Clerk, as above.

SEWERS, Mt. Vernon, O.—Proposals are wanted until December 11, for the construction of certain sewers. Address P. B. Chase, City Clerk, as above.

PROPOSALS.

BREAKWATER, New York City.—Proposals are wanted until December 2, for the construction of a breakwater at New Haven, Conn. Address Col. D. C. Houston, U. S. A., as above.

WATER-WORKS, Harrison, O.—Proposals are wanted until December 2, for the construction of a system of water-works at this place. Address Mayor J. A. Graft, as above.

BROKEN STONE, New York City.—Proposals are wanted until December 1, for furnishing 41,000 cubic yards of broken stone and 62,000 barrels of Rosendale cement. Address Lieut.-Col. G. L. Gillespie, U. S. A., as above.

METAL WORK, San Francisco, Cal.—Proposals are wanted until December 4, for furnishing the materials, labor, etc., of the metal work for the Northwest Seal Rock Light Station, California Address Major W. H. Heuer, U. S A., as above.

WATER-WORKS, Ballinger, Tex.—Proposals are wanted until January 1, 1891, for the construction of a system of water-works. Address Mayor B. S. Taylor, as above.

LIGHTING, Jersey City, N. J.—Proposals are wanted until December 1, for lighting the public streets of this place for one year from December 1. Address G. P. Robinson, Clerk of the Board of Police Commissioners, as above.

BRIDGE, Sheboygan, Wis.—Proposals are wanted, no date specified, for furnishing specifications for a swing iron bridge. Address C. V. Boley, City Engineer, as above.

PUMPING MACHINERY, Toronto, Ont.—Proposals are wanted until December 3, for furnishing a vertical pumping engine. Address J. D. Cook, Consulting Engineer, Toledo, O.

ELECTRIC LIGHTING, Harrison, O.—Proposals are wanted until December 2, for the construction of an electric lighting plant at this place. Address Mayor J. A. Graft, as above.

Continued on page 419.

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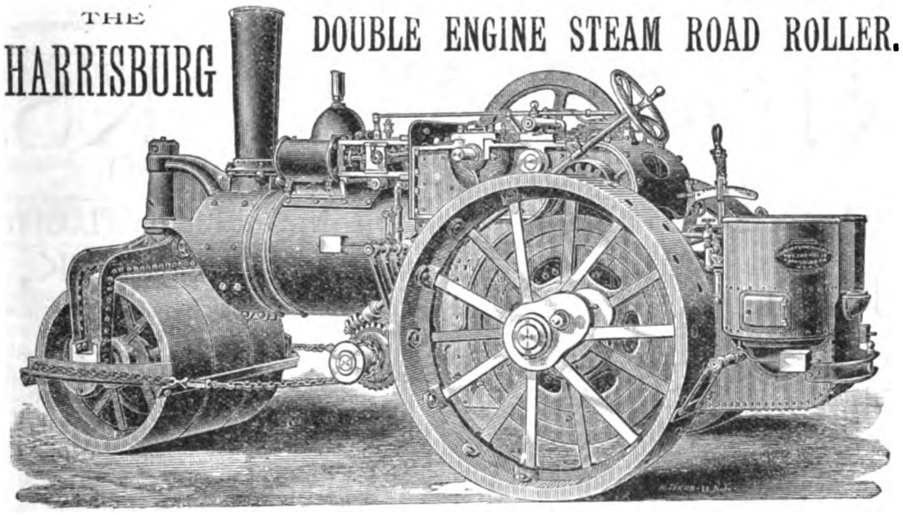

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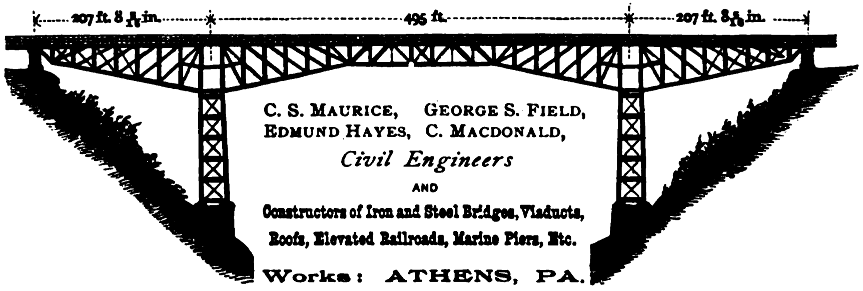

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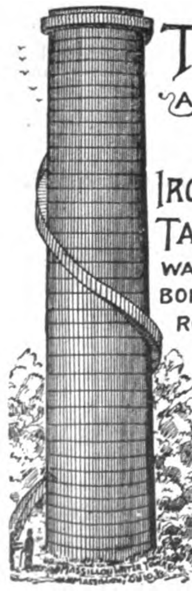

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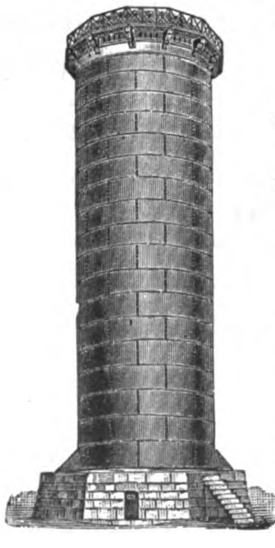

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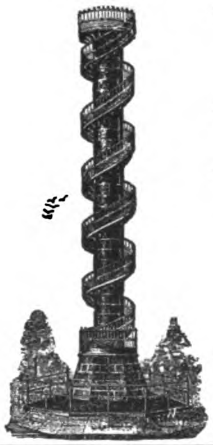

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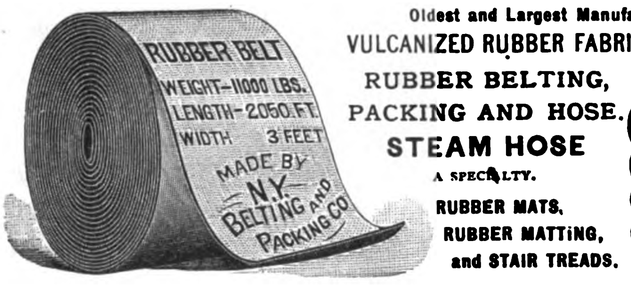

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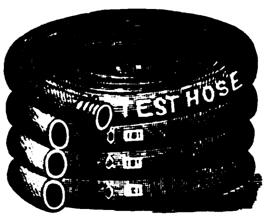

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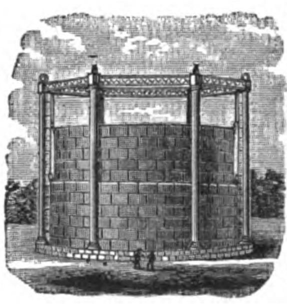

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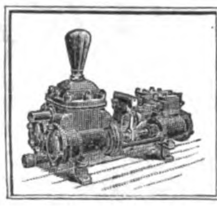

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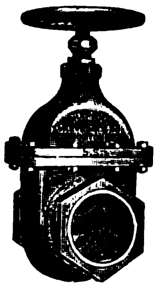

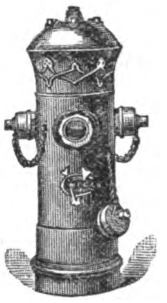

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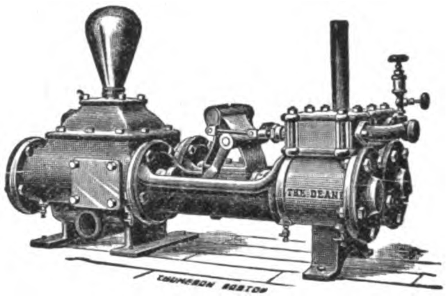

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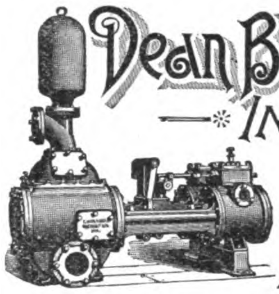

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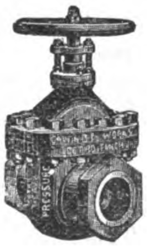

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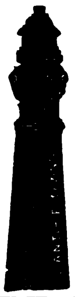

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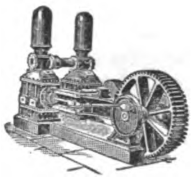

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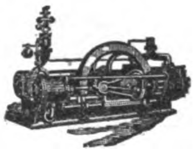

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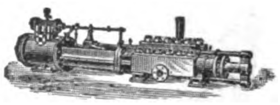

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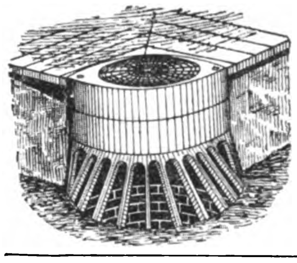

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The following facts and figures are taken from the Reports, as published, from the "office of the Department of Public Works, City Hall, Providence, R. I."

NUMBER OF WATER METERS IN USE.

	Year ending March 31, 1888.	Year ending March 31, 1890.		
Ball & Fitz Piston	3,742	3,789,	Increase	47
" " Rotary	61	58,	Decrease	3
CROWN	3,801	4,925,	Increase	1,124
Fales, Jenks & Sons	27	6,	Decrease	21
Worthington	62	29,	Decrease	33
Total	7,693	8,807,		

Total increase of Meters .... 1,114 for 2 years.
" " **CROWN** Meters .... 1,124 " " "

Meters Bought 1,171
Meters Removed 57
Total Increase .... 1,114, or 14$\frac{1}{10}$%.

Actual number of Taps to March 31, 1888 13,097
" " " " " 1890 14,305
1,208, Increase 9%.

Percentage of Taps metered, 1890 .... 61$\frac{1}{10}$%.
" additional Taps metered .... 92%.

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Consumption.		Water Receipts.	
For 1887	4,939,982 gallons.	For 1887	$339,513.60
For 1889	5,786,961 gallons.	For 1889	377,497.60
Increase	846,979 gallons.	Increase	$37,984.00

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Fall River, Mass., received for all water, year 1889, $177.85 per million gallons.
Number of Meters in use, 1889 .... 3,426.

Lowell, Mass., received for all water for the year 1889, at the rate of $111.84 per million gallons.
Number of Meters in use, 1889 .... 1,757.

Buffalo, N. Y., received for all water for year 1888, $31.83 per million gallons. For year 1889, $33.00 per million gallons.
Number of Meters in use, 1888 .... 87.
" " " 1889 .... 115.

Richmond, Va., received for all water for year 1888, at the rate of $28.24 per million gallons.
Number of Meters in use, 1888 .... 85.

New York, N. Y., received for all water for the year 1887, at the rate of $66.21 per million gallons. (Supply estimated.)
Number of Meters in use, 1887 .... 16 552.
" " " March 31, 1890 .. 20,348.

Lawrence, Mass., received for all water, year 1889, $84.57 per million gallons.
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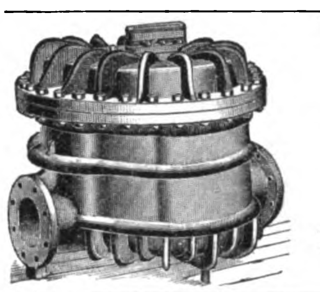

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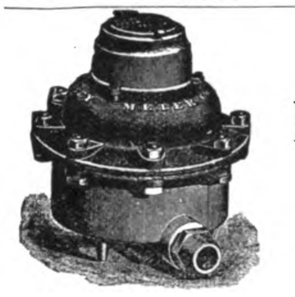

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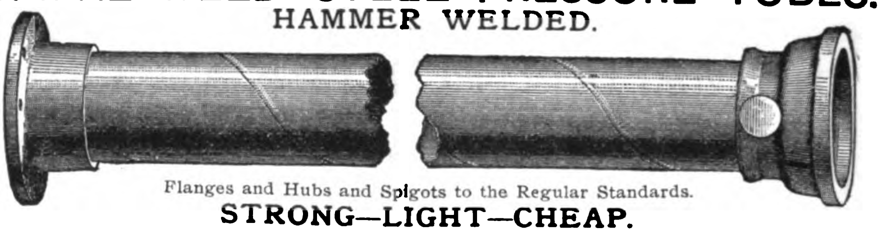

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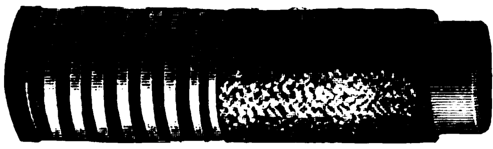

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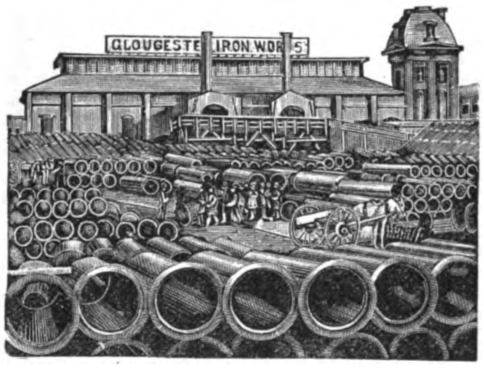

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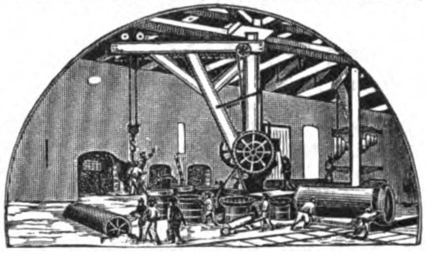

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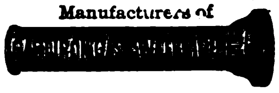

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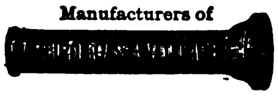

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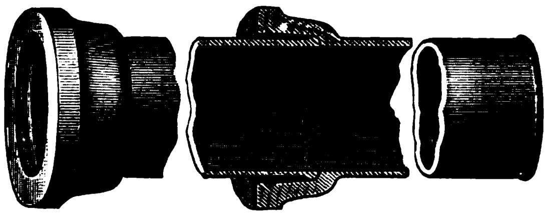

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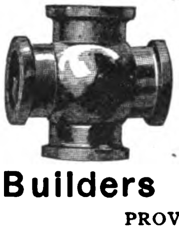

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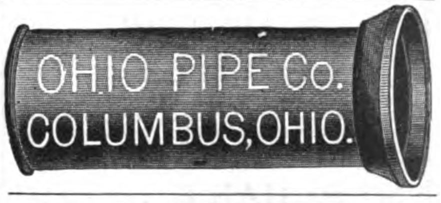
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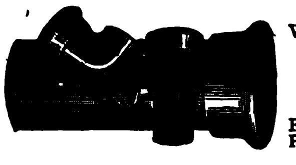

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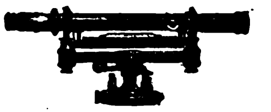

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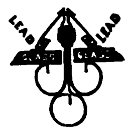

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THOMSON-HOUSTON ELECTRIC CO., Boston, Mass. Alternating Current Incandescent Lighting. P. iii.

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KNOWLES STEAM PUMP WORKS, New York City. Steam Pumps. P. vi.

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PROPOSALS.

(Continued from page ii.)

PROPOSALS FOR BREAKWATER.—U. S. Engineer Office, Duluth, Minn.—Sealed proposals, in triplicate, will be received at this office until 2 o'clock P. M., December 17. 1890, and then opened, for constructing 240 linear feet of **BREAKWATER** at MARQUETTE, MICHIGAN. Preference will be given to articles of domestic production or manufacture, conditions of quality and price being equal. The attention of bidders is invited to the Acts of Congress approved February 26, 1885, and February 23, 1887, Vol. 23, page 332, and Vol. 24, page 414, Statutes-at-Large. The United States reserves the right to reject any and all bids. All information may be obtained at this office. JAMES B. QUINN, Major, Corps of Engineers. 1

PROPOSALS FOR PIER WORK, DREDGING, etc.—U. S. Engineer Office, Duluth, Minn.—Sealed proposals, in triplicate, will be received at this office until 2 o'clock P. M., December 29, 1890, and then opened, for extending and remodeling shore ends and repairs to outer ends of canal **PIERS**, and **DREDGING** at GRAND MARAIS, MICHIGAN. Preference will be given to articles of domestic production or manufacture, conditions of quality and price being equal. The attention of bidders is invited to the Acts of Congress approved February 26, 1885, and February 23, 1887, Vol 23, page 332, and Vol. 24, page 414, Statutes at Large. The United States reserves the right to reject any and all bids All information may be obtained at this office. JAMES B. QUINN, Major, Corps of Engineers. 3

PROPOSALS FOR PIER WORK AND Dredging.—U. S. Engineer Office, Duluth, Minn.—Sealed proposals, in triplicate, will be received at this office until 2 o'clock P. M., December 22, 1890, and then opened, for building **SUPERSTRUCTURE** and for **DREDGING** at ONTONAGON, MICHIGAN. Preference will be given to articles of domestic production or manufacture, conditions of quality and price being equal. The attention of bidders is invited to the Acts of Congress, approved February 26, 1885, and February 23, 1887, Vol. 23, page 332, and Vol. 24, page 414, Statutes-at-Large. The United States reserves the right to reject any and all bids. All information may be obtained at this office. JAMES B. QUINN, Major, Corps of Engineers. 2

PROPOSALS FOR DREDGING AND PIER WORK.—U. S. Engineer Office, Duluth, Minn —Sealed proposals, in triplicate, will be received at this office until 2 o'clock P. M., December 6, 1890, and then opened, for **DREDGING**, and for repairs to breakwater at GRAND MARAIS, MINN. Preference will be given to articles of domestic production or manufacture, conditions of quality and price being equal. The attention of bidders is invited to the Acts of Congress, approved February 26, 1885, and February 23, 1887, Vol. 23, page 332, and Vol. 24, page 414, Statutes at Large. The United States reserves the right to reject any and all bids. All information may be obtained at this office. JAMES B. QUINN, Major, Corps of Engineers. 26

PROPOSALS FOR DREDGING.—U. S. Engineer Office, Duluth, Minn.—Sealed proposals, in triplicate, will be received at this office until 2 o'clock P. M., December 6, 1890, and then opened, for **DREDGING** in the harbor of DULUTH, MINN., on west side of Rice's Point. Preference will be given to articles of domestic production or manufacture, conditions of quality and price being equal. The attention of bidders is invited to the Acts of Congress approved February 26, 1885, and February 23, 1887. Vol. 23, page 332, and Vol. 24, page 414, Statutes at Large. The United States reserves the right to reject any and all bids. All information may be obtained at this office. JAMES B. QUINN, Major, Corps of Engineers. 26

BREAKWATERS AT PORTCHESTER HARbor, N. Y., and at Larchmont Harbor, N. Y. —Engineer Office, U. S. Army, Room 74, Army Building, 39 Whitehall Street, New York, N. Y., November 15, 1890.—Sealed proposals, in triplicate, for construction of **BREAKWATER** at PORTCHESTER HARBOR, N. Y., and at LARCHMONT HARBOR, N. Y., will be received at this office until twelve [12] o'clock, noon, on MONDAY, December 15, 1890. The attention of bidders is invited to Acts of Congress approved February 26, 1885, and February 23, 1887, Vol. 23, page 332, and Vol. 24, page 414, Statutes-at-Large. Further information can be obtained at this office. Applications should be indorsed on envelope "Applications for Specifications." D. C. HOUSTON, Colonel of Engineers. 1

EXTENSION OF BREAKWATER AT mouth of the Housatonic River, Conn.—Engineer Office, U. S. Army, Room 74, Army Building, 39 Whitehall Street, New York, N. Y., November 15, 1890.—Sealed proposals in triplicate, for extension of the **BREAKWATER** at the mouth of the HOUSATONIC RIVER, CONN., will be received at this office until twelve [12] o'clock, noon, on MONDAY, December 15, 1890. The attention of bidders is invited to Acts of Congress approved February 26, 1885, and February 23, 1887, Vol. 23, page 332, and Vol. 24, page 414, Statutes-at-Large. Further information can be obtained at this office. Applications should be indorsed on envelope "Applications for Specifications." D. C. HOUSTON, Colonel of Engineers. 1

EXTENSION OF BREAKWATER AT GLEN Cove, N. Y.—Engineer Office, U. S. Army, Room 74, Army Building, 39 Whitehall Street, New York, N Y., November 15, 1890.—Sealed proposals, in triplicate, for extension of the **BREAKWATER** at GLEN COVE, N. Y., will be received at this office until twelve [12] o'clock noon, on MONDAY, December 15, 1890. The attention of bidders is invited to Acts of Congress approved February 26, 1885, and February 23, 1887, Vol. 23, page 332, and Vol. 24, page 414, Statutes-at-Large. Further information can be obtained at this office. Applications should be indorsed on envelope "Applications for Specifications." D. C. HOUSTON, Colonel of Engineers. 1

PROPOSALS.

WRECK OF THE SCHOONER "JOSIAH Whitehouse."—Engineer Office, U. S. Army, Newport, R. I., November 1, 1890. To whom it may concern. Whereas the navigation of Vineyard Sound is obstructed and endangered by the wreck of the schooner "Josiah Whitehouse," lying about N. by W. ½ W. 3¼ miles from Gay Head Light-house: Notice is hereby given to all persons interested in said vessel, her cargo and all other property therein, that if, within thirty [30] days from the date of this advertisement, they shall not have signified to me their intention and taken preliminary steps to remove said wreck, etc., as soon as practicable, the same will be considered as abandoned and derelict, and it will be removed by the United States under authority of law. Sealed proposals, in triplicate, for the removal of so much of said **WRECK** as forms an obstruction to navigation, will be received at this office until 12 o'clock noon on MONDAY the first day of December, 1890, and then opened. The attention of bidders is invited to the acts of Congress approved February 26, 1885, and February 23, 1887, Vol. 23, page 332, and Vol. 24, page 414, Statutes at Large. The United States reserves the right to reject any or all proposals and to waive any informalities. Full information furnished on application. By authority of the Secretary of War. W. R. LIVERMORE, Major of Engineers. 26

NOVEMBER 26, 1890.

SEALED PROPOSALS WILL BE RECEIVED at the office of the Supervising Architect, Treasury Department, Washington, D. C., until 2 o'clock P. M., on the 17th day of December, 1890, for the **IRON BEAMS, ETC.**, for first floor, basement columns, etc., for the U. S. Court-House, Post-Office, etc., building at DETROIT, MICHIGAN, in accordance with drawings and specification, copies of which may be had on application at this office or the office of the Superintendent, at Detroit, Michigan. Each bid must be accompanied by a certified check for $100. The Department will reject all bids received after the time herein stated for opening the same; also, bids which do not comply strictly with all the requirements of this invitation. Proposals must be inclosed in an envelope, sealed and marked, "Proposal for the Iron Beams, etc., for the First Floor and Basement Columns, etc., for the U. S. Court-House, Post-Office, etc., building at Detroit, Mich.," and addressed to JAS. H. WINDRIM, Supervising Architect. 1

NOVEMBER 15, 1890.

SEALED PROPOSALS WILL BE RECEIVED at the office of the Supervising Architect, Treasury Department, Washington, D. C., until 2 o'clock P. M. on the 10th day of December, 1890, for all the labor and material required for the **APPROACHES** to the U. S. Court House, Post-Office and Custom-House at VICKSBURG, MISS, in accordance with the drawing and specification, copies of which may be had on application at this office or the office of the Superintendent at Vicksburg, Miss. Each bid must be accompanied by a certified check for $100. The Department will reject all bids received after the time herein stated for opening the same; also, all bids which do not comply strictly with all the requirements of this invitation. Proposals must be inclosed in envelopes, sealed and marked "Proposal for the Approaches to the U. S. Court-House, Post-Office, and Custom-House at Vicksburg, Miss." and addressed to JAS. H. WINDRIM, Supervising Architect. 26

NOVEMBER 26, 1890.

SEALED PROPOSALS WILL BE RECEIVED at the office of the Supervising Architect, Treasury Department, Washington, D. C., until 2 o'clock P. M. on the 17th day of December, 1890, for all the **LABOR AND MATERIALS** required for concreting the floor of basement, etc., of the U. S. Court-House and Post-Office at PITTSBURG, PA., in accordance with drawing and specification, copies of which may be had on application at this office or at the office of the Superintendent at Pittsburg, Pa Each proposal must be accompanied by a certified check for $100. The Department will reject all bids received after the time herein stated for opening the same; also, all bids which do not comply strictly with all the requirements of this invitation. Proposals must be inclosed in envelopes, sealed and marked, "Proposal for Concrete Floors for the U. S. Court-House and Post-Office building at Pittsburg, Pa.," and addressed to JAS. H. WINDRIM, Supervising Architect. 1

PROPOSALS FOR EXTENSION OF PIERS and Repairs.—U. S. Engineer Office, Cleveland, O., November 15, 1890.—Sealed proposals, in duplicate, will be received at this office until 12 o'clock M., on SATURDAY, the 6th day of December next, at which time they will be opened in presence of bidders, for extending pier and making general repair to **PIERS** at the following harbors on LAKE ERIE: Ashtabula Harbor, O.; Fairport Harbor, O.; Black River Harbor, O.; Huron Harbor, O. Preference will be given to materials and plant of domestic production or manufacture, conditions of quality and price (import duties included) being equal. The attention of bidders is invited to Acts of Congress approved February 26, 1885, and February 23, 1887, Vol. 23, page 332 and Vol. 24, page 414, Statutes at Large. All information can be obtained at this office. The United States reserves the right to reject any or all proposals. L. COOPER OVERMAN, Major of Engineers. 26

U. S. ENGINEER OFFICE, CHARLESTON-Kanawha, W. Va., November 3, 1890.—Proposals for building the **FOUNDATIONS**, and the pier, abutment, etc., for a movable dam at lock No. 8 of the great KANAWHA RIVER improvement, will be received at this office until 3 P. M. of December 19, 1890 and then opened. The attention of bidders is called to the Acts of Congress approved February 26, 1885, and February 23, 1887, Vol. 23, page 332, and Vol. 24, page 414, Statutes at Large. Information can be obtained by application to ADDISON M. SCOTT, Resident Engineer. WM. P. CRAIGHILL, Colonel of Engineers, U. S. A. 1

PROPOSALS.

U. S. ENGINEER OFFICE, ROOM 90, 134 Van Buren Street, Chicago, Illinois, November 24, 1890.—Sealed proposals, in triplicate, for rebuilding **SUPERSTRUCTURE** over 5,243 feet, more or less, of breakwaters in CHICAGO HARBOR, ILLINOIS, will be received at this office until 12 o'clock, noon, SATURDAY, December 13, 1890, and opened immediately thereafter in the presence of bidders Proposals will be accompanied by a guarantee that if the bid be accepted contract will be entered into within ten days after notice of acceptance. The United States reserves the right to reject any or all bids. The attention of bidders is invited to the Acts of Congress, approved February 26, 1885, and February 23, 1887, Vol. 23, page 332, and Vol. 24, page 414, Statutes-at-Large. Preference will be given to articles of domestic production or manufacture, conditions of quality and price (including in the price of foreign articles the duty thereon) being equal. No contract will be awarded for furnishing foreign articles when the domestic article of suitable quality can be obtained. For specifications, blank proposals, and all other information, apply, at above address, to Captain W. L. MARSHALL, Corps of Engineers, U. S. A. 1

PROPOSALS FOR DREDGING.—ENGINEER Office, U. S. Army, Newport, R. I., November 21, 1890.—Sealed proposals, in duplicate, for **DREDGING** at Edgartown, Wareham and New Bedford Harbors, Mass.; Newport Harbor, Coaster's Harbor and Greenwich Bay, R. I.; Taunton River, Mass.; Pawtucket, Providence and Pawcatuck Rivers, R. I.; and Green Jacket Shoal, Providence Harbor, R. I., will be received at this office until 12 o'clock, noon, on MONDAY, the 22d day of December, 1890, and then opened. The attention of bidders is invited to the Acts of Congress approved February 26, 1885 and February 23, 1887, Vol. 23, page 332, and Vol. 24, page 414, Statutes-at-Large. The United States reserves the right to reject any or all proposals and to waive any informalities. Full information will be furnished on application to this office. W. R. LIVERMORE, Major of Engineers. 3

U. S. ENGINEER OFFICE, BURLINGTON, Vt., November 20, 1890.—Sealed proposals, in triplicate, addressed to the undersigned, will be received at this office, until 11:30 o'clock, A. M., December 23, 1890, and then opened, for **DREDGING** 10,000 cubic yards, more or less, from TICONDEROGA RIVER, NEW YORK, and 20,000 cubic yards, more or less, from OTTER CREEK, VERMONT, and depositing the dredged material in deep water of the lake, 2 miles average haul at Ticonderoga River and 4 miles at Otter Creek. Attention is invited to the Acts of Congress, approved February 26, 1885, and February 23, 1887, Vol. 23, page 332, and Vol. 24, page 414, Statutes-at-Large. Detailed information can be had on application to this office. M. B. ADAMS, Major of Engineers. 26-3

NOVEMBER 25, 1800.

SEALED PROPOSALS WILL BE RECEIVED at the office of the Supervising Architect, Treasury Department, Washington, D. C., until 2 o'clock P. M., on the 18th day of December, 1890, for all the **LABOR AND MATERIALS** required for the approaches to the U. S. Post-Office, etc., building at BROOKLYN, N. Y., in accordance with the drawings and specification, copies of which may be had on application at this office or the office of the Superintendent at Brooklyn, N. Y Each bid must be accompanied by a certified check for $100. The Department will reject all bids received after the time herein stated for opening the same; also, bids which do not comply strictly with all the requirements of this invitation. Proposals must be inclosed in envelopes, sealed and marked "Proposal for the Approaches to the U. S. Post-Office, etc., building at Brooklyn, N. Y.," and addressed to JAS. H. WINDRIM, Supervising Architect. 1

NOVEMBER 17, 1890.

SEALED PROPOSALS WILL BE RECEIVED at the office of the Supervising Architect, Treasury Department, Washington, D. C., until 2 o'clock P. M., on the 9th day of December, 1890, for all the **LABOR AND MATERIAL**, and fixing in place, complete, the low-pressure, return-circulation, steam heating and ventilating apparatus for the U S. Court-House, Post-Office, etc., building at AUGUSTA, GEORGIA, in accordance with the drawings and specification, copies of which may be had on application at this office or the office of the Superintendent at Augusta, Georgia. Each bid must be accompanied by a certified check for $100. The Department will reject all bids received after the time herein stated for opening the same; also, bids which do not comply strictly with all the requirements of this invitation. Proposals must be inclosed in envelopes, sealed and marked, "Proposal for the Low Pressure, Return Circulation, Steam Heating and Ventilating Apparatus for the U. S. Court-House, Post Office, etc., building at Augusta, Georgia." and addressed to JAS. H. WINDRIM, Supervising Architect. 26

PROPOSAS FOR PILES, STONE, ROPE, Wire, Nails, Spikes and Screw Bolts.—United States Engineer Office, Custom House, St. Louis, Mo., November 20, 1800.—Sealed proposals, in triplicate, will be received at this office until 12 o'clock M. on SATURDAY, December 20, 1890, for furnishing and delivering the following articles for use in improving the Mississippi River below ST. LOUIS, MO.: Piles, Stone, Manilla and Sisal Rope, Wire, Nails, Spikes and Screw Bolts. Preference will be given to articles of domestic production or manufacture, conditions of quality and price (import duties included) being equal. Specifications and blank forms for proposals will be furnished bidders on application. A M. MILLER, Major, Corps of Engineers.

BRIDGE, Kansas City, Mo.—Proposals are wanted until December 12, for the construction of a bridge over Turkey Creek. Address J. S. Cannon, President Board of Public Works, as above.

PROPOSALS.

PROPOSALS FOR CONSTRUCTION OF Breakwater at Rockland, Maine —United States Engineer Office, Portland, Maine, November 11, 1890.—Sealed proposals, in triplicate, for construction of **BREAKWATER** at ROCKLAND, MAINE, will be received at this office, No. 537 Congress Street, until 3 P. M. of TUESDAY, December 2, 1890, and then opened. Attention is invited to Acts of Congress approved February 26, 1885, and February 23, 1887, Vol. 23, page 332, and Vol. 24, page 414, Statutes-at-Large. All necessary information furnished by JARED A. SMITH, Lieut.-Col., Corps of Engineers, U. S. Army. 26

ELECTRIC LIGHT PLANT, **Washington, D. C.**—Proposals are wanted until December 16, for an electric light plant for the New York Navy Yard Address N. H. Farquhar, Chief of Bureau of Yards and Docks, Navy Department, as above.

STONE, **Boston, Mass.**—Proposals are wanted until December 15, for the delivery of quarry faced granite ash for the extension of Gallop Island sea wall, Boston Harbor. Address Lieutenant-Colonel S. M. Mansfield, U. S. A., as above.

BRIDGE WORK, **Hamilton County, O.**—Proposals are wanted until December 13, for the erection of a bridge and repairs to another bridge. Address John Haggerty, Auditor Hamilton County, as above.

DAM, **St. Louis, Mo.**—Proposals are wanted until December 20, for the construction of an extension to the dam at Alton, Ill. Address Major A. M. Miller, Corps of Engineers, U. S. A., as above.

SEWERS, **Toronto, Can.**—Proposals are wanted until December 2, for the construction of certain sewers at this place. Address John Shaw, Chairman, Committee on Works, as above.

DREDGING, PIERS, **New York City.**—Proposals are wanted until December 5, for doing certain dredging and building piers. Address the Department of Docks, Pier A, North River, as above.

LIGHTING, **New York City.**—Proposals are wanted until December 31, for lighting by electricity certain streets of this city. Address the Gas Commission, Department of Public Works, as above.

RAILROAD, **Philadelphia, Pa.** — Proposals are wanted until December 8, for the construction of certain railroad work. Address the Chief Engineer, Port Reading Construction Company, 227 South Fourth Street, as above.

BUILDING INTELLIGENCE.

CAMDEN, N. J.—5th and Erie st, br mill; o, Jno E Mills.

Cor 8th and Sycamore, br church; o, Union Church Congregation.

KANSAS CITY, MO.—W A Kelly, member of the Board of Public Works, has been awarded the contract, at $68,990, for the erection of the new jail and criminal court building.

LEBANON, PA.—D W Miller will erect 3 brick dwellings at this place.

MORRISVILLE, PA.—Three dwellings are to be erected at this place by Henry Comfort.

ST. LOUIS, MO.—Compton and Bell avs, br dwell; cost, $8,000; o, J Carroll; b, T J Moynihan.

Jefferson and Allen avs, br store and dwell; cost, $8,000; o, Mrs N Murphy; b, W H Clemens.

N w cor Joab st and Park av, br store and dwell; cost, $12,000; o, J A Lynch; b, sublet.

Washington and Pendleton avs, 2 dwells; total cost, $21,000; o, S Stern; b, C B McCormack.

MILWAUKEE, WIS.—Jefferson & Wisconsin, hotel; cost, $450,000; o, Pfister Hotel Co; a, H C Koch & Co.; b, C B Roberts & Co.

SIOUX CITY, IOWA.—Cor 5th and Douglas sts, 4-story br block 50x150 for furniture store; cost, $30,000, o, P L Lindenholm.

ST. PAUL, MINN.—Lincoln, nr Grotto, 1-story fr church; cost, $8,000; o, First Presbyterian Church Society.

THURLOW, PA.—A new school building is to be erected at this place.

WILLIAMSTOWN, PA.—Several dwellings are to be erected here by Dr Thomas, of Thomas, Bondine & Co.

WOODPORT, PA.—A large hotel is to be erected at this place by Thomas Bright.

BUILDINGS.—There is nothing over $7,000 in value to report at the following places: Bridgeport, Conn.; Montclair, N. J.; Topeka, Kan.; Binghamton, N. Y.; Grand Rapids, Mich.; Geneva, N. Y.; Ogdensburg, N. Y.: Allegheny, Pa.: Charleston, S. C.; Wilkes Barre, Pa.; Clinton, Iowa; Dayton, O.; Detroit, Mich.; Knoxville, Tenn.: Canton, O.; Johnstown, Pa.

BUILDING INTELLIGENCE.

BALTIMORE, MD.—S e cor Monument st and Harford av, 4-story br warehouse; o, E D Onion.

E s Park av, bet Madison and Richmond sts, 4-story br bldg; o, Isaac H Dixon.

1613 Park av, 3-story br bldg; o, Prof W Leslie Robinson.

N s Monument st, bet Buren st and Jones Falls, stone and br elevator; o, Northern Central Railroad.

940 Linden av, 3-story br bldg; o, Frank Hannibal.

Paca st, above Franklin st, St Mary's Seminary, 6-story br addition with Mansard roof; cost, $40,000; o, Associated Professors of St Mary's Seminary; a, Messrs. Baldwin & Pennington; b, Edward Brady & Sons.

BUFFALO, N. Y.—Washington st nr Broadway, 5-story br and s bldg, 30x100, all improvements, business block; cost, $30,000; o, Chas Gillig; a, H H Little; m, Rummrill & Rupp; c, Klaus & Beck; iron, C H Kellogg.

Franklin st, residence; cost, $11,000; o and a, same as above; m, Mr Beyer; c, Mr Bingel.

Ferry st, br, s and fr res; cost, $12,000; o, Jacob L Hass; a, H H Little; c, Mr Metz; m, Chas Berrick.

Broadway, 5-story br addn to business block; cost, $10,000; o, Louis Onetto; a, H H Little; b, Fred Linderman, whole contract.

CHESTER, PA.—A new armory is to be erected in this city for Company B.

CHICAGO, ILL.—541 N State st, br dwell; cost, $10,000; o, Dr Hy Hooper; a, Burling & Whitehouse; b, Barney & Rodatz.

877-89 Carroll av, br factory; cost, $15,000; o, Vaughan & Bashnell Manufacturing Co; a, Bauer & Hill; b, Kees & Son.

213 Seminary av, br flats; cost, $8,000; o, F B Dyer; a, Lemson & Newman; b, Wm Dyer.

159 Jefferson st, br warehouse; cost, $12,000; o, P D Young.

Irving Park av, nr N W Ry, club house; cost, $16,000; o, Irving Park Hall Association; a, E Hill-Turnork; b, A F Myron.

353, etc, Jane st, br cottages; cost, $12,000; o, W D Kerfoot & Co.

3700 Forrest st, br dwell; cost, $12,000; o, Jno Moran; a, Holabub & Roche.

510 W 19th st, br store and flats; cost, $9,000; o, Prokup Krinik.

19-21 Vernon Park, br flats; cost, $9,000; o, David Pyne; b, J V Benis.

3200 Halsted st, br store and flats; cost, $14,000; o, Jno J Leary; a, N S Devine.

184-5 Michigan av, addn to hotel; cost, $28,000; o, Warren Leland; a, W W Boyington; b, C A Moses.

170 Willow st, br store and flats; cost, $10,000; o, Albert Wagner; a, A Warner; b, S Buschner.

233 Blucher, br flats; cost, $8,000; o, Jno S Errickson; a, L G Hollberg.

744 Kemmare, br dwell; cost, $10,000; o, F Glogner; b, J J Monahan.

4509 Wabash av, br flats; cost, $8,000; o, A A Whipple; a, Perley Hale; b, J J Horton.

4343-49 Grand boul, br dwell; cost, $35,000; o and a, H R Wilson; b, Oscar Anderson.

4420 Greenwood av, br dwell; cost, $17,000; o, G W Chamberlin; b, L Brouk.

1557 W Harrison, br store and flats; cost, $9,000; o, Mrs Mary Shehan; a, A G Bandry; b, John Gibson.

779 W Polk, br flats; cost, $14,000; o, M L Teimann; a, Geyer & Schultz.

607 Blue Island av, br store and flats; cost, $9,000; o, Jno Rickak; a, Ruehl & Hildinger; b, Aug Schott.

631 Fullerton av, br flats; cost, $8,000; o, Mrs Emma Greesbach; a J F & J P Doerr; b, E Banshner.

1012-14 W Superior, br flats and dwell, cost, $68,000; o, Chas Steinbrecher; a J H Huber.

447 Hermitage av, br dwell, barn and flats; cost, 9,000; o, Michael Walsh; a, H Olszwiski; b, H Schonning.

Greenwood av and 48th, br stable; cost, $11,000; o, C H Morse; a, Bell & Swift.

BUILDING INTELLIGENCE.

CHICAGO, ILL.—3509 Wabash av, br flats; cost, $10,000; o, Mrs Elizabeth Fahey; a, Martin Carr; b, M Fahey.

Belden av and Larrabee, 6-story apart bldg; cost, $85,000; a, L G Halberg; b, not let.

23d, nr State, br store and flats; cost, $9,000; o, Frank Follansbee; a, I C Zarbell.

Michigan av and 36th, br dwell; cost, $20,000; o, Simon Karger, a, as above.

Langley av, nr 47th, br dwell; cost, $20,000; o, Geo O Gordon; a, Howe & Shelton.

N Clark, nr Deming Court, br dwell: cost, $8,000; o, Hy Kline; a, W L Carroll.

Fremont, nr Belden av, br flats; cost, $18,000; o, M Cridler; a, as above.

64th and Harvard, br flats; cost, $20,000; o, Stephen Haywood; a, R S Smith.

Central Park boulevard, br flats; cost, $9,000; o, O E Mansfield; a, F D Thompson.

102 buildings costing less than $7,000 each.

DARBY, PA.—Four br dwells are to be erected here by Thomas Tarbottom.

DULUTH, MINN.—H B Walmsley, S Scarscadden and other Cleveland and Duluth capitalists will organize the United States Building Company, with a capital of $225,000. The company will put in a new plant at St Louis town site to build houses under Mr Scarscadden's patent.

EASTHAMPTON, MASS.—3 story br addn to factory; o, Geo S Colton.

EASTON, PA.—An organ factory is to be erected at this place by Jacob Raub.

ELM STATION, PA.—The Baptists of this place are to erect a new church.

GREENVILLE, MISS.—This place is to have a $60,000 court house.

KANSAS CITY, MO.—The Kansas City Suburban and Belt Line Railway Company has completed plans for a $15,000 storage warehouse, to be built at once. Five other buildings will be erected next spring by the same company.

LANCASTER, PA.—4 br dwells; cost, $12,000; o, Everts & Overdeer; a, C Emlen Urban; b, John Hiemanz.

LOWELL, MASS.—Fr house; cost, $7,000; o, Austin Chadwick.

Box shop and 2 stores; o, Lawrence Manufacturing Co.

MACON, GA.—Reports say that a $250,000 hotel is to be erected at this place by a stock company.

MANDEVILLE, LA.—There is talk by western capitalists of forming a company for the purpose of erecting a hotel at this place, to cost $100,000.

MCKEESPORT, PA.—Reports say that a $25,000 hotel is to be erected here by Mrs Sarah Savage.

PHILADELPHIA, PA —N e cor 22d and Berks st, school; b, M McManus.

E s Broad st, n Oxford, dwell; o, Cheeny Kilburn.

E s 20th st, s Dauphin st, hospital; b, W P Fogg.

N s Hope st, s Montgomery av, 5 dwells; o, A H Hoffman.

S s Market st, e 56th st, 2 dwells; o, Chas Wilson.

E s 30th st, s Race st, abattoir; b, Stacey & Reeves.

W s De Kalb st, n Aspen st, 3 dwells; o, A L Du Paget.

N s Stafford st, w Morris st, 2 dwells; o, D P Brunner.

E s Edgemont st, s Buckins st, 2 dwells; o, H Donnsboro.

W s Pratt st, n Tonesdale, 2 dwells; b, Keliver Bros.

S s Wendover st, bet Manyunk and Terrace, 4 dwells; o, Neal McIlvaine.

N s Erie av, e Fkfd av, addn to factory; b, Plouchen Schoch.

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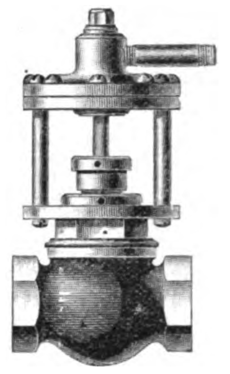

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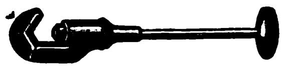

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BUILDING INTELLIGENCE.

PHILADELPHIA, PA.—N s Keystone st, n Tyson st, storehouse; o, Geo W Wells.

N w cor 35th st and Fairmount av, school; b, J H Jordan.

S s Beach st, n Vienna st, rolling mill; o, Hughes & Patterson.

E s Howard st, s Oxford st, addition to factory; b, McCartney & Oler.

N and s s Watkins, w 22d st, 23 dwells; o, Thos J Armstrong.

E s Lawrence st, s Duncannan st, 2 dwells; b, Jos Skinner's Sons.

S e cor Second and Oxford sts, school; b, M McManus.

W s Marshall st, s Cambria st, 4 dwells; o, A L Lambert.

RALEIGH, N. C.—It is proposed to erect a $100,000 hotel at this place.

SO. BETHLEHEM, PA.—The L V R R office at So Bethlehem, Pa., will have an additional story of brick and copper. J S Allam has the contract.

SPRINGFIELD, MASS.—Fr coal shed; o, Springfield Gas Light Company; b, S E Walton.

ST. PAUL, MINN.—Another arcade building, to cost $100,000, will be built from 7th to 8th sts, on 7th av, 237x75 feet. Walter Ife is the architect.

WORCESTER, MASS.—Cor Elm and Sever, fr dwell; cost, $25,000; o, Wm Maynard; a, Fuller & Delano; b, A M Kelley.

BUILDING INTELLIGENCE.

WASHINGTON, D. C.—726-32 4th st, 4 2-story br bldgs; cost, $8,000; o, H P Moore, a, T A Harding.

734-38 15th st, 3 3-story br bldgs; cost, 15,000; o and a, G A Shehan.

1440 N st, 3-story br bldg; cost, $7,500; o, K B Krane; a, I A Sibley; b, J B Williamson.

100-2 11th st, 2 2-story br bldgs; cost, $8,000; o and a, Jno Cooksey.

1620 I st, 3-story br bldg; cost, $12,000; o, William Winthrop; a, H L Page; b, Larcombe.

Le Droit Park, 2 3-story br bldgs; cost, $9,000; o, Jas Brooks; a, S J Prestcott.

513 7th st, 3 story br bldg; cost, $18,000; o, A H Lowery; a, C A Didden; b, W A Kimmel.

Trinidad av, 25 2-story fr bldgs; cost, $10,000; o, A H Simmes; a, B B Turner & Son.

1717-19 15th st, 2 3-story br bldgs; cost, 10,000; o and a, G S Cooper.

109-15 E st, 4 2-story br bldgs; cost, $12,000; o, A Heckman; a, G B Phelps; b, H L Phelps.

423 10th st, 3-story br bldg; cost, $21,000; o, J A Baker; a, L Dessey; b, J Richardson.

160 permits less than $7,000.

WHEELING, W. VA.—Cor 14th and Chapline, 4 dwells; cost, $18,000; o, Mrs A I Boreman, of Parkersburg; a, M F Giesey; b, Beltz, Flading & Co.

Main st, 4 story store bldg, with pressed brick and ornamental stone; cost, $7,500; o, J T Goodwin & Co; a and b, same as above.

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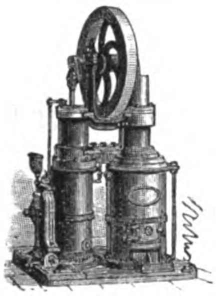

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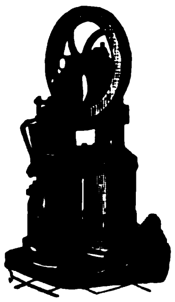

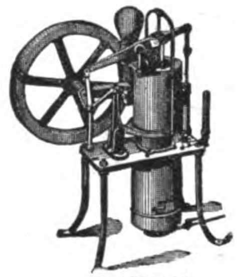

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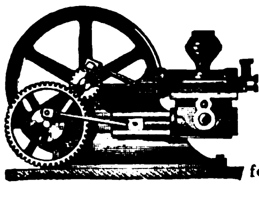

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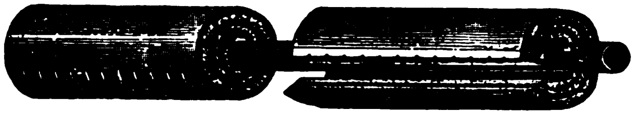

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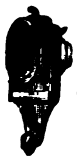

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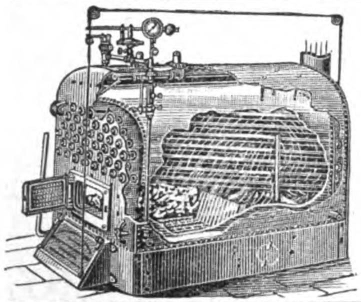

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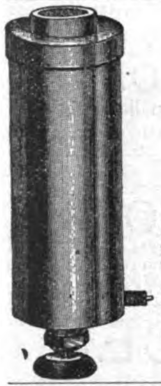

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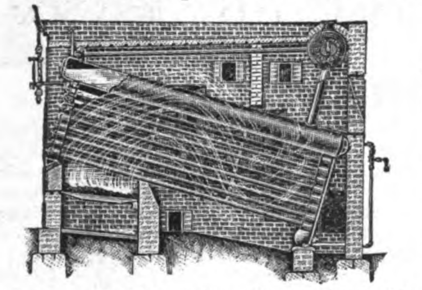

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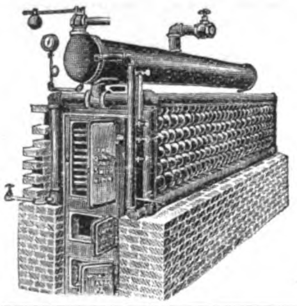

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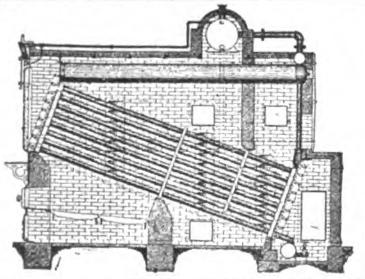

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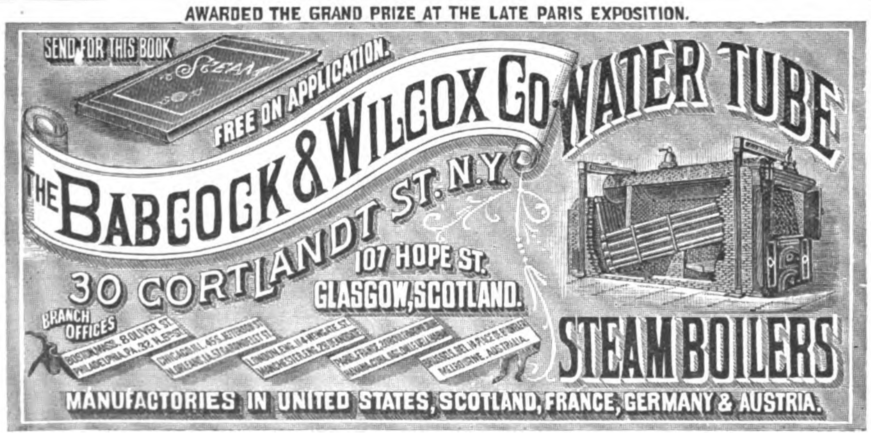
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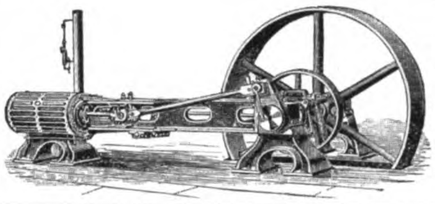

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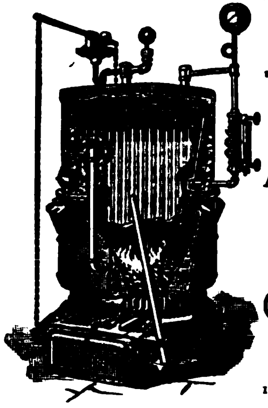

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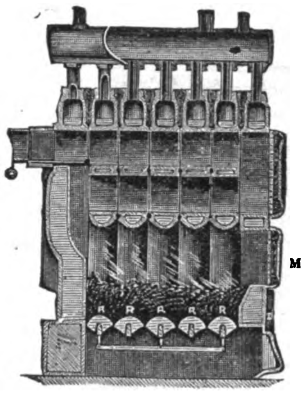

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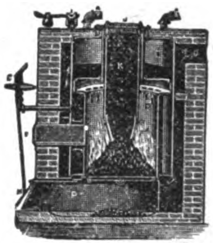

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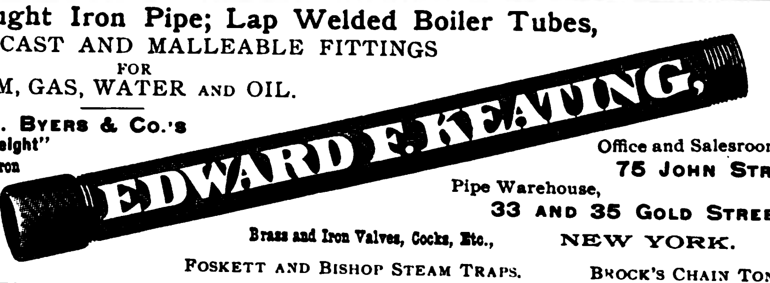

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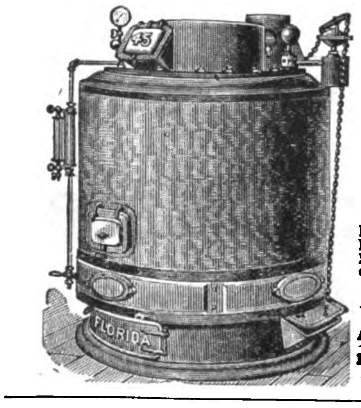

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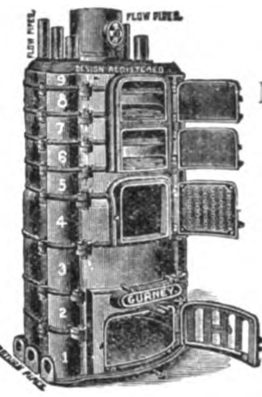

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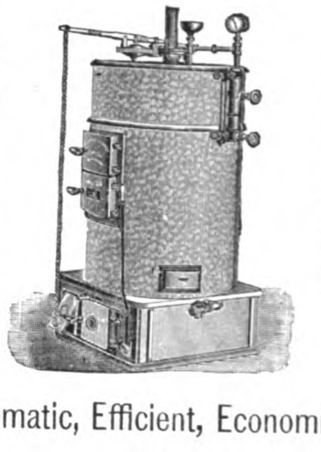

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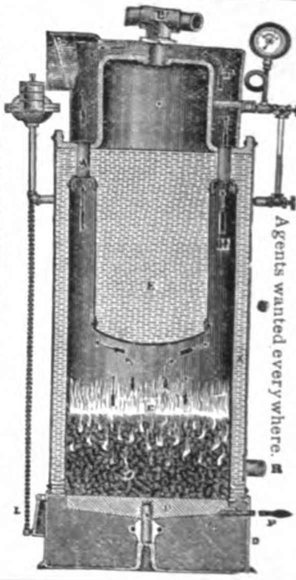

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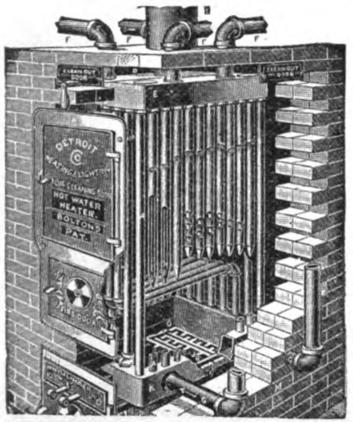

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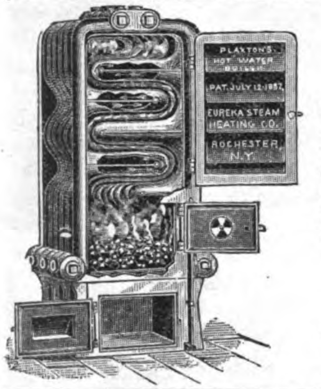

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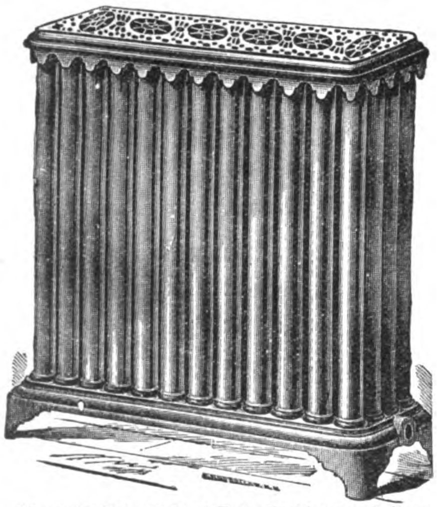

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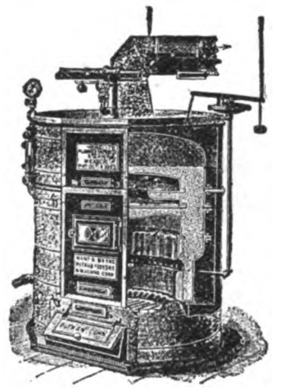

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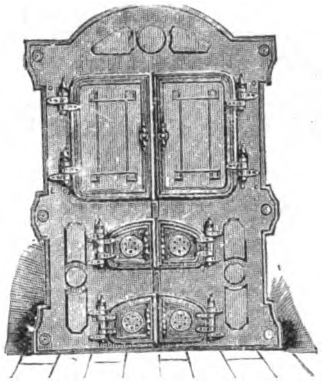

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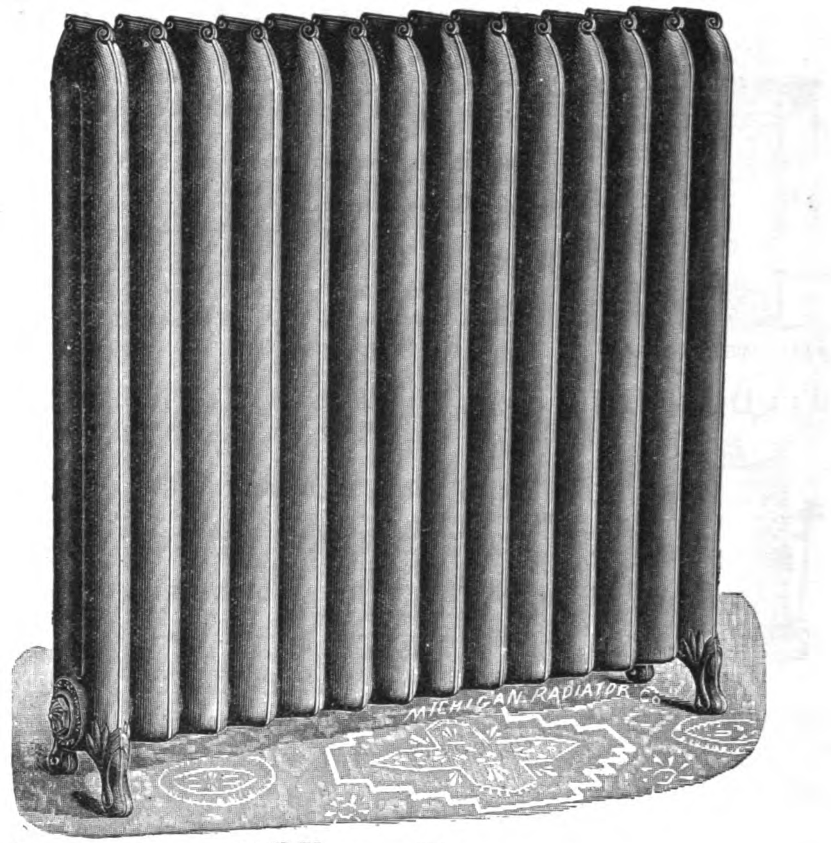
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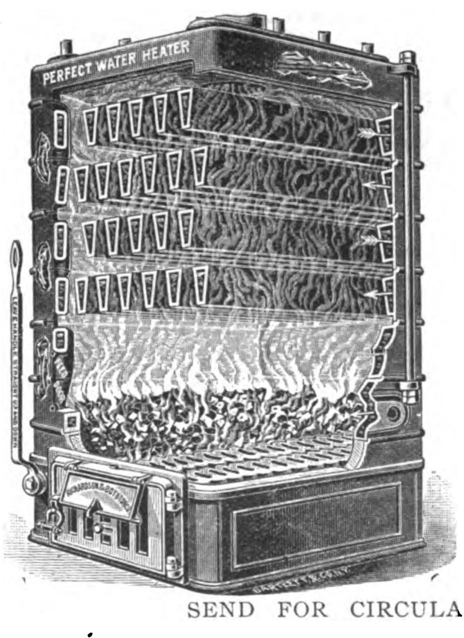

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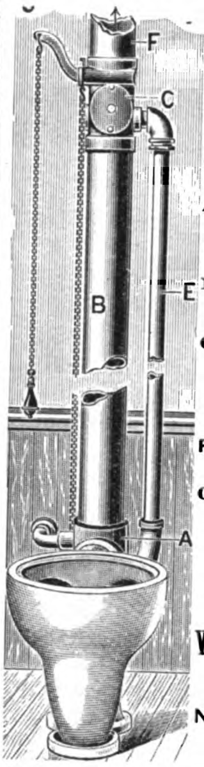

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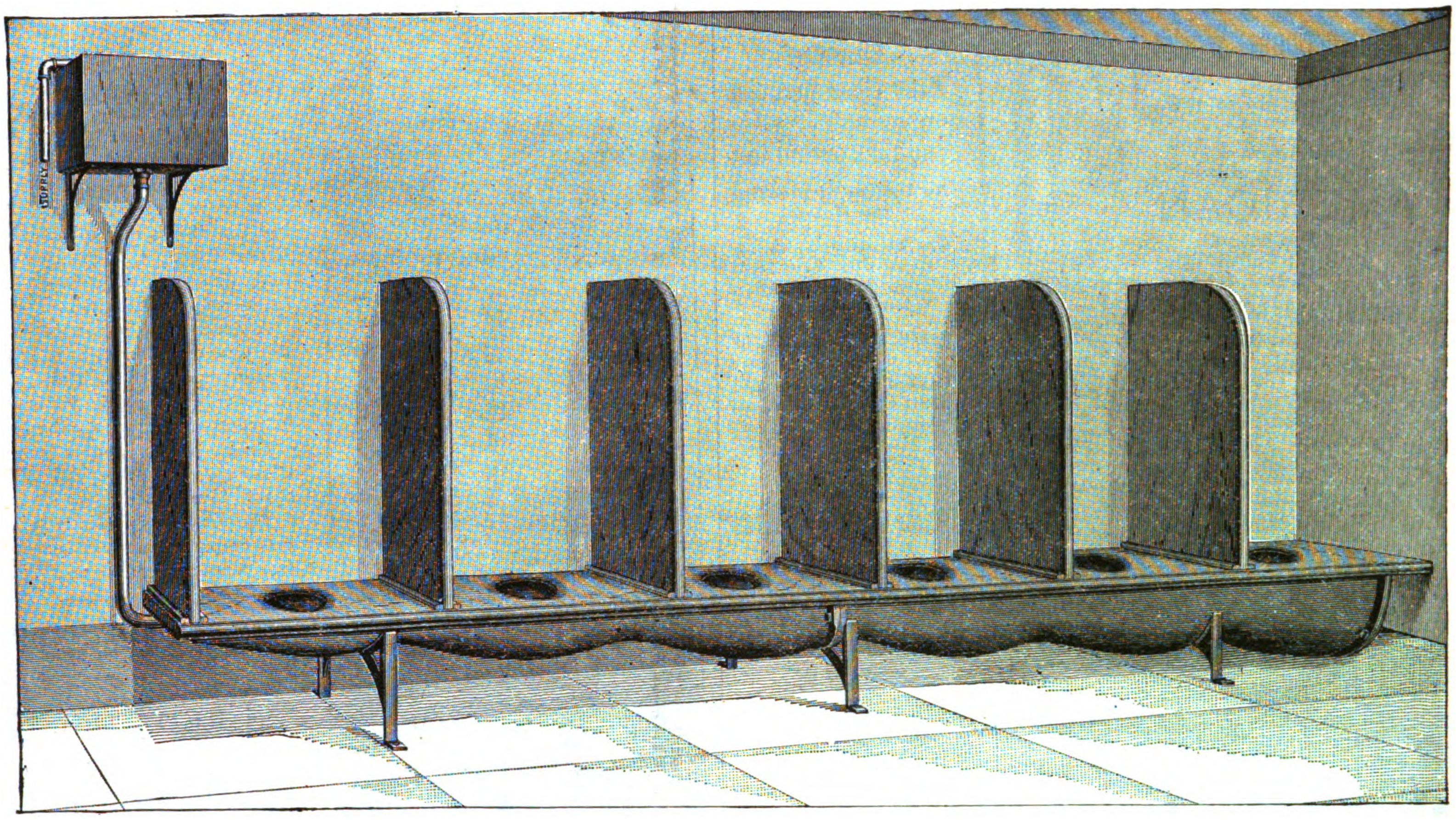

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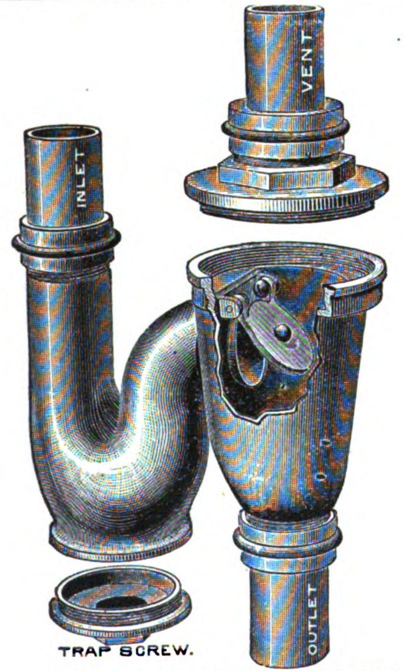

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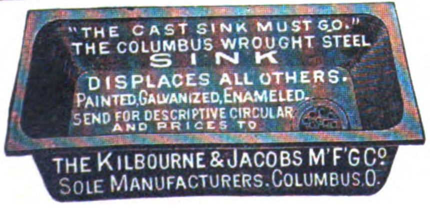

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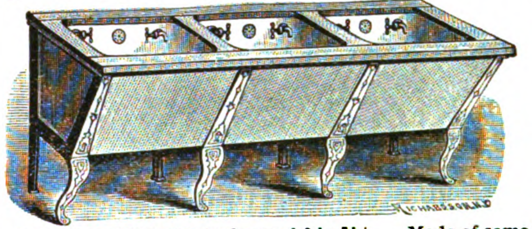
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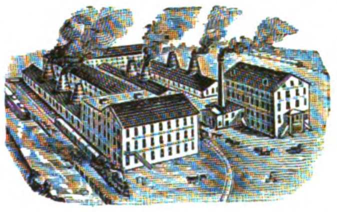

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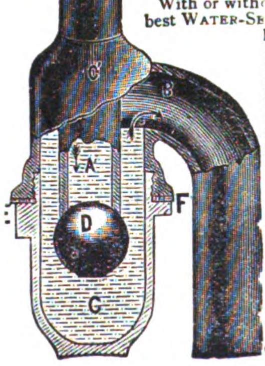

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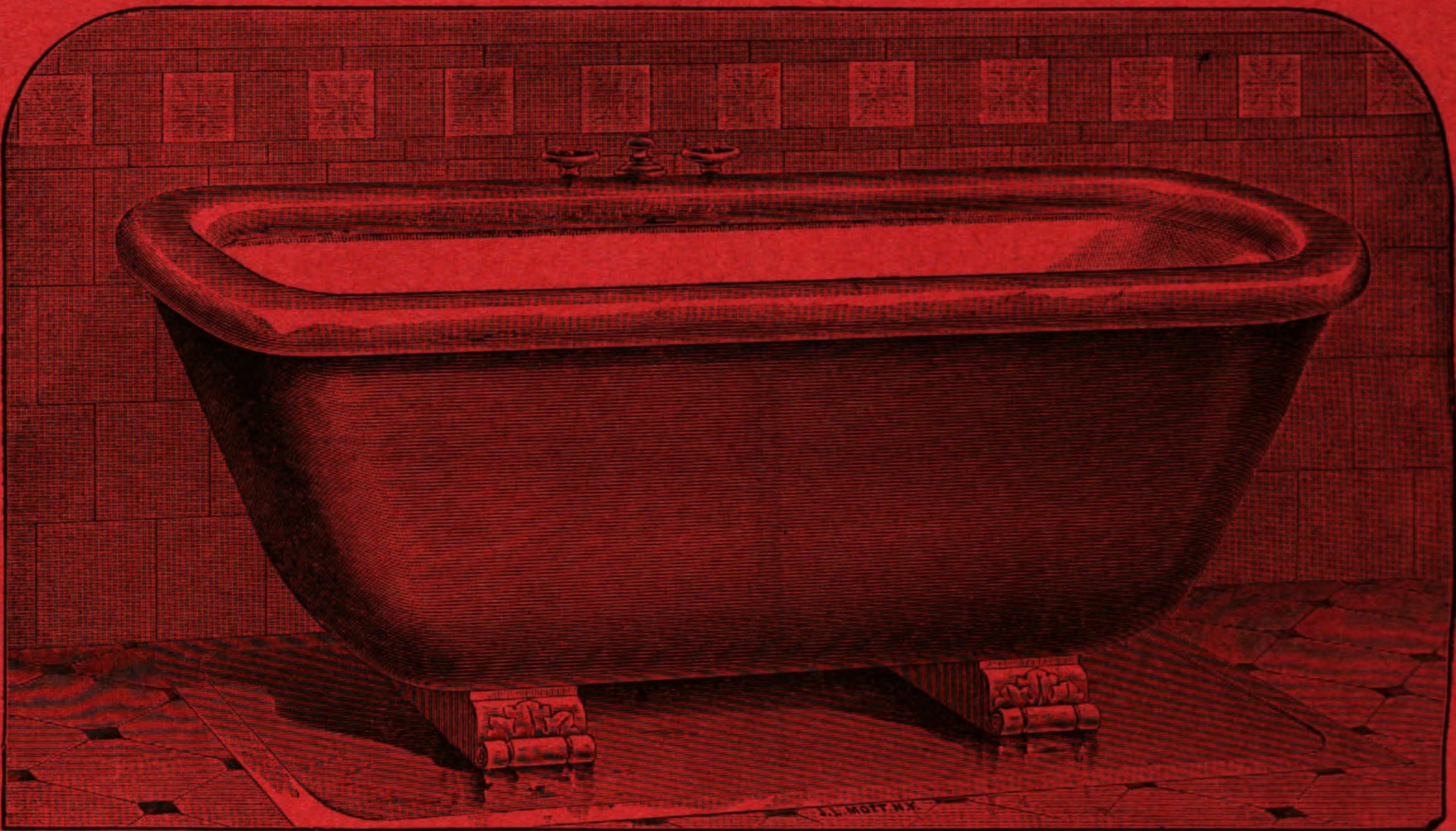

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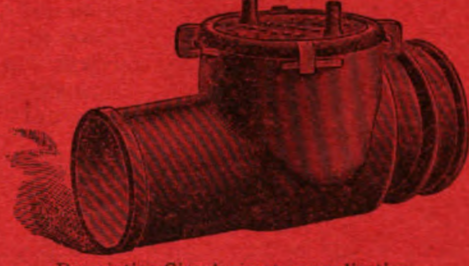

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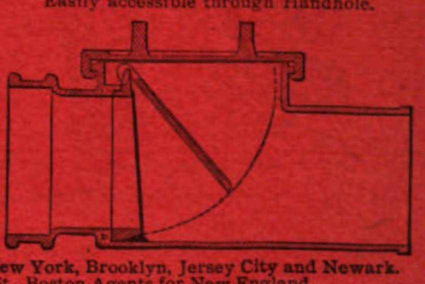

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THEIR

CONSTRUCTION AND MAINTENANCE.

REPRINTED FROM

THE ENGINEERING AND BUILDING RECORD.

COMPILED BY E G. LOVE, PH. D.

PREFACE.

THIS book is a compilation of articles which have appeared in recent volumes of *The Engineering and Building Record*, edited with a view of eliminating whatever was of timely or local interest, and arranged by divisions for convenience of use.

The science of paving and the need of proper maintenance of pavements is yet comparatively little understood in this country, and the same is true in even greater degree with regard to roads. The editor of the journal named was led to give the matter special attention by seeing what was done in Europe, during his visits there, and finally began an investigation of work on streets and roads in England, France and other countries, the result of which was the gathering of a large and very valuable mass of information in regard to the subject. Of this everything likely to be of practical use in America was printed in *The Engineering and Building Record*, and is given here in more convenient shape. With it appears a large quantity of matter from American sources, including the prize essays on Road Construction and Maintenance submitted in the competition instituted by the journal named in December, 1889.

It will be seen that the great bulk of the book is made up of records of experience and statements of cost in different places. The comments are based on this experience.

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